COMPUTER GRAPHICS

topics

Reports on Computer Graphics

C G in Medicine and Edutainment

EUROGRAPHICS 2006
September 4 - 8
Vienna, Austria

DENTRO Trento

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further impressions
of the innovation
week 2006

Advanced Applications
for Tourism and Culture

CCG/VICOMTech/
Graphitech
ISSUE

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Zentrum für Graphische Datenverarbeitung
www.zgdv.de

Zentrum für Graphische Datenverarbeitung e.V.

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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 **dialog 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. Jorge Posada, Dr. Raffaele de Amicis, Eduardo Pinto

Dear Reader,
Welcome to this COMPUTER GRAPHIK topics issue. The international network INI-GraphicsNet is pleased to present in this issue, coincident with the Eurographics 2006 Conference in Prague, some of the most interesting projects of our members in Spain (VICOMTech), Italy (Graphitech) and Portugal (Centro de Computação Gráfica). The articles address many interesting topics of current interest in the Computer Graphics research for different application areas.

VICOMTech
National Centre of Innovation in Multimedia and Computer Graphics

With the recent expansion of the Centre to include 16 companies and institutions, as well as the official recognition as one of the 92 Centres of Innovation and Technology in Spain, VICOMTech strengthens its possibilities to offer high quality research to its clients and collaborators. Two articles in this issue are related advanced with medical applications (in hepatic surgery and in radiotherapy), where advanced positioning and visualization technologies are applied in two hospitals in the Basque Country, improving the current practice of physicians. Positioning is also a key factor for Augmented Reality applications in outdoor environments, and a third article related with the EU Project IMPROVE describes better and more reliable positioning technologies. The next topic, about the e-tourgune project, deals with the strategic integration of the information and communication technologies in the tourist industry. The article about the ELEIN project explores the emotional aspects of interfaces with two e-learning companies. In the article of the EU Project CANTATA, content-aware networked systems will be developed for advanced and tailored assistance in multimedia environments. Finally, an article about a new system for 3D facial recognition is presented in an integrated biometric system.

GraphiTech

Fondazione GraphiTech contributes towards the transfer of knowledge between the research sector and the industry through the promotion of research on advanced graphics, information processing and visual communication, including Virtual Reality and augmented engineering. In this issue we present five projects. The application called ProCon3D is the result of an industrial project and it shows the result of the development of a three-dimensional product configurator for product marketing. The application, which uses EON Reality as 3D engine, combines an articulated and customizable database management with real-time 3D visualization and interaction.

The project »DentroTrento« promotes historical, artistic and cultural heritage in the area of Trentino (Italy) through the use of Virtual Reality technologies. The project's goal was to implement an user friendly system which could be used by visitors of an archeological site thus fostering a process of cultural enrichment.

The project »A Geobrowser Application for Tourism« has brought to the development of an add-on for the freely available software World-Wind, which makes it possible to download hi-resolution images and information of interest for the tourist within the area of Altopiano di Pinè and Valle di Cembra, in the Italian Alps.

The project »AMI-SME« is an ontology-based system for the management of marketing information with the aim to develop a software solution that supports Small and Medium Sized Enterprises in their internalization process.

Finally »WoodProject« introduces our project that aims to design an efficient and affective tool by which one wood object (e.g. cube) could be automatically or semi-automatically separated into 3D surface whose bounds are wood grains.

CCG
Centro de Computação Gráfica

The works reported in this edition cover a broad range of application areas, all of them very actual and of special interest in terms of R&TD. CCG presents some of its ongoing projects, particularly the work developed for implementation of the »bass drum karaoke«, a multimedia application for bass drum karaoke play, in cultural heritage context. The development of the »birds' dictionary«, a web tool for biology and ecology teaching support, is presented and detailed. The FORMI-MOLDE project is also presented aiming at the development of technical, pedagogical and learning innovative resources, contributing for the improvement of learning and qualification of the assets of the mould making companies staff. The Project »Conservation and Monument Valorization« presents innovative methodologies for inspection in the place, non-destructive inquiry and structural evaluation, evaluation and preservation of the cultural heritage using 3D technology.

Computer Aided Hepatic Surgery for Pre-Operative Planning and Intra-Operative Navigation

I. Macía, C. Paloc

In modern hepatic surgery, the exact knowledge of the individual intra-hepatic vessels, segments, and lesions is a crucial factor for the decision whether a patient might be operated and which strategy is best suited, in terms of the operation risk and long-term survival. This information is particularly essential in specific surgical procedures, such as split-liver transplantation and oncological resections.

For the planning of both operations, it is crucial to provide the surgeon with an individual three-dimensional (3D) representation of the patient's liver along with its vasculature and lesions. Such a representation allows for an exploration of the vascular anatomy and the measurement of vessel diameters and distances, as well as the analysis of the shape and volume of vascular territories. All of this is based on an accurate segmentation and analysis of the intra-hepatic vessels.

We are working on an advanced workstation DICOM allowing to analyze the patient's intra-hepatic vasculature from clinical Magnetic Resonance volume data. As a result, a 3D model of the relevant structures is generated which enables a more precise access to the individual intra-hepatic vasculature and potential tumors, and builds a new basis for pre-operative planning. The application made available to the surgeons is entirely based on semi-automatic methods together with an intuitive interface.

The next step consists of transmitting the planning data to the patient in the operating room. Intra-operative navigation systems for image-guided surgery provides the surgeon with an important additional orientation aid during the operation. Such a system requires an intra-operative imaging modality. We follow the approach to use intra-operative 3D ultrasound for precise navigation augmenting it with pre-operative data and models obtained in the planning phase.

The ultimate goal of our work is to develop an integrated liver surgery navigation system consisting of a planning module, 3D ultrasound-based navigation, and intra-operative registration of pre-operative models and planning.

Each development phase of the project is supervised by the Hepatobiliary Surgery & Hepatic Transplant Unit of Cruces Hospital.

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German Abstract

Das Ziel des Projekts besteht in der Erforschung neuester Methoden der medizinischen Bildanalyse und 3-D-Visualisierung, um zwei sich ergänzende Systeme zur Unterstützung von Chirurgen bei Leberoperationen vor und während des operativen Eingriffs zu entwickeln: ein prä-operatives Planungsmodul und ein intra-operatives Navigationssystem, das multimodale Bilder kombiniert.
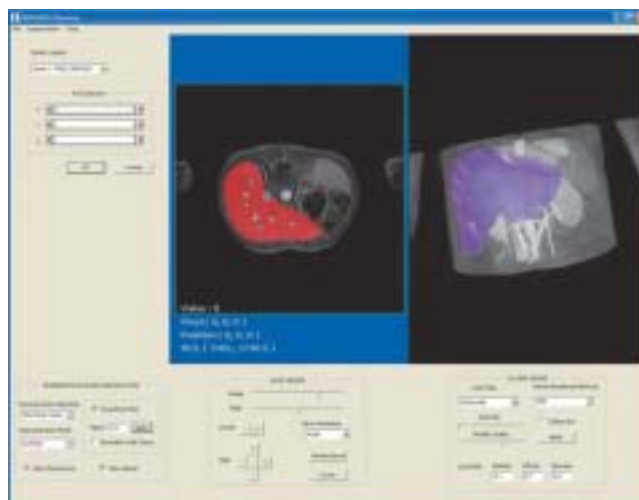
Figure 1: Pre-operative planning module of our hepatic surgery navigation system.

Hybrid Tracking for Outdoor Augmented Reality Applications

I. Barandiaran, C. Paloc

The main goal of the Augmented Reality (AR) technology is to add computer-generated information (2D/3D) to real video sequences in such a manner that the real and virtual objects appear as coexisting in the same world. In order to get a good illusion, the registration problem must be addressed. In this way, the position orientation (pose) of the camera in respect of a reference frame must be accurately estimated or updated in the course of time. In this work, we address the registration problem for interactive outdoor AR applications, working on a fully mobile wearable AR system that combines a vision-based (optical) tracker with an inertial tracker.

In an outdoor scenario, the ground and the building facades can be seen as planes. We are therefore working on an optical markerless tracking method based on planar surface tracking.

The camera pose is calculated by estimating the planar projective transformation (homography) between a world plane initially selected by the user and its projection in the consecutive frames. This homography is accurately estimated by matching feature points corresponding to inlier data obtained by using robust estimation algorithms such as RANSAC, MLESAC, or M-estimators like Tukey or Huber. These estimators allow the tracking process to be robust against noise data (outliers) produced by fast camera motions or mismatching.

Because the homography trackers can present some drift after a period of time because of error accumulation, even with robust estimation, we are also using tracking information given by an inertial tracker in order to correct the deviation of the optical tracking. Fusing the two tracking subsystems gives us the benefits of

Figure 1: Matched features using RANSAC robust estimator.

Figure 2: Augmented scene of the San Telmo square in San Sebastian, Spain.

both technologies, while the sensors' complementary nature helps to overcome sensor-specific deficiencies.

As part of the FP6-IST European project IMPROVE, our hybrid tracking system is integrated into a collaborative mixed reality environment allowing to carry out architectural design reviews on site.

Point of Contact

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German Abstract

Das wichtigste Ziel der Augmented-Reality-Technologien (AR, Erweiterte Realität) besteht darin, auf einem Computer erzeugte Informationen in reale Videosequenzen so einzufügen, dass die realen und virtuellen Objekte in derselben Welt zu existieren scheinen. Um eine gute Illusion zu erzeugen, muss das Registrierungsproblem gelöst werden, um reale und virtuelle Objekte korrekt zueinander auszurichten. Dafür muss die Position und Orientierung (»Pose«) einer Kamera bezüglich eines Referenzbildes exakt geschätzt und über die Zeit erneuert werden.

Dieses Projekt beschäftigt sich mit dem Registrierungsproblem für interaktive AR-Anwendungen auf der Basis eines vollständig mobilen und tragbaren AR-Systems, das optische und trägheitsbasierende Tracker kombiniert. Unser System ist auf preiswerte, leichte und energiesparende, mobile AR-Applikationen für unpräparierte Außenanwendungen zugeschnitten.

Video-Based Motion Detection System for Patients in Radiotherapy

I. P. Güemes, I. Barandiaran, C. Paloc

External beam radiation therapy (EBRT) uses a linear accelerator to produce megavoltage X-rays to deliver a pre-scribed dose to the tumor deep inside a patient lying on the treatment couch.

At present, the significant proportion (up to 2/3) of an EBRT session is taken up with aligning the patient to the accelerator beam. Making a more efficient use of the equipment will allow for shorter appointments and increased patient throughput, which could bring down radiotherapy waiting lists. Moreover, minimizing errors due to patient positioning and motion should also allow for higher radiation doses to be administered to the tumor if damage to the surrounding healthy tissue can be minimized.

We are developing an interactive video-based feedback system for monitoring patients' motion during external beam therapy. The system allows a therapist with very little training to visually reconcile live video with static snapshots produced from previous sessions or at the beginning of each session.

Three cameras are fixed on the walls of the treatment room for obtaining video images of the patient lying on the treatment table along longitudinal and lateral axes. The images are then processed in real time to quantify voluntary / involuntary motion of the patient that may affect the delivery of radiation to a target. A signal can be generated to suspend the delivery of radiation upon certain threshold events detected in the motion cycle.

The prototype is being evaluated by the radiotherapy unit of the Oncological Institute in San Sebastian. We expect it to greatly help to overcome the two key limiting factors in radiotherapy efficiency, namely set-up time and inaccuracies, which will lead to a higher patient throughput.

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German Abstract

Wir entwickeln ein video-basiertes System zur Fehlerminimierung und Zeiteinsparung bei der Positionierung von Patienten und der Überwachung ihrer Bewegungen bei Strahlenbehandlungen.
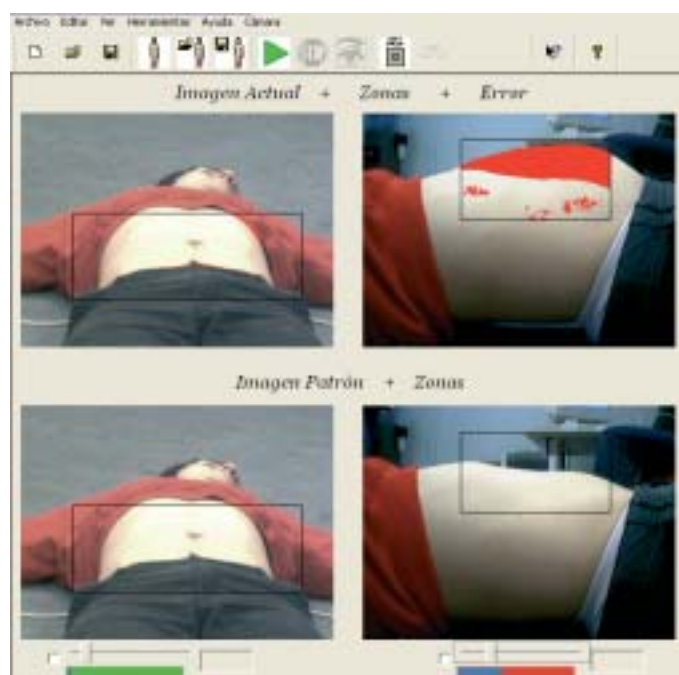
Figure 1: Reference images and movement detection area (coloured in red).

Technologies for Advanced Services and Tourist Products

M.T. Linaza, A. García

Introduction

eTourism is a new scientific area which analyzes the way in which technology can transform key tourist activities. Advances in Information and Communication Technologies (ICT) and the Internet in particular, have revolutionized the entire tourist sector, with new business models emerging, modifying the structure of distribution channels, and reinventing nearly all processes in tourism.

Due to the current situation, an R&D strategy specifically tailored to the needs of the tourist industry is required to examine several aspects of the sector by means of integration of multi-disciplinary groups and scientific knowledge, and to deal with the gaps and challenges faced by the tourist industry in the Basque Country.

What is e-tourgune?

The e-tourgune project is part of the ETORTEK 2006 Strategic Research Programme financed by the Department of Industry, Tourism and Trade of the Basque Government. Its main objective is the enhancement and development of a strategic research programme in tourism sciences through the convergence of traditional technological and scientific areas to encourage competitiveness and innovation in the tourist industry in the Basque Country and therefore in its economy and society.

One important aspect of e-tourgune is the international dimension of the project in order to strengthen the coordination of the innovation of the tourist sector and its integration within the European Research Area (ERA). The Basque tourist sector should adapt itself to the new knowledge economy, supporting the existing economic sector and encouraging the creation of new knowledge-based enterprises.

e-tourgune will disseminate and transfer knowledge among the agents of the Basque Innovation Sys-

German Abstract

Dieser Artikel gibt einen Überblick über das Projekt e-tourgune als Teil des strategischen Forschungsprogramms ETORTEK 2006 des Industrie-, Tourismus- und Handelsministeriums des spanischen Baskenlandes. Das wichtigste Ziel von ETORTEK ist das Vorantreiben strategischer Forschung in Wissenschaften, die in Zusammenhang mit Tourismus stehen, auf Basis der Konvergenz traditioneller wissenschaftlicher und technologischer Gebiete. Die Wettbewerbsfähigkeit und die Innovationen innerhalb der baskischen Tourismusbranche werden signifikant zunehmen. Es handelt sich um ein Spitzentechnologieprogramm, welches die für den derzeitigen Marktsektor notwendige kritische Masse generiert und überdies die Erzeugung neuer Sektoren ermöglicht.
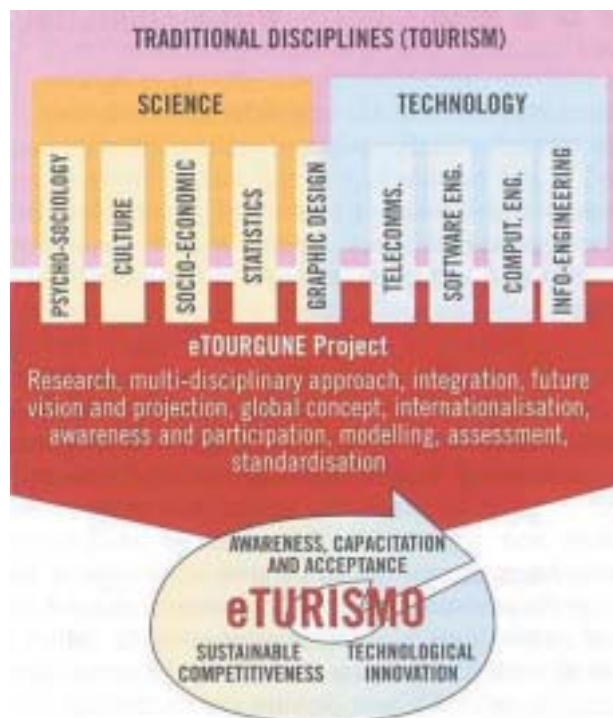
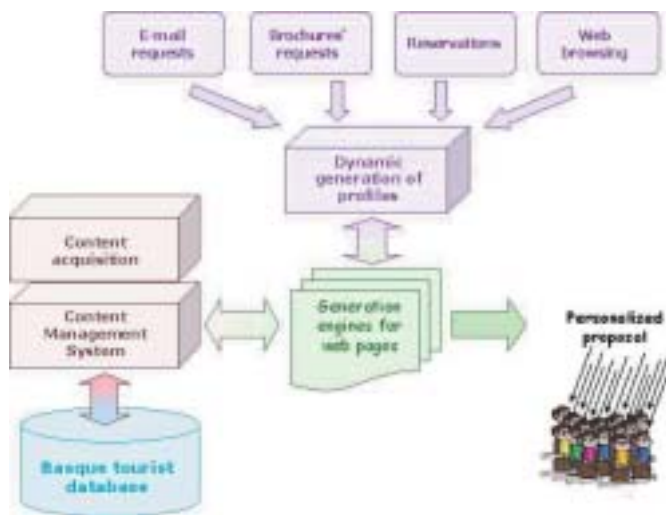Figure 1: Structure of the e-tourgune project.

Figure 2: Customer Relationship Management system.

tem, the tourist sector, and the society as a whole. In order to achieve all the proposed objectives in an effective way, a new Collaborative Research Centre will be founded.

What are the activities of e-tourgune?

Among the R&D activities that are conducted within the e-tourgune project, VICOMTech leads the development of an integrated platform to provide new added-value services for the tourist sector. Since it is an intensive economic sector, it can take advantage of the application of Information and Communication Technologies (ICT) as a key element for both consumers and providers in order to achieve a more efficient production, management, and promotion of tourist products and services. Some of the key technologies that are being developed are the following:

Content acquisition, storage, and management (CMS)
The Content Management System (CMS) of e-tourgune will include three main components: an acquisition system that will allow for the collection, indexation, and protection by means of watermarking technologies of the tourist content; a relational database for the storage of the tourist multimedia content of the Basque Country; and a content management system which will include access control and digital rights management.

Advanced tourist portals for RTO and DMO
A tourist portal is a site or a web service that includes several services such as browsing engines, e-mail lists, or blogs. Its main objective is to provide users with a unique gateway to access tourist resources of a whole destination (the Basque Country in this case). The portal will be based on a combination of a generation of web pages on the fly on the basis of the profile of the user and a batch generation for more general contents.

Personalized tourist routes
Complex algorithms for the generation of personalized routes and daily packages on the destination will be developed. Currently, tourists visit information points at the destination in order to look for a recommendation of daily plans. These plans are mainly based on the knowledge and experience of the tourist agents. In order to help tourist agents, they will be provided with several authoring tools that will customize daily trips based on some restrictions from the tourists (mainly available time and budget).

Customer Relationship Management (CRM)
One of the main objectives of the R&D activities is the development of a Customer Relationship Management system in order to gain knowledge about the profiles and preferences of the tourists and provide them with personalized tourist ser-

vices and products. The main objective of a CRM is to improve the experience of the visitor knowing in the most precise way his/her preferences, needs, and wishes. As it can be seen in Figure 2, there are several ways of getting information from the visitors.

Interoperability
Currently, one of the main problems within the tourist sector is the lack of interoperability among the countries and the destinations. Therefore, the information provided to the user is not uniform and in some cases, it is repeated. e-tourgune will work in the interoperability and integration of content resources based on European standards.

What benefits are expected from e-tourgune?

Within the new role of areas such as tourism and leisure in the information society, suppliers of tourist services, destination managers, and other agents in the tourism chain must adapt themselves to a new and not well developed value chain, increasing the efficiency in processes and productivity (lower costs, improved quality, and innovative products and services).

In the short term, e-tourgune will innovate in the direct marketing and sales of tourist products and destination organisations, improving the communication among partners and the distribution channels. Regarding the advantages for users, visitors and tourists, they will be able to take advantage of personalized services and products which provide added-value quality contents.

Acknowledgement

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ELEIN:
Emotional Pedagogically Embodied Agents for an Interactive Learning

A. Ortiz, D. Oyarzun, M. P. Carretero, M. Lehr

German Abstract

Virtuelle Assistenten, auch Avatare genannt, sind virtuelle Personen oder Figuren, welche eine natürliche und interaktive Kommunikation zwischen Mensch und Maschine ermöglichen sollen. Zu Beginn der Forschungsarbeiten untersuchten wir die Anwendung eines Avatars in der Benutzerschnittstelle einer E-Learning-Umgebung. Motiviert durch die zahlreichen Vorteile und unter der Hypothese, dass die Anwendung von animierten pädagogischen Agenten mit emotionalen Fähigkeiten in einer interaktiven Lernumgebung eine positive Wirkung auf die Lernenden hat, entschieden wir uns für eine virtuelle Figur zur Verbesserung des Lernprozesses. Das ELEIN-Projekt beinhaltet die Entwicklung von Kommunikations- und Interaktionswerkzeugen für E-Learning-Umgebungen, welche die Darstellung von Lerninhalten im Internet durch virtuelle Lehrer in Form von sprachbasierten Benutzerschnittstellen ermöglichen. Diese geben den Lernenden ein emotionales Feedback abhängig von deren Leistungen auf der Basis eines emotionalen Computermodells und aus einer kognitiven Perspektive.

Introduction

From 1945 to today, the user interfaces have been evolving with the aim of being more usable and accessible to the end user. Presently, the most commonly used interaction paradigm is the WIMP paradigm, based on Windows, Icons, Menus, and Pointers. This paradigm limits the number of human interaction channels since the user can communicate with the computer through one eye, one ear, one hand, and one finger, and he/she usually does not need oral or body language. Two aspects are crucial at this point: the person's sensorial means are ignored and the user interfaces are far away from a real communication between humans. During a lot of years other ways of interaction were explored and, although they are not already so extended as WIMP, they were investigated because of their potential for improving the user-machine interaction. So one of these research areas has emerged that focuses on Natural Conversational User Interfaces.

The people usually communicate with other people through the following communication elements, based on:

– The use of the sense of sight and hearing in order to interpret the input data in the communication.
– The use of body and oral language in order to communicate the data in the communication.

Our approach is based on the use of avatars in order to simulate this kind of communication. Avatars are virtual characters making the communication between the user and the machine more natural and interactive. The character appearance can be anthropomorphic or cartoon type, 2D or 3D, depending on the end user. The role of the avatar will depend on the application.

In this case the application will consist in an e-learning course. Here the avatar should act as a virtual teacher providing the user with interactive emotional feedback. In the following sections we will describe the importance of having avatars in a learning procces and the project we are working in order to integrate an avatar in a e-learning course.

Why embodied agents in learning processes?

A growing number of research projects have begun to investigate the use of animated lifelike characters in natural user interfaces because they present a priori a lot of advantages, which have also been validated by many authors:

– *Social interaction*: In 1994, Nass carried out five experiments which provide evidence that individual interactions between human and machine are fundamentally social.
– *User attention*: Hongpaisanwiwat said that animated characters are capable of capturing the users' attention, engaging users in active tasks, and entertaining them. This is very important for learning environments where a virtual character can have a positive effect on the learning process, more so if it can show affective responses.
– *Naturalness*: Whether the virtual character is believable or not, the illusion of life is generated and the user has the illusion of interacting with a real teacher.
– *More information in the transmitted message*: This was demonstrated by Mehrabian, who shows that 93 per cent of our messages are transmitted through non-verbal language.

Figure 1: Avatar helping user in the evaluation phase.

– *Trustworthiness and believability*: It is believed that the level of trustworthiness is increased by personifying the agent. Due to this, the design of the virtual teacher is very important.

Motivated by the advantages of having an avatar in natural user interfaces and due to the belief that the use of animated pedagogical agents with emotional capabilities in an interactive learning environment has a positive impact on learners, we decided to use a virtual character in order to improve the learning process.

ELEIN project
This project deals with the development of communication and interaction tools for e-learning environments which allow the expression of educational contents in the web, through a conversational user interface using virtual teachers. The main goals of the project are:
– To increment the pedagogical capacity of the actual courses the enterprise is offering via the Internet, by means of a 3D virtual tutor that supports and guides the learning process. This virtual tutor will be capable of providing an emotional feedback to the users' questions and answers
– To provide a technologically feasible solution for the transmission of the 3D virtual tutor's synchronized animations in low-speed Internet environments by selecting the right architecture and using streaming technologies
– To provide the industry with tools that allow the setup of future courses by means of an appropriate editor that will include the virtual tutor element

For this purpose, VICOMTech's avatar technologies will be integrated into the e-learning platform of Redox Multimedia (ADL-SCORM certificate). The final prototype will consist in a new on-line course created by CCC (one of the most important companies for distance education in Spanish) with the tools developed in this project and totally compatible with the Redox e-learning platform. The course will be divided into three parts:

1. *Course content explanations*: In this part the avatar acts as a virtual teacher explaining to the students the course contents through the web pages.
2. *Evaluation with support*: In this part of the course the user answers some questions given by the application. The interface of this part of the course (figure 1) is composed of an emotional avatar which expresses the emotions given by a cognitive model, a clock which controls the time, and a questions zone which is taken from an XML file. When the evaluation begins the emo-tional module starts to assess the event and the avatar gives the user emotional feedback and new explanations related to its results.
3. *Final evaluation*: In this part of the course the student takes an exam and when he/she has finished the avatar gives the result with the emotion obtained by the cognitive model.

We plan to evaluate the prototype developed with CCC students. This project is co-financed by the INTEK programme (IG-2006/00025) of the Basque Government.

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CANTATA: Content Aware Networked Systems towards Advanced and Tailored Assistance

P. Merkus (Bosch Security Systems B.V.), G. Marcos Ortego

Introduction

The production of audio-visual content started more than a century ago with the first photographies and movies, radio transmissions and recordings. In the 1980s, the digitization of audio started, followed by a similar development for video and TV in the 1990s. Digital audio, video, and associated data culminated in the MPEG standards that enable a digital communication of AV signals and can be classified as multimedia communication. The digital processing of such AV content and the availability of low-cost computing platforms have enabled numerous new applications and services exploiting these data as an information carrier.

However, all of the existing multimedia systems have hardly any or no notion at all about the content that is being processed, recorded, or communicated. It is only recently that the need for a more in-depth knowledge about the data itself is growing. This need is fed by the notion that knowledge about the content will lead to an improved data structuring on the transmission or storage carrier and a faster access to the desired data (shorter retrieval times). The content can be summarized as metadata that, in the form of a structured language, describes the data with (standardized) keywords.

The notion of the content can have different levels of semantic understanding, granularity, and accuracy. There is a wide spectrum of possibilities here, ranging from motion detection and color measurements, up to genre classification and detailed or full image understanding at various hierarchical content levels. The latter is the ultimate goal of the video content analysis, which can only be approached in practice.

This starting CANTATA project builds on the results of a preceding project where the firm notion of content analysis in several application domains (medical, multimedia, surveillance) has been established and forms of metadata generation were successfully evaluated on experimental platforms in the previously mentioned domains.

Main objectives of CANTATA

The general goal of CANTATA is to energize the European industry with respect to the development of content aware systems. This is based on the vision that there is a large industrial potential for such content aware systems. There are a number of factors that impede this large industrial potential; this is visualized in the A-B-C-D model, shown in figure 1.

It is the goal of CANTATA to address the following four impeding factors:

A. The currently available algorithms for the analysis of multimedia content need further enhancement and extension towards more dynamic, generic, adaptive, and self-learning approaches based on multi-modal information fusion.

B. As content analysis is known to be the most computation-intensive, scalable systems are required that provide standardized yet flexible streaming and storage facilities fit for rapid prototyping of multimedia content analysis products.

C. Application services are needed that exploit the potential of the novel content awareness to the end user and translate 'metadata' into useful functionality. This implies applications that are flexible in multiple dimensions:
   - Device-oriented adaptation
   - User-oriented adaptation (personalization)
   - Content-oriented adaptation

German Abstract

Das Projekt CANTATA hat als wichtigstes Ziel, den State of the Art von »Content-Aware Systems« zu verbessern. Die mehr als 20 Projektteilnehmer arbeiten in drei Anwendungsszenarien (Videoüberwachung, medizinische Anwendungen und Konsumverhalten zu Hause) an der Entwicklung und der Integration von Algorithmen zur Analyse von audiovisuellen Inhalten, an Speicherformaten und dem Teilen von Metadaten sowie an personalisierten, benutzerabhängigen und inhaltsspezifischen Endanwendungen.
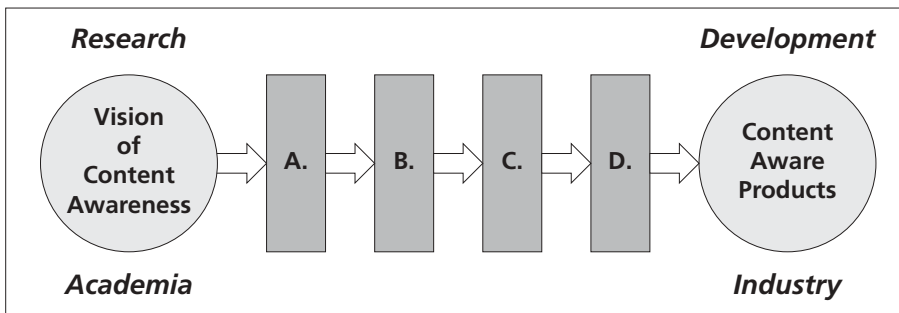
Figure 1: The A-B-C-D model with barriers for industrialization.

D. Before charging a customer for a product based on content analysis techniques, the supplier must be able to guarantee proper performance levels under all circumstances covered. Soon, both 'plain and cheap' and 'advanced and expensive' content analysis products will be offered in the market. If we cannot clearly make an unambiguous distinction between the different quality levels offered, the European industry cannot benefit from the upcoming market segmentation. Hence, a common understanding of the various different quality levels that can be achieved must rapidly be developed.

The objective of the CANTATA project is to advance the state of the art for content-aware systems in all four aspects mentioned above.

Technological innovation
In the previous section each of the four areas addressed by CANTATA, both the state-of-the-art technology and the options for improvement have been described. The technological innovations can be directly concluded from this analysis and can be summarized as follows:
A. Creation of video content models based on characteristic features allowing robust behavior analysis and solid reasoning for decision making
B. Flexible arrangements of computing tasks on multiple information processing components providing smooth integration and plug-and-play behavior of multimedia streams, object modeling, and metadata analysis tasks
C. Improved system performance under changing conditions by adopting self-learning, adaptive techniques and models
D. Unambiguous quantification of the true performance of content analysis systems, allowing objective and fair comparison of different solutions

Major visible expected results
The CANTATA project will deliver:
1. A video content analysis framework with defined interfaces, which enables comparative investigation in new and existing content analysis solutions
2. Efficient and adaptive Multimedia Content Analysis (MCA) solutions
3. Definition and implementation of an end-to-end video management platform for distributed storage, processing, and delivery of multimedia content and metadata
4. Demonstration of the functionality of content awareness by means of selected applications & services that exploits adaptive multimedia content analysis solutions
5. Definition of an overall objective validation framework that covers the various aspects of MCA systems in the different domains
6. A toolkit for validation of MCA systems, containing both annotation and comparison tools, as well as a set of reference sequences

Consortium
CANTATA is an ITEA project coordinated by Bosch Security Systems B.V. and its consortium is composed of more than twenty enterprises and research institutes from different European countries (see figure 2)

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Figure 2: CANTATA Consortium.

BioFace3D: Development of Advanced Access Control Technology Using Biometric Systems Based on 3D Face Recognition

M. Obach, B. Murguía

Introduction

Biometric systems are becoming a powerful solution in the field of the identification and verification of living individuals. These technologies claim to be high-level security tools in applications such as access control.

There is a wide variety of biometric methods. Each one is based on the use of one or more distinguishing traits, such as features of the face, fingerprints, palm prints, hand and finger geometry, iris, retina, voice, handwriting, keystroke dynamics, and others. Among these technologies, facial recognition has gained much attention during the last few years. Typically, 2D face recognition systems were the primary field of study. There are already several commercial applications using this technology. However, this kind of products has turned to be highly dependent on external conditions. In order to overcome these problems, 3D face recognition is emerging.

The purpose of BioFace3D is to build up a prototype based on 3D face recognition technologies for physical access control applications. The two main challenges to cope with are the development of the hardware needed to capture 3D images and the implementation and optimization of identification and verification algorithms.

Acquisition System

The first step of the project lies in the development of acquisition hardware of 3D images. 3D is all about conveying the sense of depth. Computer displays and photographs are inherently 2D. Thus, to recover 3D coordinates, there is a need for extracting the depth information.

The developed system is based on the principle of structured-light triangulation. Specifically, it consists in projecting multiple black and white coded stripes onto the surface of the object as shown in figure 1. Compared to systems that use laser light, this approach is safer and faster. The reflected light from the surface is captured by two video cameras. Usually, structured-light based systems consist of a projector and only one camera. Nevertheless, the use of two cameras instead of only one entails a bigger coverage area for 3D geometry reconstruction.

German Abstract

Das Projekt BioFace3D liefert den Prototypen einer 3-D-Gesichtserkennung zur Authentifizierung lebender Personen in verschiedenen Anwendungsbereichen, z.B. in Zugangskontrollen. Die beiden größten Herausforderungen liegen in der Entwicklung der Hardware für 3-D-Scans auf Basis von strukturiertem Licht und der Implementierung und Optimierung von Identifikations- und Verifikationsalgorithmen.

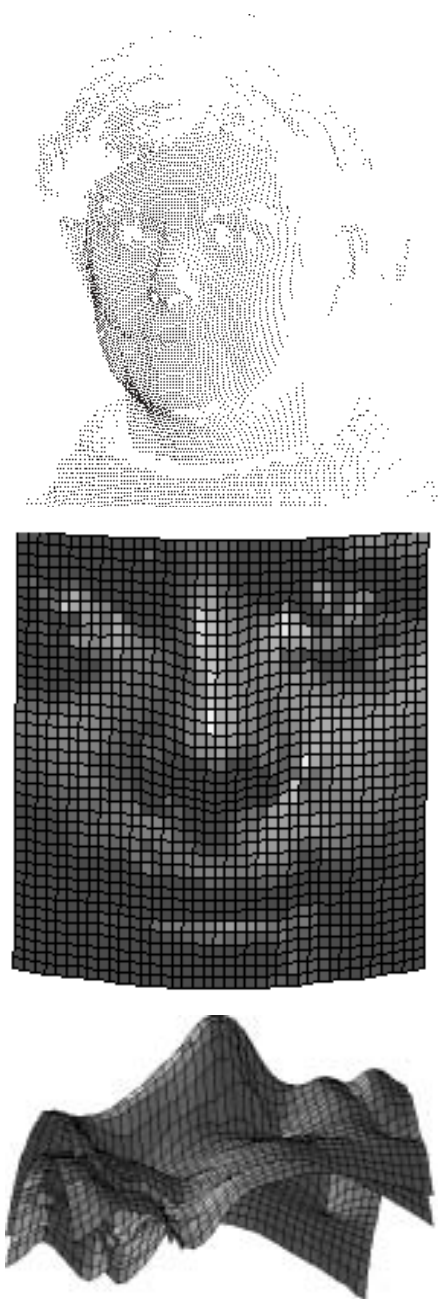Figure 1: 3D face scan process using structured light.

Figure 2: Normalization process: (a) 3D point cloud, (b) fitted mesh, (c) two unregistered meshes.

The hardware is complemented by a software application that controls the system and that is used to calibrate it. Within the calibration process, intrinsic and extrinsic parameters of the cameras are calculated. These parameters are used to establish 3D coordinates of points on the surface of the scanned face. So the other main task of the software is to obtain a 3D reconstruction of the face. The reconstruction is performed in the following way: First, one stripe projected onto the surface is identified in the images taken from both cameras. Afterwards, a single point in one of the images is selected and then it is projected onto the other image. The intersection of this projected line and the stripe gives a pair of corresponding points in both images. This process is repeated for many points to obtain an approximated reconstruction of the whole surface.

Face Recognition Algorithm

The implemented recognition algorithm is based on the use of Principal Component Analysis (PCA). This algorithm has been successfully applied to face recognition tasks, mainly concerning 2D images. However, it is also possible to apply it to 3D point clouds. In our case, first a normalization process is performed obtaining a regular 3D mesh model that represents each face. Then, the Principal Component Analysis is used to map each mesh into a lower-dimensional space. Finally, a nearest neighbour classifier is used for recognition.

With the normalization process, we intend to obtain a regular mesh with a fixed number of points, which represents only the relevant information of a face. Moreover, the different meshes are supposed to have the same orientation relative to the acquisition system.

The input 3D point cloud contains also points that do not belong to the face. The first step of the normalization process consists in finding the tip of the nose, and then fitting a regular mesh centered on the nose that covers just the face.

One of the prerequisites of a PCA-based algorithm is that all the faces must be correctly registered. Usually, the different point clouds have different positions and rotations relative to the 3D acquisition system. The registration process is performed by the Iterative Closest Point algorithm (ICP). We register each mesh with an average model obtaining the transformation, i.e. rotation and translation, that best aligns each image with the mentioned model.

Once a transformation is obtained, it is applied to each original point cloud, and then the first step of the normalization process is repeated. Figure 2 shows some steps of the normalization process.

As we have seen, each point cloud can be represented as a regular 3D mesh. We transform each 3D mesh of a face as a two-dimensional intensity image. Each node of the 3D mesh is regarded as a pixel of an intensity image and its depth value is considered as a greyscale intensity value. Thus, a mesh can be treated as a 2D image to apply PCA. To perform the PCA algorithm, we need a set of training images. In order to reduce the dimensions, we select the largest eigenvalues and their corresponding eigenvectors to approximate the »facial space«. These eigenvectors are usually called Eigenfaces.

All images in the training set are projected into the Eigenfaces space, as well as the current image. So we obtain one vector to represent each image, which we compare using the Euclidean metric.

Conclusion and Future Work

The prototype has been tested on many faces and has shown a good recognition accuracy. One of the future steps consists in reducing the data acquisition time in order to recognize a person in just a few seconds and to obtain a 3D face recognition system that can be used as part of a reliable and competitive commercial access control system.

Acknowledgements

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New Developments in the AMI-SME Project

E. Barbu, R. de Amicis

Introduction

In the new globalization context, the competition for expanding to new markets becomes sharper for Small and Medium Sized Enterprises (SME). Lacking financial resources, they cannot afford to hire consultant companies to make detailed market studies. Nevertheless, competitiveness requires the accessing of reliable and detailed information about the target market before competitors.

There are many factors that play an important role in the SME decision-making process, for example the strength of the competitors already present in the market, the buying power of the potential buyers and the legislation of the target market.

The aim of the European Project Analysis of Marketing Information for Small and Medium Sized Enterprises (AMI-SME) is to develop a software solution that supports SMEs in their internalization process. Currently, in order to gather information about the potential markets, SMEs relay on Web searching engines like Google and Yahoo. Even if the storage and indexing power of these Web searching engines is impressive, they lack support in managing the information relevant to the user. The AMI-SME system, a flexible meta-searching engine coupled with a series of useful components for information extraction, overcomes these limitations using a library of ontologies.

System Overview

The AMI-SME system is a flexible meta-searching engine coupled with a series of useful components for information extraction. A central concept of the system is that of information source. An information source is any data repository or any software that exposes an interface for querying a data repository. Examples for information sources are: web search engines, database systems and the user file system. At the moment, the system-supported information sources were: the web searching engines Google, Yahoo and A9, the local file system and the Internal Document Database.

Unlike the queries formulated in the web searching engines, AMI-SME queries are defined inside projects. A project can be thought of as a high level context that binds together the user query, his/her personal ontology and the documents he/she is interested in. In the system, any project is identified by its unique name. Take for example a company that wants to sell computers to France. A good name for the project related to this activity would be »Computer-selling in France«. The most successful queries related to this project could be saved for further run.

After the query is executed over all of the information sources in the system, a ranked list of documents is returned as an answer. One can select the documents he/she is interested in for future processing. After the selection is performed, the system triggers a series of transformations over the document content. Therefore, the document is automatically summarized, interesting metadata as title and author are extracted, NER (Name Entity Recognition) is performed and so on. All the ontologies in the system are kept in the Ontology Library. The user loads his/her personal ontology and annotates his/her documents with concepts and instances from the ontology. The interesting documents can be saved in the Internal Document Database. The document metadata, like the user comments and the automatically generated summary, will be saved in the Document Annotation Database. The Ontology Library, the Document Annotation

German Abstract

In Zusammenhang mit der neuen Globalisierung wird der Wettbewerb um die Eroberung neuer Märkte für kleine und mittlere Unternehmen immer schärfer. Unsere Antwort auf ihren Informationsbedarf ist das AMI-SME-System. Das AMI-SME-System ist ein ontologiebasiertes System zur Verwaltung von Marketing-Informationen. Im Rahmen dieses Systems wird gezeigt, wie speziell aufgebaute Domäne-Ontologien dazu beitragen die Informationen kleiner und mittlerer Unternehmen sinnvoll zu organisieren.
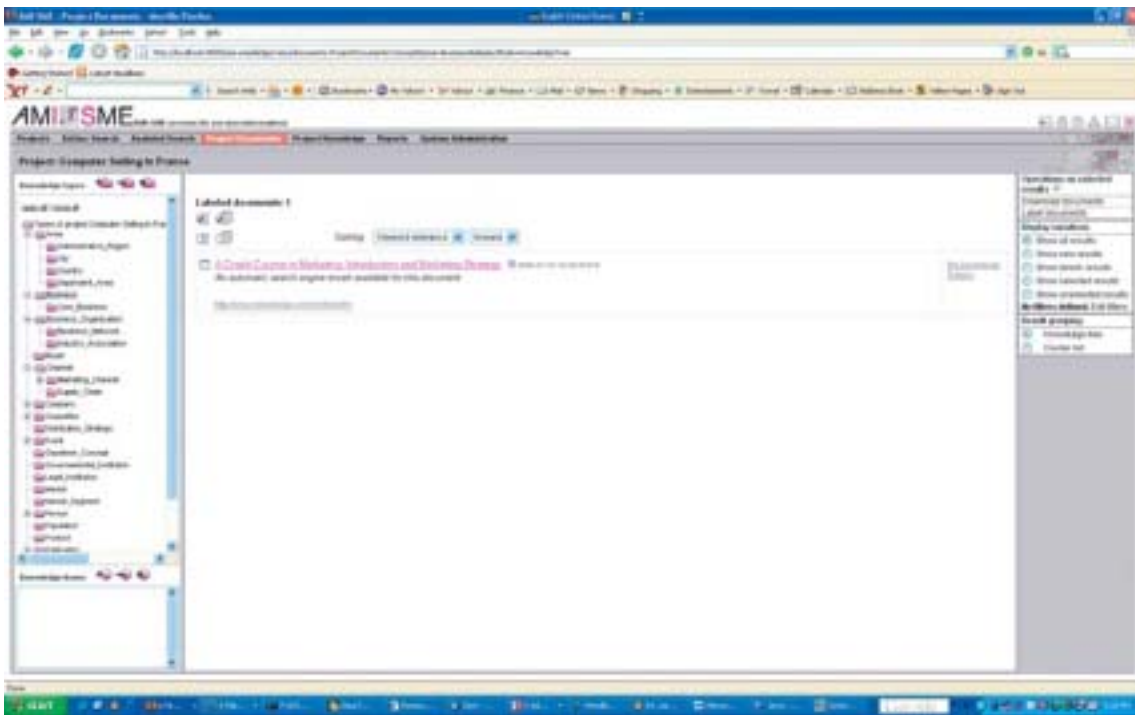
Figure 1: A snapshot of the AMI-SME system.

Database and the Internal Document Database are linked such that all the information related to a document can be retrieved easily.

Ontologies Role in the System
Currently, the AMI-SME Ontology Library comprises GMO and other ontologies which describe the products sold by two industry partners. In the AMI-SME system, the ontologies have the following roles:

1. *The annotation role.* The concepts and instances from the ontologies are used for document annotation. The annotation process takes profit of the taxonomic part of the ontology. In this way, the annotations explicitly provided by the user are easily extended. For example, if a user annotates a certain document with the label Microsoft, the system will look in his/her personal ontology and see that »Microsoft« is an instance of the concept »Competitor« and the concept »Competitor« IS-A »Company«. It can thus infer that the implicit annotation of the found document is »Microsoft-> Competitor->Company«.

2. *The NER and summarization role.* The ontology instances are searched in the documents. The documents that contain them are automatically annotated as

explained above. The ontology concepts and instances are used in the summarization task. From the point of view of the genre, the summary produced by the AMI-SME system is a generic summary which favors the virtual important information for the user. The summarization system has four components. Based on different criteria, each component assigns scores to the sentences of the document to be summarized. One of these components assigns higher scores to sentences that contain concepts and instances from ontology. All the scores computed by the four components are combined and the sentences that have highest scores are selected in the summary.

3. *Assisting the user formulate its query role.* After the ontology grows enough, it can act as a repository of potential useful keywords for query building. The user query can be formulated by ontology-browsing and concept/instance selection.

Conclusion
Up to now, the information related to the market obtained by Small and Medium Sized Enterprises was hard to manage. To overcome this obstacle, we developed the AMI-SME sys-

tem, a meta-searching engine coupled with a series of useful components for information extraction.

Points of Contact

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ProCon3D – An Interactive Solution to Product Configuration

P. Stefano, C. Giuseppe, G. Gabrio, R. de Amicis

Introduction

Marketing departments today are facing growing pressure from a globalized market. Customers' expectations are higher, and overall product quality becomes of great importance. Having interactive tools capable of quickly and effectively verifying configurations as well as being capable of checking different solutions without the need for physical prototypes is the key to a fast time-to-market and to reduced costs. The system described in this paper is called Pro-Con3D, which is a 3D product configurator. This paper shows the results of an industrial project which has lead to the development of a fully customizable 3D product configurator. The system can be used to generate a complex database of 3D objects and associated product attributes as well as to configure several product configurations and sales/use layout. Its easy-to-use and interactive features allow usuage by non CAD/3D modeller specialists, making it the ideal tool for consumer product companies who want to streamline their product development process.

The Main Functionalities

As soon as the users start the system, they are asked to insert their username and login. At this stage, the main software window is started, and the user can select a number of features. As visible from figure 1, the system offers five different main features, each activating a different GUI:

1. A first section shows where they can load data into a database, associate a 3D model, define attributes and link other documents.
2. The second option is chosen by the user to configure a scenario. This is a fully configured environment in which products contained in the database are placed and

German Abstract

Dieser Artikel beschreibt die Ergebnisse der Entwicklung eines dreidimensionalen Produktkonfigurators für das Produktmarketing. Die Anwendung ProCon3D (3D Product Configurator) ist das Ergebnis eines Industrieprojektes. Sie erlaubt die komplette Konfiguration einer Produktdatenbank und die Definition von Marketing-Szenarien. Die Anwendung, die als 3-D-Maschine EON verwendet, verbindet eine gegliederte und anpassbare Datenbankverwaltung mit einer 3-D-Echtzeitvisualisierung und -interaktion. Dies macht ProCon3D zu einem sehr leistungsfähigen Werkzeug für Bedienungspersonal in Marketingabteilungen, Verkaufsabteilungen und Lagerverwaltungen. Im Folgenden wird das System genauer vorgestellt und die Schnittstelle aufgezeigt.

Figure 1: The main interface showing the five main options of the system.

rendered interactively to create different product configurations or layouts.

3. Further, the ProCon3D let users define privileges according to the different operator's working profile. At this stage, it is possible to authorize each single user to the system and to define the portion of the system visible to them.

4. A fourth option can be used to configure technical aspects of the system, such as its graphical layout.

5. Last but not least, the user can manage the database by defining its location within the file system. This feature becomes important when working with different databases across several machines.

Given their importance, the following sections will focus on the first and second option, showing how to populate the database and how to configure a scenario.

Population of the Database

Whenever the user selects the »database« option, the window in figure 2 is shown. At this stage, the interface is divided into three main sections. The bottom part can be used to create new objects and to define, for example, their category, their product type, their production year and their product code. The content of the drop-down menus can be customized by editing a simple .ini file.

Most importantly, it is possible to associate a 3D model to the product itself. This has to be an EON prototype, previously exported by the operator using standard EON software (www.eonreality.com). A preview window, placed on the top-right corner, shows the 3D object selected by the user. The 3D object can be fully interactive, that is, it can contain interactions as well as other features supported by any EON prototype. In fact, the whole set of interactions supported by standard EON applications is supported by ProCon3D. Usually in an ideal workflow, the operator creates a customized library of EON prototypes which can be used both within standard EON software and within ProCon3D.

Figure 2: The database interface.
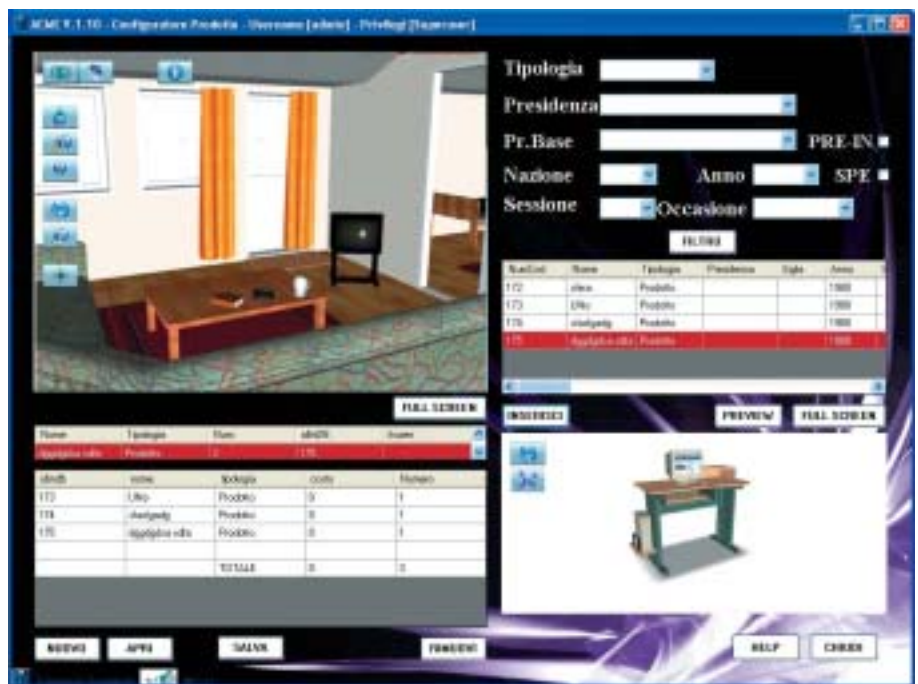
Figure 3: The scenario interface.

At this stage, the user then selects the 3D model to be associated to the database entry. This becomes the means to interact with the object within ProCon3D and fully represents the product within the system. Two buttons are shown in overlay to the 3D environment: These allow zoom-all and orbit functionalities. At this stage, the user can also associate other documents, such as CAD files, documents, PowerPoint presentations and videos of the product's advertisement. This allows the creation of a complete database associated with the 3D model, whereby the user can specify product details as well as all other related documents which are necessary to track the product's evolution.

The table at the top-right corner shows the whole set of objects present within the database and their features. The table can be ordered by

Figure 4a (left) and 4b (bottom): The scenario (fullscreen mode).

object free falling indefinitely once dropped from a table, an invisible plane with mass property has been placed at the ground level.

Once both scene and furniture have been selected from the database, the user can start adding their products. These can be selected from the top-right panel and dropped into the scene. Once added, they appear floating next to the user and following them during their movements within the scene. The user can navigate the scene and then place the objects at the proper position. To help them during the task, an additional top-view window can appear in overlay to the scene, centered on the user and showing the surroundings. This feature is available together with other features, such as the activation of gravity on each single object, the reset of the position of an object, the freezing of the object and the full screen mode. The object can also be placed through a pointer shown at the center of the window.

Every time an object is added to the scene, this is included in the table below the scene. The operator can decide to view the complete list of objects or to group the objects present in the scene according to their type. Once the operator has defined a product configuration/layout, they can save it on the disk to retrieve it at a later time.

Conclusions

This paper shows an interactive product configurator developed at GraphiTech. The paper highlights its features and shows an example of its use. The final system, called Pro-Con3D, has been the result of an industrial project and can be adapted to a number of different scenarios. ProCon3D is ideally used for the definition of an interactive product layout system based on 3D models made with commercial applications. For this reason, ProCon3D is a perfect candidate for real-life applications within the consumer product industry.

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any of the elements in the table, which represent the features of the product. Whenever an item is selected from the database, the user can see its 3D representation and edit the product's properties.

ProCon3D tracks each database entry. Therefore, it is possible at any time to ask the system to recall the product's action history, which details the date of creation and the author as well as any further modification to the product.

The Configuration of the Scenario
Once a few products are inserted into the database, the user can start configuring a product's scenario. To do so, he/she activates the appropriate window shown in figure 3. The interface is now divided into four areas. At the top-right corner, a number of drop-down menus can be used to compose a query by defining the most appropriate filters. The products which meet the filter constraints are shown in the table below. Whenever an object is selected from the table,

the user can show an interactive preview of the 3D model in the bottom-right window, and the product can be placed into the scene.

To create a scenario, the user first chooses a scene. This can be added to the database just like any other object; however, by defining an object as a »scene«, it has consequences from the performance point of view, since, as it will be illustrated later, this allows some major optimization of the SceneGraph. Once the scene is added to the environment, the user can then add the furniture. Similarly to scenes, furniture-objects are items in the database defined with a special tag. This allows them to be added onto a scene. However, furniture are subject to gravity and have mass property, therefore it is possible to place products onto them during the configuration of the scene. In comparison, scene objects do not have mass property. They were chosen in order to optimize performances. However, to avoid undesired effects, such as an

DENTROTRENTO – A Walk Back to Roman Age

G. Conti, G. Girardi, S. Piffer, R. de Amicis

German Abstract

Das Projekt hat gezeigt, wie wirksam VR zur Förderung des kulturellen Erbes eingesetzt werden. Hauptziel des Projektes war die Verbesserung des didaktischen und des Unterhaltungs-Potentials der antiken römischen Stätte des SASS, welche sich unterhalb des Theaters und des Battisti-Platzes in Trento, Italien, befindet.

Das Projekt, welches von der örtlichen Behörde für kulturelles Erbe unterstützt wurde, sollte eine benutzerfreundliche virtuelle Umgebung realisieren, die den Besuchern die Bedeutung der archäologischen Fundstücke der antiken römischen Stadt Tridentum, lateinischer Name von Trento, nahebringen sollte. Die Notwendigkeit einer VR-Simulation lässt sich durch die besondere Lage der Gebäude begründen. Diese befinden sich nämlich unterhalb eines Platzes in Trento zwischen den Grundmauern des Theaters. Dieser Umstand erschwert das Erfassen der Stätte, da Stücke römischen Ursprungs zwischen Betonpfeilern und -platten über ein Labyrinth von Räumen und Fluren verteilt gefunden wurden.

Das Projekt führte zu einer qualitativ hochwertigen und wissenschaftlich korrekten Rekonstruktion der römischen Stadt, die mittels einer benutzerfreundlichen, immersiven virtuellen Umgebung erfahren werden kann. Verschiedensprachliche Benutzer können gleichzeitig eine virtuelle Zeitreise erleben. Die gesamte Umgebung soll eine Dauerausstellung in den Räumlichkeiten der archäologischen Stätte des SASS werden.

Introduction

This paper illustrates the DentroTrento project which has contributed to the development of a VR system of an edutainment system for the visitors of an archaeological site in the town of Trento. The work, which was commissioned by the local authority for cultural heritage, aims at enhancing the didactic and entertaining potential of a Roman archaeological site, which is located between the city theatre's foundations, through the development of a computer graphics-based application capable of high visual and emotional impact.

This has been made possible through the creation of an interactive system in which the virtual reconstruction becomes a guide for the visitor through a virtual walk across time. The relevance of the work illustrated is underlined by the importance of the site and its articulated layout. This, in fact, is located underground below a square, thus preventing visitors from perceiving the urban outline of the roman town. Furthermore, traditional teaching material does not let visitors fully perceive the way of life typical of the time.

The system developed instead engages the visitor into a more exciting experience replicating not only the architecture, but the way of life of the Roman town. The scope of the project, together with the heterogeneity of the working team, has required a rigorous approach to the management of the entire project.

Context

The importance of the project resides in the environmental context of the reconstructed archaeological site. In fact, the site was discovered during recent renovation works of the Trento town theater. The site was found at the foundation level, below one of the most important squares within the city center. The coexistence of fragments of ancient remainings in the midst of structural elements, such as concrete walls, pillars and slabs, confuses the ordinary visitor, who ends up experiencing more than the ancient town, a spatial disorder that risks spoiling the visit to the archaeological site. This circumstance has stimulated the local authority for cultural heritage to promote the installation of a VR set-up within the premises of the site, which could help to better explain the importance and the

Figure 1 (top): Virtual fly in Roman town of Tridentum.

Figure 2 (right): The reconstruction of the modern site.

Figure 3: »A door to the past«.

Figure 4: The 3D widget used to mark the »Hotspot«.

Figure 5: The help interface.

historical value of the lost urban space. The project has contributed to the development of the system discussed in this paper as well as to the forthcoming installation of a stereoscopic immersive VR set-up within the archaeological site's premises.

The visitors' experience will be enriched by a 4.5 meters wide, 2 meters high stereoscopic screen, where a very detailed 3D graphical reconstruction of the historical buildings and monuments will be projected. This way, it will be possible to fill the perceptual gap between the archaeological finds that are located within such an occluded space. Environmental sounds will be played by loudspeakers to contribute to the richness of the experience. Concurrently, additional voice comments up to a total of more than 1.5 hours of audio will be broadcast to wireless headsets worn by visitors. The software has been developed in order to play multi-language audio comments when close to »hotspots« of particular relevance. Users can select the wanted language and listen to comments in their language while browsing the virtual reconstruction.

The Working Team
The development of the system has required an heterogeneous working group, whereby archaeologists had to sit next to computer 3D-modelers, software engineers as well as VR specialists. The cooperation was necessary to deliver a scientifically-sound 3D graphical reconstruction of the Roman street that is the main part of the archaeological site, together with historical buildings and monuments whose traces are still visible within the site. The project thus offers the visitors a coherent and global view of the site, filling the perception gap between the archaeological finds and their reconstruction, in order to enhance the comprehension and the fruition of the cultural heritage by a broad public, tourists and local citizens.

The Interface
The challenge that the development team had to address was the choice of the presentation metaphor which should be simple, yet effective for a broad public visit of such a complex environment. The final choice aided in the development of an immersive VR platform which can be navigated through a standard joystick.

The virtual guide starts from what is visible today. Therefore, visitors wearing stereoscopic glasses find themselves immersed into the projection room where they are physically located at that very moment. The user can then start moving freely

within the reconstruction of the modern site using a joystick, or it can activate pre-set fly-throughs. The initial room becomes the gateway between the real and the reconstructed environment. By pressing a button of the joystick, the visitor sees the modern structure smoothly fading away, removing all the disturbing elements present in the real place, and just leaving the historical remains. Other buttons allow moving to specific parts of the reconstruction as well as to two other ages. The travel in time can be mixed with today's layout by overlaying historical reconstruction onto the today's archaeological findings. This lets the user experience the spatial organization of the ancient city, including the structure of the buildings and their interiors, letting he/she perceive the outline of the site with reference to the ancient urban plan.

The scene, which can be navigated in space and time, contains a number of so-called »hotspots« which highlight particularly relevant points of interest within the site. Navigating close to these hotspots causes a visual feedback (the symbol slowly animates). Following this, the user can press the fire button on the joystick. This triggers the playback of additional information, which is animation as well as playback audio in multiple languages. Each »hotspot« inside the virtual world is placed at the height of the observer's point of view to capture the visitor's attention.

By pressing the trigger button of the joystick, an event is sent from the rendering engine to the audio-sub system. This is a software module which is capable of playing-back and which, through an RF transmitter connected to the graphics workstation, broadcasts audio content simultaneously in different languages about the specific point of interest. Each user can then hear the comment in the preferred language through his/her wireless headsets borrowed at the museum's entrance, while ad hoc animations allow the user to focus his/her attention on items and parts of the room in synch with the audio explanation.

Figure 6 (top): A snapshot showing the quality of the historical reconstruction.

Figure 7 (righ): Snapshot showing an example of a »hotspot« placed in the historical reconstruction.

Figure 8: Virtual overlay of the past in the present.

Conclusions

The project delivers a media-rich tool that allows learning the history of our cultural patrimony and ancient built environment by exploring the archaeological site across space and time. The final result is an integrated application that combines high quality visualization of an environment, which is, from the archaeological point of view, philologically consistent, and an ad hoc user interface with synchronized sounds and commenting audio. Technological advancements in VR technology and affordable high-performance computer graphics hardware have made it possible to extend the range of immersive VR applications from the field of scientific research to the general public, and specifically to the field of cultural heritage and virtual reproduction of lost built environments for edutainment purposes.

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A Geobrowser Application for Tourism. The Experience of a Tourism Board

G. Conti, S. Piffer, G. Girardi , R. de Amicis

German Abstract

Der Artikel beschreibt ein Projekt, das von einer Tourismusbehörde von Baselga di Pinè und Valle di Cembra in den italienischen Alpen gefördert wurde. In diesem Projekt sollte ein 3D-Portal für Touristen, die die Gegend besuchen wollen, generiert werden. Aus dem Projekt ist eine Anwendung auf der Basis der Open-Source-Software Nasa WorldWind [2] hervorgegangen, die in der Lage ist, hochauflösende Bilder des Geländes (die von einem Server über das Web geschickt werden) darzustellen und über der Landschaft für die Touristen interessante Informationen zu zeigen. Das Projektergebnis kann kostenlos im Web unter [1] eingesehen werden.

Introduction

Territorial marketing and promotion are essential to the economical wealth of areas heavily relying on tourism for their economy. Advertisement campaigns, including TV, magazines and posters are certainly one of the major causes of cost for most tourism boards' budgets. However, their effectiveness is limited since their results are entirely based on the projected image that these short messages can convey to the prospected visitors. Moreover, their effect is not persistent in time since it is limited to the time the advertisement campaign is broadcasted.

In the last year, however, the behavior of average prospected tourists has changed dramatically. The Web has revolutionized the way people choose their final destination and how they do their bookings. In fact, most people today, especially in the younger age range, use the Web as the prime source of information about their specific travel destination. The Web is also becoming extremely popular by people booking their travels. The commercial success of on-line flight ticket sales and hotel booking entirely reflects this tendency.

More recently, the major success enjoyed by Google Earth [3] has been dramatically changing the users' habits. In fact, a growing number of people use geobrowsers, such as Google Earth, Nasa WorldWind [2] or Microsoft Virtual Earth [4], to virtually explore the area they want to visit. Geobrowsers are used by people to check the position of a hotel or a restaurant, to check if amenities are within reach or to check if they are in a pleasant environment.

The project presented in this paper aimed at benefiting from such a shift in people's habits by deploying a 3D interactive and information-rich environment specifically targeted to tourists to promote a specific area within the Italian Alps.

The Choice of the Platform

The project has led to the development of a 3D visualization system in real time based on the WorldWind software [2]. This is an open source software developed by Nasa [2]. If compared with the other most relevant alternative, Google Earth [3], this platform has the two key advantages of supporting a number of standard communication protocols and of being open source. This makes it an ideal choice for developers or service providers since it makes it possible for the service provider, in our case the tourism board, to autonomously manage the dataset which has to be streamed to the clients.

In fact, the most significant limitation of Google Earth is the fact that all the data has to reside on Google's servers, which use a proprietary technology for the data streaming. It is possible to extend the data available through the central Google repository. However, such information must be sent to Google which then manages the databases' upgrade (at intervals of a few weeks). This approach causes a loss of control and ownership of the information. Further, the tourism board has no warranty that the data will be publicly and freely available in the future.

The choice of WorldWind, which is the most consolidated and used alternative of Google Earth, has allowed both the use of a standard platform (therefore with a wide impact on the public) and the independency in terms of data management. The company/service provider can then set-up its own servers, over which they can have total control, both in terms of accessibility and of data content.

The final Application

The project has contributed to the development of an add-on for WorldWind which is freely available on the Web [1]. This makes it possible to download hi-resolution images of the area of Pinè and Cembra, Italy, at different levels of detail according to the user's distance from the terrain. The user can download the add-on and install it onto the existing installed version of WorldWind. Once the add-on is installed, the user can activate it from an icon which is installed in the main toolbar.

When the application is started, the application connects to a custom server where an up-to-date version of the configuration file is located. This is used by WorldWind to manage the data to be rendered. When the application is started, the latest configuration is confronted with the current one, and if a new version is found, this is downloaded and used for the session. This approach allows having a constantly updated system whereby all users can be automatically upgraded with new information available on the specific area.

When the application is started and the user flies in the proximity of the alpine area, the application starts sending requests to a custom-tailored server which returns very hi-resolution images of the area at a varying level of detail according to the user's distance from the terrain. As visible from the pictures, the resolution achieved is very high and, essentially, only depends on the quality of the data available at the server side. Whenever new, better and higher resolution images are available, these can replace older ones with the consequence that all users will benefit from the new, available dataset.

Further, the add-on creates a number of extra layers within the Layer Manager, containing several categories of interest for the tourist willing to visit the alpine area of Altopiano di Piné and Valle di Cembra (Pinè highlands and Cembra Valley). Such data structure, organized in layers, activates a number of hotspots over the terrain, each corresponding to a geo-referenced point of interest. Whenever the user moves the mouse over a hotspot, the system renders

Figure 1. Application screenshot.
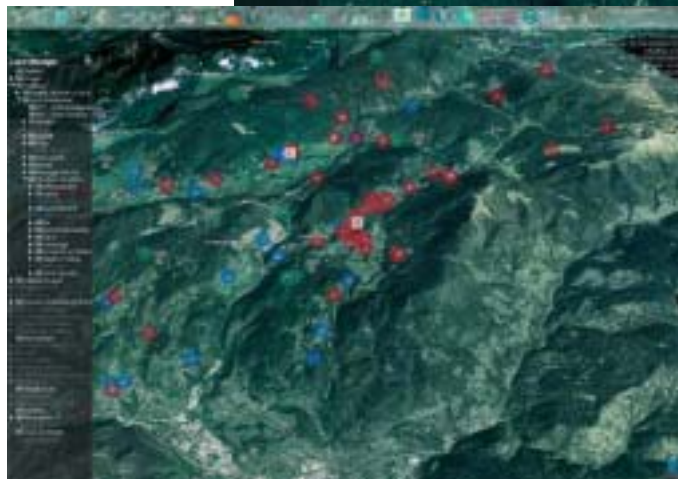
Figure 2. Application screenshot.

key information regarding the point of interest. When the user clicks on the hotspot, the system automatically starts up the default browser and loads the corresponding web page containing a detailed description, images and other multimedia data.

Conclusions

This paper describes a project sponsored by a tourism board in the Italian Alps, which aimed at the customization of a geobrowser for tourism purposes. This choice follows the current success enjoyed by geobrowsers such as Google Earth or Microsoft's Virtual Earth, which have made geographical geo-referenced information successfully available to the public for personal use.

The project has lead to a software solution, whereby the prospected visitors can fly over the territory rendered with very high quality images and see hotspots of interest (such as hotels and restaurants). As a result, the user can navigate over the region and

query the system about information he needs for the planning of his next trip.

References

[1] 3D visualization of tourist information for the area of Piné and Cembra, Italy, available at: www.graphitech.it/projects/IVVST/index_en.html
[2] World Wind, the open source 3D interactive world viewer, available at: worldwind.arc.nasa.gov/
[3] Google Earth available at: earth.google.com/
[4] Microsoft's Virtual Earth platform available at: www.microsoft.com/virtualearth/

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3D Wood Objects Modeled Using Their Grains

M.-S. Dao, M. P. Riggio, R. de Amicis

Introduction

Tree-ring analysis and wood surface inspection are one of the most important tasks related to forest science, weather research and the wood industry. Tree-ring analysis could help forest scientists (for example dendrochnologists) understand climatic and environmental changes better. Wood surface inspection is very useful in discriminating between sound wood and defects, which is the key to getting rid of lumber boards or sawn timber that contains knots and/or shakes.

Much research has been investigated in this area in order to propose efficient and affective methods with which the most significant characteristics or features of wood surfaces, such as tree-ring, knots, shakes and grain, could be extracted, recognized or analyzed automatically or at least semi-automatically. Conner et al [1] proposed the modified Canny edge detector for detecting tree-rings. The most significant improvement of this method is taken into account: the knowledge of the physical characteristics of tree rings at the boundary between rings. There is a steep transition from the dark late-wood of one year to the light early-wood of the next year. Tree rings are so-called circles with the same center, thus if considering a narrow area that runs from the center of a tree outward towards the bark - namely ray -, small parts of the tree rings will be parallel and orthogonal with such a ray. Since this method bases completely on the outstanding characteristics of tree rings , it is very difficult to detect arbitrary wood grains in sawn timbers or lumber boards that appear with no rule. Soille and Misson [3] used mathematical morphology for measuring rings area. Another method presented in [7] uses knowledge that relates to each type of tree as pre-knowledge to increase the qualification of tree-ring analysis. In the commercial area, WinDENDRO is considered a good commercial software for the tree-ring, stem and wood density analysis and measurement [6]. Although most of the methods proposed so far have gained good results, there is still a big challenge for researchers who want to

German Abstract

Im Rahmen des in diesem Beitrag vorgestellten Projekts wird ein effizientes und effektives Werkzeug entwickelt, mit dem Holzobjekte automatisch oder halbautomatisch mit Hilfe von Oberflächenaufnahmen dreidimensional modelliert werden können. Anhand dieser dreidimensionalen Darstellungen können Jahresringe und Maserungen analysiert werden, um z.B. fehlerhafte Maserungen wie Astlöcher erkennen zu können.
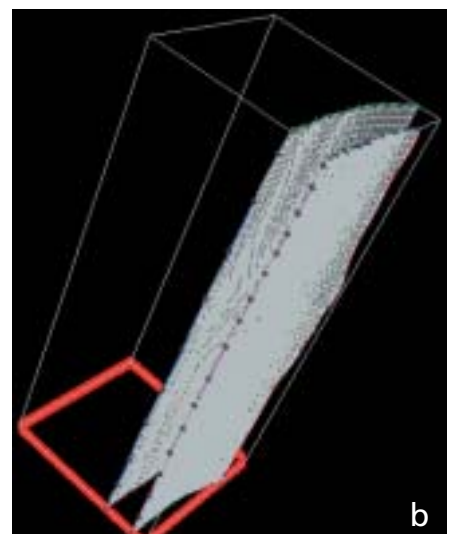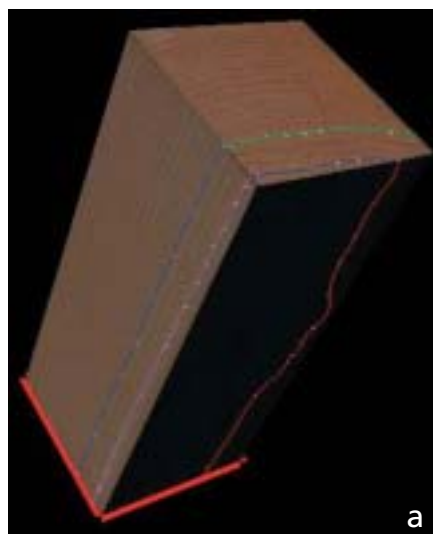
Figure 1: The application (a) grain detection and B-spline modelling for each grain (b) 3D wood object modelling.

propose an automatic tool to analyse tree-rings [2].

For wood surface inspection, Silvén et al [9] introduced a non-supervised clustering based on local binary patterns and a self-organizing map for discriminating between sound wood and defects. Other methods have also been used for solving this issue, such as those from Kauppinen [10] and Lampinen [11], to name but a few.

The purpose of this paper is to integrate tree-ring analysis and wood surface inspection to model 3D wood objects using wood grains (for simplification, »cube« is considered a 3D wood object). Tree-ring analysis is extended to recognize not only tree-rings, but also fee wood grains; wood surface inspection is used to detect defects in order to interpolate or connect broken grains.

The application is designed as follows (see figure 1):
– Each surface of a wood object is scanned, stored as images and labelled from 1 to 6, successively.
– Tree-ring analysis and wood surface inspection are performed for each surface to detect a set of grains.
– These grains are modeled as B-splines and constructed as a 3D B-spline surface.

Figure 3. Modified Canny edge detector (a) original image (b) global gradient direction (c) direction of gradient (d) morphology (e) result with snakes technique.

Figure 2: Defects of wood surface: (a) shake (b) knot.

Proposed Methods

This section presents the most important tasks of our project as well as introduces which methods we inherit and what our improvements are.

Wood Surface Inspection

This task is in charge of detecting defects such as shake, knot or any errors which cause grains to break (see figure 2). After these defects are detected, they will be marked by their positions and will become the cues with which edge linking is used to connect broken grain reasonably.

The method of Silvén et al [9] is considered as the basic method for inheriting and improving.

Wood Grain Detection

This is the most difficult task due to the appearance of sawn timber. Its huge natural variations make the task of determining the types of defects and the grade of each board become complicated and inaccurate [9]. Therefore, we decided to first design with semi-automatic wood grain detection and with automatic in the future.

The core of this step is edge color detection. According to Ziou and Tabbone [4], smoothing and differentiation are always treated as pre-processing for edge detection. Differentiation, however, is an ill-conditioned problem, and smoothing also results in a loss of information. These problems led to the design of a general edge detection algorithm which performs well in many contexts and captures the requirements of subsequent processing stages. Therefore, the knowledge of tree-ring and wood grade are taken into account in our project to design a suitable methodology to solve our problem. For smoothing, we use a morphology which is evidenced as a good method for the segmentation of

Figure 4. Effection of qualification input images (a - top) complex texture (b - bottom) the contrast between grains and background is too low.

object and background, especially when knowledge of the object is known [12].

Our algorithm, which is based on a modified Canny detector method [1] and the edge-linking method of Hajjar and Chen [8], is denoted as follows:

1. Each surface is divided into small parts with a pre-defined size. This task could extract a set of parallel grains (see figure 3a).
2. The gradient of pixels is calculated, and the global gradient vector (GGV) is determined. The direction of grains is orthogonal which such a GGV.
3. Non-maxima suppression is then performed. Only a pixel whose gradient direction is the same as GGV's is maintained.
4. Hajjar and Chen's edge-linking method and the results from section 2.1 are applied to connect broken grains.
5. The snakes technique [13] is used with a start model as lines, which are detected from step 4, to generate more accurate grains.
6. Lines detected from step 5 are normalized into the B-spline.

The iteration is continued from step 1 to step 6 until all surfaces are completely detected. The B-splines of each surface will be connected to another surface to generate a 3D B-spline surface.

Conclusion and Future Plans

Although our project received some optimistic results, there are still some problems. Since the wood surface is influenced by a lot of outer reasons, such as the qualification of input materials (for example camera, scan), and inner reasons, such as the grade of wood surfaces, the grains can not be automatically detected successfully.

There are still some missing grains or wrong detected grains due to the low contrast between the background and the grains, or due to complex textures (see figure 4). Therefore, the interference of users could help the system work more accurately and save time.

The next step of our project is to offer the users a tool for connecting broken grains, deleting redundant or wrong grain, choosing markers for watershed transformation [5] and controlling B-splines surfaces. Beside that, the edge color detection and wood inspection will be investigated more in order to improve the qualification of the automatic grain detection process.

References

[1] W.S. Conner, R.A. Schowengerdt, M. Munro and M.K. Hughes, »Design of a Computer Vision-based Tree Ring Dating System«, Proceedings IEEE Southwest Symposium on Image Analysis and interpretation, 1998.

[2] H. Laggoune, Sarifuddin, and V. Guesdon, »Tree Ring Analysis«, Canadian Conference on Electrical and Computer Engineering, 2005. pp:1582 - 1585.

[3] P. Soille and L. Misson, »Tree Ring Area Measurements Using Morphological Image Analysis,« Can. J. For. Res. 31:1074-1083, 2001.

[4] D. Ziou and S. Tabbone, »Edge Detection Techniques – An Overview«, technical report, No. 195, Dept Math & Informatique. Universit de Sherbrooke, 1997.

[5] M. Kazanov, »A New Image Segmentation Algorithm Based on Watershed Transformation«, 17th International Conference on Pattern Recognition (ICPR'04), Vol. 2, pp. 590-593.

[6] WinDENDRO for Tree-ring, Stem, Wood Density Analysis & Measurement: http://www.regent.qc.ca/products/dendro/DENDRO.html

[7] P. Cherubini, B.L. Gartner, R. Tognetti, O.U. Braker, W. Schoch, and J.L. Innes, »Identification, Measurement and Interpretation of Tree Rings in Woody Species from Mediterranean Climates«, Biol. Rev., vol. 78, 2003, pp. 119-148

[8] A. Hajjar and T. Chen, »A VLSI Architerture for Real-Time Edge Linking«, IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 21, No. 1, Jan. 1999, pp: 8994.

[9] O. Silvén, M. Niskanen, and H. Kauppinen, »Wood Inspection with Non-supervised Clustering«, Machine Vision and Application, Vol. 13, 2003, pp. 275-285.

[10] H. Kauppinen, »Development of a Color Machine Vision Method for Wood Surface Inspection«, Dissertation, Acta Universitatis Ouluensis C141, University of Oulu, Department of Electrical Engineering, Oulu, Finland.

[11] J. Lampinen, S. Smolander, O. Silvén, and H. Kauppinnen, »Wood Defect Recognition: A Comparitive Study«, Workshop on machine vision for advanced production, Oulu, Finland, 2994.

[12] L. Vincent, »Morphological Gray Scale Reconstruction in Image Analysis: Applications and Efficient Algorithm«, IEEE Trans. on Image Processing, Vol. 2, No. 2, Apr. 1993, pp: 176-201

[13] C. Xu and J.L. Prince, »Snakes, Shapes, and Gradient Vector Flow«, IEEE Trans. on Image Processing, Vol. 7, No. 3, Mar. 1998, pp. 359-368.

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Conservation and Monument Valorization

A. L. Lima, D. Oliveira

Introduction

The countries that are bathed by the Mediterranean Sea possess a high number of old buildings, Portugal being an excellent example in this context.

The old monuments and small farms are resulting from the influences of the civilizations and the cultures that encircle the Mediterranean Sea: European, African, and Asian. The development of these cultures has unfortunately led to a high number of abandoned buildings or structures with a deficient maintenance, due to both social and economical reasons, but also due to a loss of pride and significance of these monuments. The idea that the old buildings could be restored and reused has become attractive to the markets just during recent decades.

Presently, the public trend is not only to preserve but also to bring life into the buildings and the historical zones of the cities, aiming at making them functional and attractive for both the inhabitants and the visitors. It is the unique atmosphere of small streets and old squares that adds significance to the cultural heritage, representing the everyday life of the local population.

The goal of this project is to consider integrated and innovative methodologies for the inspection of the sites, a non-destructive testing, a structural evaluation, and to harmonize the phases of evaluation and preservation of the cultural heritage, until the historical place will be restored, through the project of intervention and conservation, to the enjoyment of the visitors.

The Project

The main objective of the project is to define and to validate an efficient approach for the evaluation, preservation, exploration, and enjoyment of old constructions. This approach will be developed and tested at two selected buildings.

The selected structures are of moderate dimension and will be under restoration during the course of this project, allowing the implementation and the testing of the processes that are intended to be carried out. The methodology intends to minimize the gap between the restrictions (economic conditions, changes of financing, labor cost for the craftsmen, education and training of the craftsmen, etc.) and the application of the most advanced techniques.

German Abstract

Das Projekt »Erhaltung und Aufwertung von Baudenkmälern« beschäftigt sich mit integrierten, innovativen Methodologien für die Denkmalpflege, d.h. in einzelnen Schritten für eine Vor-Ort-Begehung, ein zerstörungsfreies Prüfen und eine Bauauswertung. Ebenso sollen die Evaluierungs- und Bauphasen vereinheitlicht werden. Das kulturelle Erbe soll mit Hilfe historischer Unterlagen und entsprechenden Baumaßnahmen wiederhergestellt werden, um dann die Öffentlichkeit mit attraktiven Angeboten zum Erleben einzuladen. Die Methodik des Projektes zielt auf ein Managementinformationssystem auf der Grundlage eines 3-D-Modells.

Figure.1: Web Site of the Salzedas Monastery.

Figure 2: Manager of the Database.

Since the ultimate objective of these interventions is to make the cultural heritage accessible and safe to the places and/or visitors, the cost-benefit ratio of the survey techniques will also be evaluated, taking into account its impact on the program for the planned period of support, maintenance, and exploration of the structure.

Innovations Factors

The innovative character of this project can be pointed out by the:
– Integration and correlation between NDT and MDT researchers offering new solutions for information acquisition and its interpretation;
– Intensive use of 3D laser scan models, on which all the tests and monitoring results are imported, compared, and stored for continuous updates according to the maintenance program;
– Definition and application of strategies for modulation to determine the load capacity of old structures, before and after the intervention;
– Analysis cost;
– Benefit of the considered procedures taking in consideration the different levels of complexity and the available budget;
– Elaboration of a detailed database on traditional technologies for construction and repair.

– Careful evaluation of the mechanical and chemical impact of materials and recently developed techniques for restoration;
– Fact that it will be a complete conservation project for two national cases of study;
– Recommendations for strategies for monument conservation in Portugal;
– Innovative multimedia solutions with wireless technology to increase the enjoyment of monuments and the technical information.

Consortium Partners and Acknowledgments

The project is supported by the FCT - Fundação para Ciência e Tecnologia. It is under implementation by the Center of Civil Engineering; the Cen-

ter of Mechanical Engineering; the Center of Geologic Inspection; the Resources Valorization Institute, and the Center of Physics all of them from Universidade do Minho and the CCG - Centro de Computação Gráfica

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Figure.3: Panoramic of the Salzedas Monastery.

Interactive Multimedia Karaoke for Traditional Popular Instruments - the Drum House.

João Peixoto, António Diogo, Luís Almeida

Introduction

In Portugal some municipalities have very peculiar cultural traditions and cultural heritage manifestations that must be preserved for future generations and explored in the context of a new kind of tourist offers, typically in the interior part of the countries. These traditions are more and more asked for by a new kind of tourists looking for culture. One example of such cultural traditions are the drummer groups which are responsible for the animation of popular festivities and celebrations. One group of instruments consists of three bass drums, two snare drums, and one flute (figure 1). All drums are hand-crafted in a traditional way and used in a peculiar manner that can be considered as a kind of ritual. All these traditions, having their roots in certain regions, should be preserved and passed on whether to tourists, local citizens, or future generations. The new multimedia and communication technologies are particularly suited for this aim. Having this in mind, the Fundão municipality has decided to perpetuate the tradition by creating the »Drum House« (Casa do Bombo), including the drum museum and a multimedia application called the »Drum Karaoke«. This application is expected to serve for edutainment, enabling the visitors to feel the experience of playing the drum, but also serving as a place for teaching music and musical instruments.

The Project

The visitors of the »drum house« are invited to get in contact with the traditional manufacture of drums, the natural and recyclable materials used, and they also have the chance to try to play traditional themes, assisted by the multimedia application - the karaoke.

CCG runs a project for developing the multimedia application for karaoke. The main objective is to simulate the traditional groups of drummers playing during the popular festivities by an instrumental karaoke.

Typically the groups consist of six elements (one flute, two snare drums and three bass drums, figure 2). The

German Abstract

Die Verbreitung von Traditionen und kulturelle Veranstaltungen kann zur Erhaltung des Kulturerbes beitragen. Dies trifft auch zu auf die traditionellen Pauken- und Trommelgruppen, die es in einigen Regionen im Hinterland von Portugal gibt. Bei Volksfesten stellen sie oft die einzige Unterhaltung und Anregung dar. In diesem Beitrag wird eine sich in der Entwicklung befindliche Multimedia-Lösung zur Realisierung des sogenannten »Karaoke der Trommeln« vorgestellt. Hiermit soll ein nützlicher Beitrag zur Bewahrung und Verbreitung von Traditionen beigesteuert werden.

Figure 1: The traditional instruments.

Figure 2: Traditional bass drum group.

flute, and possibly the voice, is presented as playback, while the other instruments are physically available in the room and can be used by the visitors if they want to play one of the themes. The visitors can play the themes in front of a large projection screen, where the karaoke signals are combined with high quality videos, captured on streets and squares of typical villages of the region. In this way, the users have the sensation of being included in the real group of drummers, playing together with them.

Traditional karaoke solutions show the lyrics synchronized with the song music, in a way that the participants just have to follow the sequence of highlighted characters while singing. In our karaoke solution, it is necessary to find a way of representing individual graphical/visual signs for the instruments, the bass drum and the snare drum.

Our first approach is to use a graphical representation for each instrument, with animations representing the movements and the rhythm the user has to perform for

playing the selected theme. The idea is, similar to any traditional karaoke, that the user can get an impression of how to play that specific theme on the instrument (figure 3).

The Technical Solution

The system under implementation comprises a Content Management System (CMS), enabling the creation and/or actualization of musical themes over time. The CMS contains all audio elements (MP3), the video(s) (QuickTime® format), and the karaoke signals (animated 3D models) for each theme.

The multimedia presentation control system (MPCS) gets the multimedia elements from CMS. The MPCS is responsible for presenting and synchronizing all the multimedia elements necessary for the theme to be played, according to the user's selection. At the same time up to five users can be in the room playing the same theme (three bass drums and two snare drums), but not necessarily at the same time. The MPCS controls the playback of musical samples for a theme, depending on the number of players in the room and the musical instruments they are playing. The MPCS processes, in real time, the video information for the projector and the sound for the Sound Processing System (SPS). The hardware has been selected to have the best performance in terms of video and audio display.

The software application controlling the MPCS has been designed to be of easy usage by any person, with intuitive interface, like for example any multimedia kiosk with touch screen.

Using the application interface, the user can select the theme to be played, as well as the number of players in the room and the kind of instrument they want to play. Having this information, the system will compensate for the possible instruments not in use, by displaying the corresponding samples for the selected theme. The video image, representing the street or square in the village, and the karaoke signals are then synchronized with the sound for simultaneous presentation.

Figure 3: Showing the Karaoke signals.
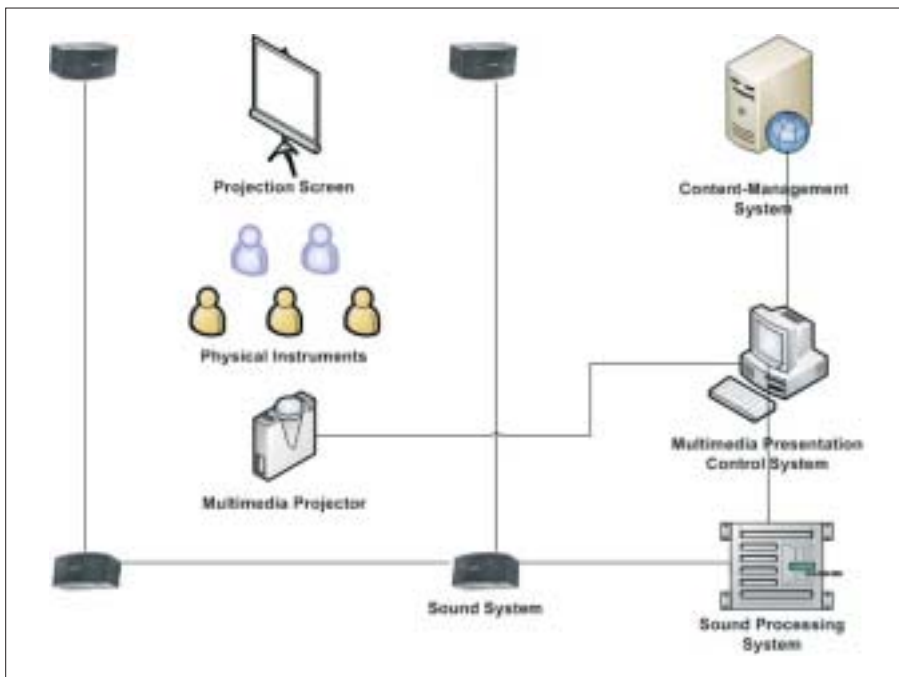
Figure 4: Simplified schematic representation for the complete system.

Special attention has been paid to the room conditions, in terms of projection area, natural light conditions and control, in order to have the best video quality, and the largest projection screen.

The sound system comprises one digital signal processing module receiving information from MPCS, and sending the audio signal to two amplifiers; the amplified signal is then sent to the four loudspeakers installed in the room. This configuration has been designed to achieve a better sensation of immersion in the scenario.

The sound volume was one of the prerequisites to be fulfilled. Indeed, each bass drum generates a very high sound volume, which implied a sound attenuation in the room by installing special materials on the walls. On the other hand, the amplification system should suffice for amplifying the digital sound to the same level as the instrumental sound, achieving the perfect equilibrium between the digital sound from the SPS and the real sound from the bass drums.

For this project the final quality of sound is of fundamental importance. Therefore, the choice of the equipment was a key aspect.

Conclusion and Future Work

From the tests already performed, it was possible to verify that the visitors were enthusiastic about the system and this innovative way of playing the drums.

According to the registered reactions, it seems to be a very interesting tool for teaching and learning music, especially for certain musical instruments, suitable for pupils from basic schools, but also for the promotion of regional cultural heritage and patrimony, in particular about the bass drum tradition.

As a multimedia system, it allows to transmit the learning process and the information to the visitors in a playful way, which is especially attractive for the young public.

As future work, it is our intention to apply this solution in other locations, adapted to other kinds of instruments.

Another aspect to be further evaluated is the possibility of having individualized karaoke signals for each instrument/user, instead of displaying it together with the video, using, for example, small individualized screens for each location where the users and instruments stand.

Last but not least, adding more musical themes to the platform is another important topic, generalizing as much as possible the range of traditional musical themes available for the »drum karaoke«.

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The Bird Dictionary – Pedagogic Content for Biology and Ecology

Manuel Santos, Luís Almeida

Motivation

The content platform presented here aims at contributing to fill the lack of scientific information available to pupils at basic schools, as well as to the public in general, despite the huge amount of information available, for instance on the web, typically scattered and not organized or prepared for utilization by these target groups.

The content is related to biology and other natural sciences focusing in particular on ecology, botany, and zoology. The content presentation assumes that the concepts must be presented contextually, using, as much as possible, examples or appealing animal species, easily recognizable by the users. For the project, a particular taxonomic group was assumed: the birds. Indeed, this group is ideal for illustrating the majority of the concepts. On the other hand, the majority of the users can easily identify a not very common bird, even in the cities. The same is not true for other kind of animals. Nevertheless, the platform under development is structured in a modular way, enabling to add other taxonomic groups, like mammals, reptiles, superior plants, etc.. Ideally, this platform should cover the majority of animal and flora species composing our patrimony of biodiversity. Nevertheless, due to time and budget restrictions, a modular structure was adopted.

This option was not a constraint for the project. Indeed, the initial perspective for expansion and modularity allowed to structure the project by modules, allowing for future extensions, in terms of updating content and information technologies.

The Project

For the project implementation some of the target users considered are the pupils and teachers at basic schools, but also any person interested in ecology and biology. The main objective is to explore the Internet as the interactive communication means for the:

– Improvement of the comprehension of the concepts of biology and ecology, usually part of basic school curricula. In order to achieve this goal, multimedia information resources are used.
– Improvement of opinion making and ecological awareness.
– Incremented usage of Internet information servers as the source of information and communication between and among pupils and teachers, located remotely.

German Abstract

Dieser Beitrag stellt das laufende Projekt »Das Vogelverzeichnis - Pädagogische Inhalte für den Biologie- und Ökologie-Unterricht« vor. In diesem Projekt sollen das Internet und neue Informations- und Kommunikationssysteme als Mittel zur wissenschaftlichen Informationsvermittlung im Bereich Biologie (Ornithologie) und Ökologie eingesetzt werden. Das Projekt stellt eine technologische Aktualisierung des bisherigen Projektes dar, welches 2001 entwickelt wurde und eine erfolgreiche Initiative war in Anbetracht der konstanten und kontinuierlichen Teilnahme vor allem der Vertreter der öffentliche Zielgruppe - Schüler und Lehrer an Grundschulen und ganz allgemein junge Leute.

Figure 1: General aspect of the actual prototype.
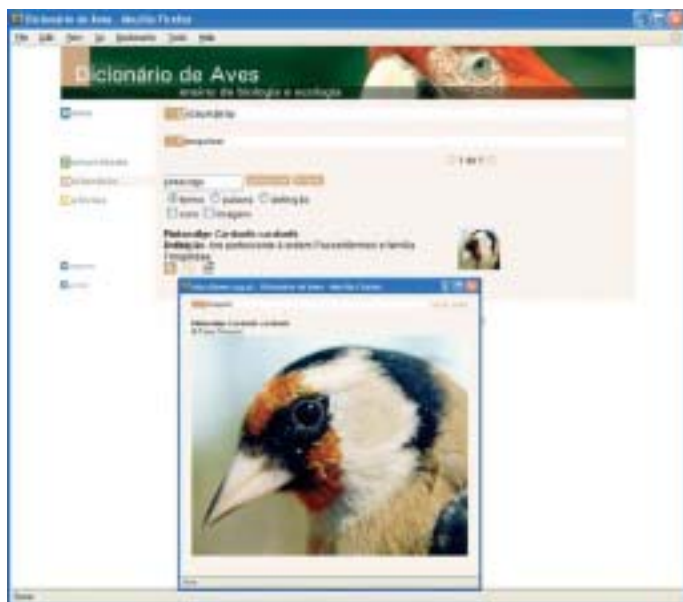
Figure 2: Example of multimedia content.

Finally this project aims at filling the lack of educational elements, for free, in the field of biological science. It intends to be a useful tool for students in their daily search for information and content. It implies to increase the quality and quantity of available content, having in mind the web platform intuitivity and an easy use.

The information must be available to the widest range of users possible. Therefore, Portuguese speaking countries, but also people from other locations using the English version, are potential users. Indeed, for African countries and Brazil, the free availability of content in Portuguese can be of fundamental importance for improving the teaching quality in such countries. The constant updating of information and user support, by a CIBIO team, specialized on biodiversity and scientific information dissemination, complemented by CCG's experience in using the TICs for pedagogical support, and the contribution of a team of scientific illustrators from »Gradientes e Texturas« is a guarantee for quality and success. In the future, other synergies will be integrated, namely by involving NGOs.

The Technical Solution
For the project development and implementation, tasks have been assumed by the consortium partners according to their profiles and competences. CCG has, among other things, the responsibility for the relational database system design and implementation, as well as the web platform specification and implementation.

Microsoft SQL server technology has been adopted for the information management platform implementation and .NET for the software development, integrating whenever possible open source libraries. All the content, collected, prepared, and revised by partners is classified and included into the database remotely through the web-based back office application. Such an application is restricted to authorized users, who are, for now, the project members.

In terms of content type, the platform will manage and provide all kinds of multimedia formats, indispensable for illustration and presentation of the topics. The platform will manage and present news, events, newsletters, a set of contacts for persons from the fields of biology, links to other resources and institutions, etc., but the most important features will probably be the dictionary of birds and the discussion forum, enabling the users to share information with other users, but also to ask questions that are immediately answered by the specialists. The layout attractiveness, the design of menus, and the functionality access and presentation are key aspects for the success of the platform. The possibility of presenting mixed-media content, as a way for better illustration and attractiveness for the matters will be included.

Accessing the front office, the users will be able to use the dictionary functionality for querying the database about a certain bird species, refining the query when needed using an advanced search form. Images, sounds, video, textual description, scientific name, etc., are presented in an appealing way.

The entire platform is W3C-compliant, and special care was taken about the accessibility by users with special needs.

Future Work
The project is now under development, to be available online in the near future. Partners are now collecting information and creating new contents (scientific illustration, for example) to be included into the database. Once the platform is online, the continuous updating and monitoring is mandatory in order to guarantee that the users get the expected support, in terms of retrieved information. Future extensions are expected, namely for the implementation of additional sections addressing other branches of biology and ecology. Some more advanced features can be added, exploring the new possibilities for bandwidth access. The web platform access by mobile devices, the content optimization for a transmission via wireless connection, and its visualization on such kind of devices is one of the top priorities for the future work.

Consortium Partners and Acknowledgements

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Formimolde: Training and Innovation in the Moulding Industry

A. L. Lima, R. Soares

German Abstract

Portugal nimmt einen weltweit herausragenden Platz in der Plastik-Formgussindustrie ein. Große internationale Konzerne beauftragen immer öfter portugiesische Firmen mit der Entwicklung und Produktion von Gussformen.
Die Aktivitäten zur Förderung und Vereinheitlichung von Innovationen haben sicher eine strategische Bedeutung in diesem Industriezweig gewonnen, die sehr stark mit den Kooperationsnetzen verbunden ist, die die Betriebe dieser Branche angeregt und gefördert haben wie z.B. mit Centimfe (Nationales Technologiezentrum), verschiedenen Universitäten und anderen nationalen und internationalen Wissenschaftszentren.
Wenn wir in diesem Zusammenhang berücksichtigen, dass die neuesten Kommunikations- und Informationssysteme Anwendung finden und so oft wie möglich Telearbeit und Kooperationen durchgeführt werden sollen, so glauben wir, dass der Plan der Formgussindustrie neue Trainingsmodelle einzuführen ein strategisches Mittel besonders im Bereich der Personalwirtschaft darstellt, nicht nur wegen der Auswirkungen auf die Motivation sondern auch aufgrund des ständigen Trainingsbedarfs der Mitarbeiter.

Introduction

The project Formimolde aims at developing a set of technical, pedagogical, and learning units which are innovative, contributing decisively to the global movement of reinforcing the training and qualification of company assets in the sector of plastics and moulds.

In spite of its global character and the potential of the diffusion in the productive activity, it is understood as being advantageous and innovative that the project shows the moulds and the associated industry processes, based on virtual models of the:

– Conventional mould,
– Movement mould, and the
– Hot canals mould.

The Project

As specific objective seven applications will be developed to support a continuous professional training (auto-training, e-learning, or presence training) based upon the concept of »learning by doing«. These applications will somehow allow a virtual experimentation of a great set of possible operations to be applied to a subgroup of typified moulds.

The project will serve as a dissemination platform of information technologies and its potentialities in the professional and applied training domain, especially concerning the plastics and moulds sector.

The project aims at demonstrating that the methodology presented could be adapted and then used with the same high degree of applicability for the professional training in many other industrial sectors.

Support Typology of the Resource

The learning units to be developed can be classified as integrated software in a multimedia application in
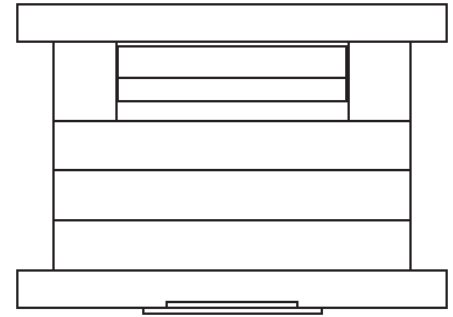
Figure 1: Example of a conventional mould.

web format. As an alternative all the contents are adapted and enriched for a version distributed off-line in CD-ROM format.

The web application is only constituted for this purpose, such as the CD-ROM, a learning unit which allows further functionalities and additional contents compared to the other applications.

Thus, the integration of the remaining applications will be complemented with functionalities like the indication of dynamically actualized contents (web version), FAQs, or the linking to additional resources. In this way, it is possible to extend and to update the contents.

Structure and components
This learning unit will allow the formation of the diverse constituents of the moulds, namely guides, bushings, extractors, supports, sliders, screws, centering rings, hot canals, racords, hydraulical cylinders, plates, cores, sockets and inserts.

Functional systems
This resource serves for training at the level of the functional systems of the mould using Virtual Reality Technology for shaping 3D objects.

Figure 2: Example of a mould to be visualized.

autonomous interaction to establish the intended sequence of the assembly, with notification in case of wrong assembly action and its reason.

Innovation Factors

The innovative aspects in terms of these learning resources are basically related to the possibility of interactions (in both ways) between trainee and the object of his/her study (in this case a mould and its components).

In a more apparent way, the type of learning unit that shall be implemented will use »Immersive Virtual Reality« in which the trainee will be able to manipulate objects using adequate equipment.

Points of Contact

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Battery of moulds

This application will allow the interaction of the trainee with objects shaped in 3D, i.e. to initiate their assembly, to get error messages in case of assembly process errors, to get information on definitive components, to twirl, to extend, and to move components, etc.

Assembly and disassembly of moulds

This phase is of extreme importance in the learning process.

The interactions possible in this resource comprise the animated visualization of a predefined sequence of mould assembly, controlled by the user or not, allowing advance, retrocession, and request for aid; an

Figure 3: Example of a mould in 3D.

More Highlights of the INI-GraphicsNet Innovation Week

It was a week with enthralling workshops, demonstrations of latest technologies, enjoyable evening events, and awards and honors to outstanding scientists – the innovation week of INI-GraphicsNet from Mai 29 to June 3, 2006.

In the course of the week, about 1000 guests were welcomed in the premises of the Fraunhofer IGD, the new building of the INI-GraphicsNet Stiftung, and, for the evening event, at Jagdschloss Kranichstein. The picture gallery published in the last topics edition already gave an idea of what our international guests were enjoying. In the course of that week too many pictures were taken to place them all in one edition. But we don't want to deprive you of them.

This is why we have decided to present to you further highlight pictures in this and all following topics issues in 2006.

Of course, all pictures of the innovation week are available for download or can be ordered in the Internet under www.inigraphics.net/innovations-woche.

At the same address you can also find the interesting innovation speech of Professor José L. Encarnação. In this speech, he gave during the evening event »A Rainbow of Innovation and Culture«, he impressively describes the history and the future of the INI-GraphicsNet Stiftung founded by him.

German Abstract

Eine Woche voll spannender Workshops, Demonstrationen neuester Technologien, unterhaltsamer Abendveranstaltungen und Ehrungen wohlverdienter Wissenschaftler – das war die Innovationswoche des INI-GraphicsNet vom 29. Mai bis 3. Juni 2006.

Die in der letzten topics-Ausgabe veröffentlichte Bildergalerie vermittelte bereits einen kleinen Eindruck davon, was unsere internationalen Gäste erlebten. In diesem und allen folgenden topics-Ausgaben des Jahres 2006 präsentieren wir Ihnen weitere Highlight-Bilder dieser ereignisreichen Woche. Sämtliche Bilder der Innovationswoche stehen natürlich auch im Internet unter www.inigraphics.net/innovations-woche zum download sowie zur Bestellung bereit.

Unter der selben Adresse finden Sie auch den Innovationsvortrag von Professor José L. Encarnação, in er eindrucksvoll Geschichte und Zukunft der von ihm gegründeten INI-GraphicsNet Stiftung beschreibt.

Prof. Encarnação and Prof. Wörner hand out the Alwin Walther medal and certificate to Prof. Reinhard Wilhelm.

Also Prof. Martin Grötschel receives the Alwin Walther medal and certificate from Prof. Encarnação and Prof. Wörner.

Prof. Encarnação together with his wife, receiving presents for his birthday.

The guests enjoying the Alwin Walther Award ceremony.

Prof. Trottenberg congratulates Prof. Encarnação at the International Conference on Transnational Technology Transfer.

Wolfgang Kniejski, Treasurer of the INI-GraphicsNet Stiftung, opening the inauguration ceremony with his talk on the development of the INI-GraphiscNet and the INI-GraphicsNet Stiftung.

Prof. Seidler, chancellor of the TU Darmstadt, at the inauguration ceremony.

Prof. Seidler together with Prof. Encarnação.

Also Wolfgang Glenz, Mayor of the city of Darmstadt, speaks at the inauguration ceremony.

Dr. Joachim Rix, Scientific and Technical Director of the INI-GraphicsNet Stiftung.

Dietmar Opitz, architect of the new building with the symbolical key.

CAST e.V. as one of the sponsors of the innovation week is represented at the exhibition by Dr. Ulrich Pinsdorf and Claudia Prediger.

Prof. Encarnação opens the sponsors' exhibition together with moderator Nick Maloney.

Among the guests of the gala event is also João de Vallera, Portuguese ambassador in Germany.

Walter Hoffmann, Lord Mayor of the City of Darmstadt, with the new road sign, which he gives as a present to Prof. Encarnação

The organizer of the innovation week, Bernad Lukacin, with the star guest, a Marylin Monroe double, and the moderator (right).

Karsten Schmidt from the Compter Graphics Center and his band finish off the beautiful gala event.

The virtual goal keeping game, developed by the Computer Graphics Center, is one of the main attractions of the GameDays 2006.

School classes visit the GameDays 2006 in large numbers.

Pupils vividly discuss the effects of violent computer games.

NEWS
A-Z

CAD2Vis – Conversion simplified

Fraunhofer IGD is developing a conversion tool for the import of CAD data in visualization applications.

Today product developers can no longer do without an efficient combination of computer-supported design (CAD) and Virtual Reality (VR) technologies. For design reviews and presentations they more and more use VR models based on the CAD raw data of the designers. For the conversion of these CAD data into VR models conversion programs are used most of which are only available in a set with often very expensive VR data processing tools.

The department Industrial Applications of Fraunhofer Institute for Computer Graphics IGD is developing the conversion software CAD2Vis. For data conversion the user does not need a license environment for a particular CAD or VR system. For unlike other products available on the market CAD2Vis allows to convert the data independent of a particular provider. The software supports the important CAD formats CATIA V4, CATIA V5, Pro/E, SAT, STEP, IGES, and VDA-FS as well as the VR formats OpenInventor, VRML97, and, soon, also X3D and OpenSG.

If the target data format is supporting a NURBS representation (e.g. OpenInventor and X3D), CAD2Vis can store the loaded CAD model as a precise NURBS model. Such NURBS models can then be flexibly triangulated in the target system. If CAD models are converted into data formats which do not support parametric surfaces (NURBS) the precision of the triangulation can be adjusted.

The software developed at Fraunhofer Institute for Computer Graphics IGD is especially suited for product developers embedding VR technologies or digital mock-ups (DMU) into their process chain and

looking for an independent solution for the conversion of CAD into VR data. It is also suited for service providers processing VR or web presentations based on CAD data or for VR providers wanting to offer a CAD import.

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Summer Academy for Designers: Fit for the Job Market – Thanks to Advanced Training

From July to September, 2006, the Computer Graphics Center ZGDV e.V. and the Design Zentrum Hessen e.V. are offering for the first time advanced training courses especially for designers.

In collaboration with the Computer Graphics Center (Zentrum für Graphische Datenverarbeitung e.V., ZGDV) the »Summer Academy for Designers« has been initiated by the Design Zentrum Hessen e.V. At DESIGN HAUS DARMSTADT and at ZGDV Darmstadt designers offer the opportunity to acquire in personalized workshops the necessary qualification to get into the lead in the job market. In groups not exceeding twelve persons each participant will enjoy an intensive support by renowned experts having many years of training and practical experience. Due to the limited number of participants an early registration is recommended.

Course offer
In addition to the training of so-called soft skills where the attendees learn, among other things, to skillfully use their body and voice in presentations, the Summer Academy will mainly offer the following software courses:

Adobe InDesign Basics
1st date: July 31 / August 1, 2006
2nd date: August 24 / 25, 2006
Registration fee: 430.00 Euro

Dreamweaver – Professionally Generating Web Pages
1st date: August 14 to 16, 2006
2nd date: September 4 to 6, 2006
Registration fee: 580.00 Euro

Flash Basics
1st date: July 27 / 28, 2006
2nd date: August 31 / September 1, 2006
Registration fee: 430.00 Euro

Photoshop Basics
1st date: August 3 / 4, 2006
2nd date: August 21 / 22, 2006
Registration fee: 430.00 Euro

Rhino 3D CAD Modeling
Date: August 22 / 23, 2006
Registration fee: 430.00 Euro

3D Studio Max Basics
1st date: August 7 to 10, 2006
2nd date: September 11 to 14, 2006
Registration fee: 770.00 Euro

These courses will take place in the premises of Computer Graphics Center.

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3D GIS – Growth Market with Good Prospects

3D Geo-Information Systems (3D GIS) are offering an intuitive access and a realistic representation of spatial information. The systems are used e.g. in the fields of city planning, architecture, or tourism. The research and development work of the 3D GIS technology so far has mainly concentrated on solving technical, political, and societal questions. An analysis of the economic chances and risks of this young market has not yet be carried out.

This gap is now filled by a study executed by the scientists of the Graphic Information Systems department of Fraunhofer IGD. Nearly 500 experts from the European geo-information market – data suppliers from public authorities, providers of geo-information systems, organizations,

institutions, and research institutions – were asked for their view on the significance of the 3D GIS technology, the market potential, and possible customers and users. Their answers give a wide overview of the economic relevance and the economic potential of 3D GIS.

Since the beginning of June, the study, which does not only present the results of the inquiry but also gives an overview of the technology and the worldwide GIS market and some selected expert interviews, can be ordered at a price of EUR 49 (plus VAT).

Based on the results of the first study the scientists of Fraunhofer IGD have started a second inquiry in June 2006. This follow-up study shall identify the requirements and expectations concerning 3D GIS from the users' perspective. The users identified in the market study were addressed and asked for their opinion. The inquiry was carried out in form of an online inquiry. Public institutions, enterprises, and scientists dealing with this subject were asked to participate in this inquiry. The participants will get a condensed version of the evaluation free of charge.

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Anchoring Collective Knowledge: European Shipbuilding Day in Brussels

European shipbuilders are in keen competition with their Asian competitors. With innovative hightech ships, however, they want to take the lead in the world market. From July 12, 2006 especially actors from Mecklenburg-Vorpommern were presenting themselves as innovation partners in the sector. The first European Shipbuilding Day 2006 was dedicated to the innovations in shipbuilding and discussed its competitive power all over Europe.

In view of the internationally growing competitive pressure in industry and economy the ship market in Europe and Asia is hard-fought. »The international competition does not only concern the cost-effective production, but also the development of efficient production processes maintaining high quality standards«, Dr. Uwe von Lukas says, co-initiator of the Shipbuilding Day and head of Computer Graphics Center (Zentrum für Graphische Datenverarbeitung e.V., ZGDV) in Rostock. »Using the Virtual Reality technologies developed by us can improve the efficiency of the planning and maintenance work of ships and will reduce the running cost of the shipowner in the training and maintenance sector. The »Schweißtechnische Lehr- und Versuchsanstalt« (teaching and research institute for welding technology) also resident in Rostock introduced their mobile laser technology in Brussels - another example for hightech from Mecklenburg-Vorpommern.

The European Shipbuilding Day was first established by the information office of the state of Mecklenburg-Vorpommern at the EU in cooperation with the European shipbuilding association (Europäischer Schiffbauverband) CESA.

Under the motto »Innovations in

Shipbuilding - Competitive Power for Europe« numerous top-class speakers from politics, research, and development came together on July 12, 2006 to explain the significance of research and development for the prospects of shipbuilding and to show its role for the competitiveness of the European industry. »The shipbuilding sector offers a broad spectrum of innovative products and methods. Mecklenburg-Vorpommern does not need to fear comparison as a hightech location. But it is partly lacking a supraregional appearance«, von Lukas continues. This deficiency shall now be remedied in Brussels.

Further information as well as the detailed program can be found under: www.mv.bei-der-eu.de/ pages/veranstaltungen.html.

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Einsamkeit / Zweisamkeit (Loneliness / Togetherness)

In the scope of the exhibition series house-art Fraunhofer Institute for Computer Graphics presented the works of the artist Robert Arndt.

In a more and more complex world the individual becomes less and less important. The human relations are in danger of being adversely affected. The individual feels lost in a world increasingly dominated by technology. The works of Robert Arndt entitled »Einsamkeit / Zweisamkeit« (Loneliness / Togetherness) present his personal impression of the decay of human relations.

Starting point of the artist's works are realism and representation. Robert Arndt creatively deals with the relationships of persons with each other, shaped by powerlessness and sadness but also by hope, love, and freedom. Robert Arndt counts among the autodidacts among the artists. For five years now he has worked as an freelance artist. The exhibition »Einsamkeit / Zweisamkeit« was the first individual exhibition of the Weiterstadt artist.

One of the pictures showed at the exhibition »Einsamkeit / Zweisamkeit«.

The pictures of Robert Arndt were shown from July 7 to August 8, 2006 at the Foyer of Fraunhofer Institute for Computer Graphics IGD, Darmstadt.

AAATE 2007 - 9th European Conference for the Advancement of Assistive Technology in Europe

In recent years Assistive Technology has been gaining importance in the scientific & technological community while institutions at every level have introduced Assistive Technology as »hot topics« in their research and social policies. In parallel, European population are ageing, thus increasing the social and institutional awareness, pushing Assistive Technology to become one of the key players to face challenges derived from this demographical revolution.

In this context, the Assistive Technology community has the opportunity and responsibility of taking a step forward to social inclusion; independence and autonomy of people with disabilities and elderly people by making their research developments become real solutions for real people in real conditions. It is therefore time to face the challenges Assistive Technology pose, and take advantage of this need: making prototypes become products, making ideas become services, making »dreams come true«.

Within this global context, the enlargement of Europe is an opportunity to establish the European Union as a world reference space, making efforts to improve social awareness and inclusion, and in the development of technology based solutions that are affordable in real markets.

The 9th European Conference for the Advancement of Assistive Technology will take place during 3, 4 & 5 of October 2007 at San Sebastián, Spain. It is being organized by FATRONIK with the collaboration of INGEMA and VICOMTech. More information can be found at: www.fatronik.com/aaate2007/

This conference will offer a good opportunity to take a close look at these main challenges that the Assistive Technology community and society in general, will have to face in the next few years.

– *New Technologies*: Ambient Intelligence technologies, computer graphics, Augmented and Mixed Reality, smart and advanced materials, nanoelectronics, biomechatronics and even bionics can offer important options for suitable solutions for people with disabilities and elderly people.
– *Socio-Economic Issues*: In this age of globalization, technology based markets are being affected by low cost production countries and powerful countries suffer economical problems. The Assistive Technology market, far from benefiting from this revolution is still suffering problems to develop affordable technically high quality products for end users. Making Assistive technology products affordable to end users is definitely one of the big challenges for the incoming years.
– *Universal design and its engagement with Assistive Technology*: Universal design and Assistive Technology are considered two parallel, independent strategies for bridging the gap. Since the exact line between »for all« and »assistive« is not always clear, it is needed to go deeper in the definition and discussion of the interface between the two of them.
– *Evidence based Practice*: A lot of current initiatives in Assistive Technology are at a research level, and it is time to take some steps towards a real practice level, and to establish all those profitable products, methods, procedures and systems in market. Assistive Technology will only be successful, if it benefits real people with disabilities in their daily lives.
– *Ageing and disability*: Europe, as all other developed regions in the World, is facing a new social challenge: population ageing. Since ageing is associated to a higher degree of disability and dependence, Assistive Technology must play a role in sustaining and maintaining the independence and quality of life of people as they become older.

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, IGI 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 is 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 none 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. A good place to start searching for Marie Curie Actions, actual proposals and deadlines for applications, is the website *http://cordis.europa.eu/mc-opportunities/.*

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 seems to be very promising (see also *http://europa.eu.int/comm/education/programmes/leonardo/new/leonardo2_en.html).*

Do not 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.daad.de/ppp* (in German).

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A L U M N I

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. Jorge Posada
December 9, 2005
»A Methodology for the Semantic Visualization of Industrial Plant CAD Models for Virtual Reality Walkthroughs«
Supervisors:
Prof. Dr. José L. Encarnação,
Prof. Dr. Frank L. Krause
Prof. Dr. Julian Florez

There are still many open questions and needs in important aspects of the scientific area of Large Model Visualization (LMV) for Plant Design. Performance to achieve interactive rates in immersive virtual environments is certainly one of them, especially if resources are limited, but not the most critical one anymore. Surprisingly, the different processes used today to generate the walkthrough experiences take very few explicit semantic considerations into account.

Jorge Posada addressed this problem in his Ph.D. thesis. His work focused on the improvement of the visualization of large 3D CAD models of industrial plants, overcoming several current limitations. The main

approaches presented in the literature of the field of LMV are mainly related to algorithms and compression methods to be applied to the geometric entities that compose the CAD model. However, no sufficient attention is given to the following aspects: (i) These models actually belong to a special engineering domain with related standards; (ii) the different potential users have diverse backgrounds and intentions; and (iii) an adapted visualization walkthrough of the model can be different for a specific user and purpose in that context in order to use the available resources and techniques in an optimal way.

Therefore, the most common situation is that the generation of visual walkthrough experiences is typically not aware (in proprietary systems with links to PDM, the situation is better to some extent) that the 3D CAD model of a plant is actually just a geometric representation of a complex engineering system. This knowledge is not sufficiently exploited in the generation of the walkthrough experience. The consequence is to have advanced VR environments for the interactive exploration of models of millions of triangles, that have little explicit use of the knowledge - and in many cases none - about the domain, users and visualization purposes involved.

Jorge Posada defines a formal methodology that allows the explicit

introduction of semantic aspects, pushed from an engineering domain perspective (and strongly complemented with computer graphics and semantic technologies), in the process of generating visual walkthrough experiences for specific users, visualization purposes and resources in the Plant Design domain. The methodology was also implemented in a prototype system for the interactive walkthroughs for Design Review, which has been extensively tested with real-world industrial plant models.

Dr. Jorge Posada with Prof. José Encarnação at the celebration.

Emotions in Human-Machine Interaction EmoControl - A Framework to Control Affective Systems

Diploma thesis by: Christian Graf
Supervisor: Karina Oertel

This thesis focuses on the question, how a computer system has to be designed and to be implemented to control an application according to the emotional state of the user. Adaptive interfaces hold potential for numerous types of computer application and they could be advantageous for both sides of the screen: The user experiences a new quality of interaction, and the task is executed smoothly and with less frustration.

The aim of this work is to lay the foundation for a network constituting from application, emotion recognition and control unit. Through providing an emotionally beneficial environment, the user should feel eased during the execution of the task at hand. Thus his willingness, disposition and perseverance to further engage with the task will be fostered.

The Development of User and Interaction Models to Simulate and Evaluate Personal Digital Assistants

Diploma thesis by: Ellen Pietzarka
Supervisors: Gerald Bieber, Karina Oertel

Personal Digital Assistants (PDA) are used to support the user in different cases. During the last years, the spectrum of applications and devices has expanded. One part of this extension includes the trade fair and event guide, xGuide, which was developed at the Fraunhofer Institute for Computer Graphics IGD in Rostock, Germany. The xGuide is an information system that contains different features.

Within the scope of this diploma thesis, an additional function for the xGuide has been supplemented. This new function makes it possible for the user to improve all appointments and tasks on a day, for instance, during a trade fair. This diploma thesis shows how to arrange an individual day's schedule by presenting different methods. Furthermore, the day's sched-

ule is able to adapt the user's emotions and form of day to his environment. By means of an optimizer, the adaptation of different tasks to the individual day's schedule occurs step by step.

This diploma thesis includes the conception of this optimizer.

Identification and Recognition of Audio Streams Using Perceptual Hashing

Diploma thesis by: Jaime Corvera Vargas
Supervisor: Martin Schmucker

The task was to implement an audio fingerprinting framework and its integration within the AXMEDIS framework as a plugin. The implementation was realized in C++ using different open source libraries such as FFmpeg, ImageMagick and FFTW3. A general basis class toolset was designed in order to offer common functionality to developers of similar projects (video, image and music scores fingerprint systems). The system implementation is explained respecting all development constraints, and an exemplary benchmarking of the system is performed.

The Reconstruction of 3D Line Models from Monocular Video Sequences

Diploma thesis by: Karl Markus Moll
Supervisor: Harald Wuest

This thesis deals with the problem of reconstructing 3D line models from monocular video sequences. 3D reconstruction is an interesting topic which has been studied extensively since the 1970s.

This thesis aims to implement a fully automatic approach to generating line models, which can then be employed for markerless tracking.

The automatic generation seems promising, as features are extracted in exactly the same way as later on, during tracking.

A method to allow incremental updates using further video frames was explored and evaluated. The results showed that the problem is feasible, but also that there is still much room for improvements regarding stability and speed.

There are several approaches to 3D reconstruction, especially factorization methods commonly followed by bundle

adjustment and methods involving the fundamental matrix (two-view, point features) or the trifocal tensor (three-view, line features).

Here, we choose the trifocal tensor reconstruction for various reasons.

The reconstruction algorithm was implemented using the VisionLib framework provided by the Virtual and Augmented Reality department of Fraunhofer IGD.

The performance was measured using both synthetic and real test data.

Results were good concerning the general feasibility and correctness of the implementation, as 3D models have been extracted from real video data. They also demonstrated weaknesses regarding stability and speed.

Web Service-based Research of Brand Piracy on the Internet

Diploma thesis by: Mikel Nin-Lascurain
Supervisor: Dr. Ulrich Pinsdorf

Due to the continuous increase of brand piracy on the Internet, the department for Security Technology in Graphics and Communication Systems of the Fraunhofer Institute for Computer Graphics IGD has developed a system that is able to crawl the Internet searching for images that infringe a brand's copyright.

Thanks to the innovative Web service technologies offered by some eCommerce platforms or web page search engines, such as eBay or Google, it is possible to considerably improve the crawling performance of the already developed system, saving time and optimizing the results.

Therefore, this project is focused on the development of new components that will interact with Web services, supplying the system with more relevant and accurate data.

Implementation and Validation of a Distributed Software Infrastructure

Diploma thesis by: Pedro Hermoso Puga
Supervisor: Michael Hellenschmidt

The visions and ideas of Ambient Intelligence demands technologies that make the communication and cooperation of different heterogeneous devices possible. Not until mechanisms for communication and self-organization of distributed

devices and software components are established can the cooperation of devices within a dynamic environment be realized. Within the project DynAMITE, the Fraunhofer Insitute for Computer Graphics IGD designed and specified a software infrastructure that realizes the self-organization of software components by the definition of transducers and channels. This software infrastructure - SodaPop - realizes the conflict resolution of competing components (for example for messages and tasks) by means of the application of domain dependent channel strategies. These strategies are executed in a distributed manner among the participating devices. The presented thesis elaborates the specification and implementation of distributed SodaPop-Daemons that are running on the individual physical devices as well as describes the semantic protocol that is used for the message exchange. The self-organization of the physical devices is realized by means of the persistent data management of the SodaPop-Daemons and the specific communication mechanisms by using underlying communication technologies. The thesis uses a threelayer architecture to implement the SodaPop-Daemon communication according to the specification and design documents of the DynAMITE project.

Oriented Principal Components Analysis for the Fingerprinting of Music Scores
Diploma thesis by: Francisco Javier Rodríguez Arrios
Supervisor: Martin Schmucker

The main objective of this diploma thesis is the analysis of a fingerprinting system for the automatic identification of music scores based on oriented principal components analysis (OPCA) and its comparison with the existing fingerprinting system based on principal components analysis (PCA).

The selection of suitable features to be extracted from the music scores was made for the previous fingerprinting system, and it is enhanced with new additional features. The OPCA is used as a dimensionality-reduction method for the features. The compression capacity of the OPCA is tested and compared with that of the PCA, searching for a compromise between robustness and data compression.

Compactness of data is a requirement to be met because the results are supposed to be stored in databases. However, the robustness of the identification method must be kept, and a compromise between these two parameters must be found. Moreover, the identification of distorted music scores is tested for new kinds of distortions.

In the end, a comparison of the outcomes of both fingerprinting systems will lead to the pertinent conclusions and outlook.

Topographical Routing in Mobile Ad-hoc Networks
Diploma thesis by Steffen Reidt
Supervisors: Jaromir Likavec MSc, Peter Ebinger, Prof. Dr. Ulrich Reif

Background
In a number of applications, mobile ad-hoc networks not only have to guarantee a connection between all affected nodes through multihop routing, but have to meet several other demands as well. One important challenge is to include radio wave propagation and its interaction with solid buildings or vegetation in the calculation. Knowing one's own position, the location of friendly or even hostile nodes and the topography itself, one can develop effective routing strategies and even pay regard to safety aspects, like the minimization of irradiation and plausibility tests of position reports.

Given Task
Within this diploma thesis, a model and a simulation mechanism integrating topographical data and simple propagation characteristics of radio waves were designed. The simulation was related to a given geoposition topography and involved propagation performance as well as network connectivity. It was also based upon a scenario, in which 10-20 nodes communicate via IEEE 802.11 modules. For the simulation itself, the network simulator ns-2 was used, which incorporated not only the provided position of all nodes, but also a related topography model. With regard to the model, it is not crucial to create a perfect image of reality, but a simplified one which still reflects an authentic propagation performance.

Realization
In order to be able to calculate the radio wave propagation and the interference through solid buildings within a simulation, it was essential to define a certain topographic model first. All kinds of objects are described using polyhedrons, as their handling is easy and enables efficient calculations. To use the respective topographical data in further calculations, it was read into a specially developed data structure. This data structure consists of three parts, which separately store the data of points, faces (walls) and polyhedrons (buildings), and provide certain features. The face data structure, for example, offers the option of estimating the direction of reflexion of a ray impinging on the face. Shapefiles are used as sources for topographic data and are also used by land registries to store the topographies of cities. A separate parser enables the import of provided shapefiles into the data structure.

A ray optical propagation model based on common methods of computer graphics was used to draw conclusions regarding the connectivity of respective nodes with the aid of the processed data structures. All popular radio propagation systems, like IEEE 802.11x, or even those that will be developed in the near future, use wave bands above 2 GHz. High-frequency radio waves move almost radially, which justifies the assumption of radially moving waves within the model. Calculating the power of reception of the target node, which defines the successful transmission of a package within the C++ network simulator ns-2, was done in two parts. In a first step, the different pathways of rays going from the sender to the receiver node were determined, with reflexion and deflection being the decisive factors in the model. The detection of the rays was done by a ray-tracing algorithm. Having successfully determined the pathways of the rays, the power of reception was calculated taking the waves' polarisation into account. The length of the path of the rays, the angles of reflexions or deflections, and the walls' permittivity factor was included in the calculation. Keeping the time used for calculation procedures at a reasonable level was a serious challenge. Since the time for calculation is highly dependent on the depth of the reflexions and deflections, it was possible to configure those values. It turned out that the inclusion of

pathways with more than three reflexions or more than one deflection did not affect the simulation results in a noteworthy amount.

To visualize the simulation and to permanently evaluate the calculations, the visualization tool iNSpect of ns-2 was widely expanded. The lower picture shows the expansion of iNSpect, which enables the visualization of the transmitted rays between the sender and the receiver node in the chosen tab.

A Graphical User Interface to Detect Forgeries in the Internet

Master thesis by: Stefan Uhrig
Supervisor: Dr. Ulrich Pinsdorf

According to the Wall Street Journal, the Internet became the third largest reloading point of forged fancies in 2004. To facilitate and largely automate the tracing of such forgeries, the iDetective system was developed. This system allows the searching of the Internet using arbitrary algorithms. These algorithms are encapsulated in components that can be individually configured and combined. Additionally, new components may be added to the system at any time.

This thesis describes the concept and implementation of a graphical user interface intended for this system. The implemented user interface supports all technical concepts of the iDetective system and makes the complexity of the system easily manageable for a user. By using the developed user interface, iDetective components can be configured and combined to a job making inquiries in an easy and intuitive way. For this purpose, the user interface offers modern interaction metaphors. Additionally, the user can supply inquiry jobs to the iDetective system, monitor and manage their execution inside the iDetective system, and retrieve the inquiry results.

The programming language Java and the eclipse Rich Client Platform were used to implement the user interface. The linking of components was implemented by using the Graphical Editing Framework which supports the model-view-controller pattern. The system's expandability by new components is guaranteed by employing the eclipse plug-in mechanism.

The Visual Authoring of Topic Maps

Diploma thesis by: Tobias Helm
Supervisor: Mario Aehnelt

With the rising of new requirements in handling knowledge structures, caused by the lack of contextualisation, more effort was put into the development of semantic technologies. One result of this development was the ISO/IEC 13250 Topic Maps-Standard, that provides a unified notation for the representation of meta data of information resources. However, it contains neither approaches for visualization nor support to design or build topic maps. To challenge this lack, our own concept will be developed, based on the analysis of existing visualizations for interlaced structures. It deals especially with the advantages of visual methods for supporting building and editing complex structures. A prototype implements the concept. In times of growing information, the need of quality improvement by specifying semantic meta data has to be emphasized, and authors have to be offered the possibility to get adequate technologies for support.

Intrusion Detection Systems for Mobile Ad Hoc Networks

Diploma thesis by:
Eneko Ibarzabal-Atucha
Supervisor: Peter Ebinger

In mobile ad hoc networks (MANETs), security is a major issue. Intrusion detection systems (IDSs) developed for wired networks are not suitable for MANETs, so a new system has been designed, in which nodes cooperate exchanging data to perform the intrusion detection. The proposed system uses both signatures and anomaly detection engines.

Distributed Virtual Worlds - Conception and Implementation of Multiuser Functionality into an Existing Virtual Reality System

Bachelor thesis by: Thomas Beer
Supervisor: Marcus Roth, Prof. Dr. Herwig Mayer (Fachhochschule Darmstadt)

Disrtibuted virtual worlds allow users to interact in realtime while actually beeing on physically distributed sites. Modern computer games are an example for the state of the art of realistic visualization of interactive virtual environments. Concerning the aspect of distribution the virtual space provides an interesting option: As the virtual space does not exist physically, it's representation as computer-generated images is not bound to any special physical place. Computer networks make it possible to visualize and enter the same virtual world at physically distant sites. Such systems make it possible to co-work on a common virtual prototype while preventing the need for a physical travel. Existing VR-systems are highly specialized for special tasks. The proposed standardizations lead by the web3d-consortium have not proceeded far enough yet. Usable results are the VRML scene description language and appropriate VRML-browsers that are capable of displaying 3D-scenes. Those browsers lack interactivity with and between such scenes. The Avalon project, jointly developed by the ZGDV and the Fraunhofer IGD, provides a component based framework for rapid development of Virtual/Augmented/Mixed Reality applications with full integration of the VRML standard. This thesis deals with the conception and implementation of additional components to this framework, providing a base for the development of distributed multiuser systems. Concepts of existing mulituser sytems have been described: Started as military applications (SIMNET) multiuser systems were developed for academic and commercial use (e.g. DIVE). Attempts of Internet communication using virtual environments have not gained much user acceptance yet. To get a better idea of distributed interactive applications a multi user distributed 3D computer game was developed (distributed 3d pong) beforehand. The new components described and developed for the avalon VR system provide network connections between scenes at VRML-level using the concept of »remote routes« over networks.

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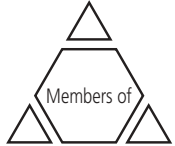Germany

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