INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Project-Team IPARLA

Visualization and interaction for complex data, on mobile and connected devices

Futurs

THEME 3B

Activity Report

2003

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1. Team

IPARLA is a joint project of INRIA and the LaBRI laboratory. The LaBRI is joint lab of the University of Bordeaux 1, CNRS (UMR 5800), and ENSEIRB, located in Bordeaux.
The project has been officially created on the 13/11/2003.
Some people are coming from other laboratory, from the IRISA (joint lab between CNRS - UMR 6074- , INRIA, the University of Rennes 1, and the INSA of Rennes) and the LSC (Laboratory of Cognitive Sciences from University of Bordeaux 2).

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2. Overall Objectives

The main goal of this project is to allow the visualization of complex data and their manipulation on mobile and connected devices (MCD), like PDA and cell phones. To be sufficiently small and autonomous, they have some limited resources: a restricted computational power and storage capability, a limited bandwidth, a small display size. These limitations raise some specific problems that we want to address.

One of the main assumption of our work, is that these devices are connected to a local or a global network. In a first approach, we want to use the wireless standards like IEEE 802.11 (WIFI) or BlueTooth, and then we want to extend it to some other protocols like GSM, GPRS, UMTS.

On these devices, we first want to visualize some complex (large and rich) data. For this, we have to consider all the required transformations from the stored data to the display, and find the more suitable solution. We also want to interact with these complex data (i.e. navigate, select some part, edit, etc). This will lead to the development of a full usable visualization and interaction system.

The data that we want to deal with, are very large numerical and multi-dimensional data, like some virtual environments and 3D numerical models (buildings, town, human body, etc.), like some more abstract data (financial statistics, weather, etc.), or any multidimensional numerical data produced by simulations or captors.

Glossary

GPRS *General Packet Radio Service.* A GSM data transmission technique that does not set up a continuous channel from a portable terminal for the transmission and reception of data, but transmits and receives data in packets. It makes very efficient use of available radio spectrum, and users pay only for the volume of data sent and received.

GSM *Global System for Mobile Communications.* A standard for digital cellular communications (in the process of being) adopted by over 60 countries. The GSM standard is currently used from the 900 MHz to the 1800 MHz bands

UMTS *Universal Mobile Telecommunications System.* Evolution in terms of services and data speeds from the GSM networks.

3. Scientific Foundations

3.1. Network environment

Since 1995, the industry of cell phones and mobile telecommunication has raised significantly. Currently, more than 60% of people (in France) have such devices, compare to none few years ago. Mainly based on voice transmission and the GSM (9.6 kbps) standard, this market has evolved to more general data transmission. At the beginning, only short-text messages were exchanged using the SMS protocol. Now, the user can access to some multimedia data, like with the WAP protocol. Even if this one, combined with the GSM protocol, is not so used, the new network protocol with higher bandwidth, like GPRS (20 to 60 kbps - appeared in 2002) and UMTS (400 kbps to 20 Mbps), will lead to a better adoption of such communications.

To complete the development of these international networks, some standard protocols for local wireless communications has been introduced, like BlueTooth (1 Mbps, 100 m) or IEEE 802.11 (10 Mbps, 500m, recently renamed WIFI). More and more mobile devices, from cell phones to computer through PDA have now integrated them.

Glossary

SMS A message service offered by the GSM digital cellular telephone system. Using SMS, a short alphanumeric message (160 alphanumeric characters) can be sent to a mobile phone to be displayed there, much like in an alphanumeric pager system. The message is buffered by the GSM network until the phone becomes active.

WAP An open international standard for applications that use wireless communication, e.g. Internet access from a mobile phone.

3.2. Hardware environment

These protocols for general data transmission are progressively integrated to a large range of devices with a spectacular increase of their hardware capabilities (processor, memory, display, etc.). These terminals have currently the same possibilities than an graphic workstation from the begin of the 80's.

3.2.1. Central Unit

As the difference between a laptop and a workstation has been greatly reduced during the past years, if we consider the computational power and storage capability, the qualitative difference between the mobile devices and the workstation will also surely decrease. But due to the inherent limitations for power consumption, weight and cost, these differences will never completely disappear. As a floating point unit requires a high power consumption, fixed-point arithmetics and integer only computation will still be the best solution for a time in a mobile device.

3.2.2. 3D Architecture

Nowadays, different companies are working on the development of 3D processors for the visualization on mobile devices. Some companies, like Imagine Technology (with its Power VRMBX processor, in collaboration with ARM), EyeMatic (in collaboration with Texas Instrument), NeoMagic are working on such solution. With the release of the specification of OpenGL|ES 1.0 in July 2003, such solution will increase. As an example, BitBoys as already release an OpenGL|ES chip, the Acceleon G30. It is clear that this approach is fundamental for the industry, for a commercial aspect (to be the first on the market), but also to re-use existing code based on the OpenGL/Direct3D architecture. The OpenGL|ES standard is promoted by many companies involved in the mobile device market, like Nokia, ARM, Toshiba, etc [1]. As an example, OpenGL|ES is the development library for the recently released Nokia N-Gage, a device that combines a multimedia player, a mobile console, and cell phone, with 3D capabilities.

Glossary

OpenGL|ES Subset of the OpenGL API, designed for the embedded systems

3.2.3. Display

But even with such hardware, the qualitative aspect of the display will not increase a lot, for one main reason: the display size will always be restricted. As a PDA, for example, has to fit in one hand, it is reasonable to think that the physical size of the display will not increase a lot in the near future. Currently, the resolution has reached the VGA standard (640x480), we one can expect this will be quite stable.

3.3. Software environment

A large number of people is already working for the development of new software tools (API, visualization tools, etc.) for the mobile devices. One of the main problem, is currently the need of floating point architecture, that is missing on the mobile processors, and that is essential for the classic 3D pipeline.

Among those companies, we can cite Superscape[2], as an example, that is developing interactive graphic applications since 15 years (for games, education, electronic commerce,etc.). Its expertise on working for limited resources devices (memory, processor) allows to reach the cell phone market and to participate actively to the MPEG4 development. More recently, Superscape is offering a new product (Swerve) that contains a 3D modeling package based on 3DS Max (Swerve Author), an embedded client for cell phones to provide some services to the applications (Swerve Client), and some tools for communications and games. Swerve provids a 3D rendering engine based on polygonal representations, some standard data structures (basic primitives, scene graph) and an classical rendering scheme (Z-buffer, Gouraud shading, texturing, etc.). Note that Superscape have signed a open partnership with ARM to integrate Swerve on their next generation DSP.

We can cite also Parallel Graphics (the first to offer a VRML viewer for PDA, that includes also a Virtual Environment editor), Ekkla[3] and Hybrid Graphics[4](that are developing OpenGL API for mobile devices), and EyeMatic[5](that has announced some media players allowing to display human figures).

4. Application Domains

Key words: *multimedia*, *digital images*, *realistic and non-photorealistic rendering*, *visualization*, *virtual and augmented environments*, *mobile devices*, *telecommunications*.

[1] see at http://www.khronos.org/opengles/openglesadopters.html for the complete list
[2] http://www.superscape.com/
[3] http://ekkla.free.fr/
[4] http://www.hybrid.fi/mobile.php
[5] http://www.eyematic.com/

As it is very difficult to make an exhaustive list for all the possible application domains involving the visualization of complex data, and the interaction on mobile devices, we only mention here few that seems representative.

Assisted Navigation: In this context, the mobile devices can help the user to determine its position in an environment, and to decide its way, by the visualization of a virtual environment, augmented with some information. The urban environments are an interesting target for these applications, and we already have some technologies and the knowledge (automatic generation, simplification, visualization, etc.). The car industry is already providing some navigation solutions, but the current solution can definitively be improved. The display has a poor quality (generally 2D graphs or stored pictures) and all the data have to be embedded (CD-ROM, etc.). This last point is a real problem for the cost of the solution and for the information availability. Moreover for a dynamic environment, like urban one, these data have also no guaranty to be up-to-date. This Assisted Navigation approach can be extended to a rural environment. In such place, a PDA with a GPS receptor will replace the classical paper map, and will provide the hiker with a simplified visualization of its position and a symbolic display of the planned path.

Embedded Augmented Positioning: For this application, the user visualize a representation of an existing environment, augmented with some information (augmented like in "Augmented Reality"). Some touristic place already provide the visitors with PDA that contains a tour guide, with a combination of place descriptions and explanations (reconstructed buildings that have been destroyed, construction schemes, etc.). The museums represent an interesting market for this approach. But we can consider also on-site maintenance or intervention after a disaster: the technician visualize the location of the intervention, the fireman can have one-site some crucial information, like the kind of fluid that go through a pipe in fire. As a last example, this approach can be used for a virtual visit on-site. A constructor can show to its clients, the planed building and construction, and a prospector can visualize the current structure of the surface and of the underground. Combining the on-site information (the reality) with some virtual information (augmented reality) is a promising way of action planning.

Remote Consultation and Supervision: For this domain, we want to visualize some abstract data. Its one on the richest application domain. To give an rough overview of the possibilities, we will introduce several examples. In the scientific community, it is common that a process (simulation, experiment, etc.) can be as long as multiple days. To supervise it, there are currently only two solutions: a group of people that alternate for the supervision, or to check from time to time, with the possibility to miss an important event during the experiment. Even more, the video systems are not well suited for this context, as they provide only the user with visual informations. And most of the scientific experiment have a large number of parameters. The goal of our work will be to allow a visualization, on the mobile device, of all the abstract data from the captors. A complete information will then be available to the user, for any of his location. This can be extended with some additional functions (alarms,processing tools,etc.).

This general approach can be used for different contexts:

- a physician can have an instant access to all the captor parameters of a patient on supervision, and in case of troubles, can visualize the results of the tests.
- a technician can supervise all the production machines, from any place in the factory.
- during his patrol, a guard can still have access to all the alarms, captors, videos.
- a financial decision maker can have access at most of the complex financial information (Stock Market, financial results, publications, etc.) and can be averted on specific events.
- as an other small example, a single-handed yachtman has to stay in permanent contact with its information system, even when he is operating on the deck.

Remote Control: A directly connected extension, is the availability for the user to remotely control a process with his mobile device. This can be done either through a global network, from a long distance, or through the local network when the user is on place. The main advantage is the unification of the needed hardware and software, that will simplify the user job. Even more, this will ease the preparation of an action, as it will provide a smooth transition from the plan, to the realization.

Video Games: To conclude this quick overview, the video game domain is an other great target for our work. For them, independently of tthe platfrom (PC, games consoles) the interactive visualization of complex virtual environment is the key-point for the current game engine. Unfortunately, the approach that have been developed can not be directly adapted to mobile devices, due to their limited resources for the 3D rendering. And nowadays, the goal of this industry is to offer to the user a smooth transition between different medium for the same game: the user can play in the same way at home on his own PC/console, as in the public transportation, on his mobile device. It is also challenging to allow multi-player games with such devices.

5. Software

5.1. Contribution to OpenSG

Participants: Patrick Reuter [correspondent], Marc Alexa [Technique University of Darmstadt (Germany)], Johannes Behr [Computer Graphics Center (ZGDV) - Darmstadt (Germany)], Laurent Grisoni [GRAPHIX/LIFL], Christophe Schlick.

Key words: *scene graph*, *triangle stripping*, *normal quantization*.

We developed an improved adjacency data structure for fast triangle stripping [7]. The data structure can be created quickly and robustly from any indexed face set, and its cache friendly layout is specifically designed to efficiently answer common queries during stripping such as neighbor finding and least-degree triangle finding in constant time. An implementation of a stripping algorithm shows a significant speed-up compared to other implementations, and we integrated the stripping algorithm in the new version 1.2.0 of the Open-Source Scene-Graph System OpenSG that was released on the 18th of March 2003 (OSGNodeGraph [6]).

Moreover, we developed a normal quantifier allowing to quantify normals into 2^{3+2n} different directions, with a specifiable number n of subdivisions determining the precision. Like the stripping algorithm, we integrated the normal quantifier in the new version 1.2.0 of OpenSG (OSGNormalQuantifier[7]).

5.2. Contribution to HyperFun

Participant: Christophe Schlick [correspondent], Benjamin Schmitt [Digital Media Professionals, Japan], Alexander Pasko [Hosei University, Japan].

Key words: *function representation*, *constructive solid geometry*.

The HyperFun[8] project is a free software development for modeling, visualization and animation of 3D shapes based on a so-called "Function Representation" (F-Rep). The F-Rep model can be seen as a generalization of the Constructive Solid Geometry (CSG) model where a much greater variety of solid primitives and combining operators are allowed. Many contributions to the HyperFun project, mainly based on constructive sculpting and constructive texturing [9], where developped in the team during the thesis of Benjamin Schmitt (coadvised by Christophe Schlick and Alexander Pasko, from Hosei University in Japan), that ended up in January 2003 when he leaved for a post-doctoral position at Digital Media in Japan. The collaboration with the HyperFun project is still going on as we plan to implement the hardware point based rendering technique that we developped to get realtime rendering of F-Rep models.

[6] http://www.opensg.org/doc-1.1.0/classosg_1_1NodeGraph.html
[7] http://www.opensg.org/doc-1.1.0/classosg_1_1NormalQuantifier.html
[8] http://www.hyperfun.org

5.3. Plugin for PointShop 3D

Participant: Patrick Reuter [correspondent].

Key words: *point rendering*, *solid texturing*.

Following a reseqrch result form the previous year (see below), a pluginavailable for download at http://www.cotex.fr.st of this new interactive constructive solid texturing approach has been developed for the PointShop3D system.[9]

[a] P. REUTER, B. SCHMITT, A. PASKO, C. SCHLICK. *Interactive Surface Texturing of Arbitrary 3D Objects by Combining Constructive Texturing and Point-based Rendering*. Technical report, number RR-1284-02, LaBRI, Université Bordeaux I, 2002.

6. New Results

6.1. Modelisation

6.1.1. Point-Based Reconstruction

Participants: Patrick Reuter, Irek Tobor, Christophe Schlick.

Recent 3D acquisition technologies provide a huge number of unorganized 3D points. We developed new methods to reconstruct implicit surfaces from such large unorganized point sets. These new methods divide the global reconstruction domain into smaller overlapping local subdomains by using adaptative domain decomposition methods, solve the reconstruction problems in the local subdomains using radial basis functions with global support, and blend the solutions together using the partition of unity method. Whereas a first method [21] uses an adaptative decomposition based on a octree and blends the solution of all the leaf nodes together, the second method uses a perfect binary tree and at all the interior nodes, the solutions of the two children are blended together. Both methods have a nice linear behavior for the required reconstruction time and memory usage, with the respect of the number of initial points.

6.1.2. Point-Based Texturing

Participants: Patrick Reuter, Irek Tobor, Christophe Schlick.

The two new reconstruction methods are not limited to reconstruct the implicit surfaces, but also apply to the reconstruction of continuous functions of any dimension. Consequently, we used the reconstruction methods to define a new class of procedural solid textures that can be reconstructed from the attributes of unorganized point sets.

We developed a new interactive environment for constructive texturing of surface of arbitrarily defined 3D objects [19]. A user can texture the surface by defining space partitions that are combined using constructive texturing, and by specifying attributes that are applied in the space partitions. In order to give an interactive feedback, a point-based multiresolution representation of the surface is used not only for rendering (cf. 6.2.1), but also for the evaluation of the texture. We always keep a feedback to the initial geometric representation of the object (polygonal mesh, parametric or implicit surface, voxel arrays, etc) which means that the final textured object can be easily exported to standard graphics software that cannot directly handle discrete surface points (e.g. CAD systems, photorealistic rendering software, etc).

6.1.3. Automatic creation of digital territory environments

Participants: Joachim Pouderoux, Jean-Christophe Gonzato, Pascal Guitton, Salvatore Spinello.

The main goal of this subject is to create quasi-automatically a virtual environment from digital supports like scanned topographic maps, pictures. The map contains complex data to recover : DEM (Digital Elevation Model) from contour lines, environment objects from forest, town, road representation. The reconstruction of original DEM from contour lines consists in an imbrication of automatic operations by using classical image

[9] available at http://graphics.ethz.ch/pointshop3d/

analysis, neuronal networks and morphological mathematics: selection of contour lines, of skeleton, fill of gaps, altitude affectation and finally interpolation of the 3D virtual DEM. We developed a software named *AutoMNT*[10] that load any topographic map and convert it in a classical DEM model [18].

In a second pass, we plan to retrieve other essential information (road, forest, town , etc) and to integrate them in a complete "GIS like" (Geographic Information System) database in order to view them in different environments : Reality Centers, classical PC, Web and PDA.

6.2. Rendering Techniques

6.2.1. Point-Based Rendering

Participants: Patrick Reuter, Irek Tobor, Christophe Schlick.

We developed a new rendering technique for the implicit surface reconstructed from unorganized point sets. The implicit surface is rendered view-dependently in an output-sensitive multiresolution manner, using points as rendering primitive. The initial unorganized point set is used to establish a multiresolution representation of bounding sphere hierarchy, and a reconstructed implicit surface is used to generate additional points through a local ray-casting when the initial unorganized point set does not provide enough detail for rendering [13][8].

6.2.2. Non-Photorealistic Terrain Rendering

Participants: Salvatore Spinello, Gwenola Thomas, Kadi Bouatouch.

As the memory size of a mobile display is limited, it can be interesting to replace a complex geometry by an abstraction. In this context, a complex polygonal 3D terrain is replaced by a set of feature curves[20]. This method is inspired by stroke-based rendering methods. The feature curves are flux lines and isolines; they can be rendered by varying the stroke density, depending on the illumination. The rendering is performed in a client/server configuration. The original geometry of terrain is located on the server side. For the client side - a mobile terminal -, the transmitted data is limited to the set of feature curves. For this client/server architecture, we are working on new rendering algorithms and on protocol specifications (for progressive transmission of the data, for view-dependent update of the data).

6.2.3. Image-Based Rendering

Participants: Kadi Bouatouch, Gwenola Thomas, Gerald Point.

A classical rendering pipeline is not well suited to mobile terminals due to their limited performances. A better alternative is to use an image-based rendering (IBR) approach. To render highly complex scenes on mobile terminals, we have developed an IBR algorithm in the framework of a client/server architecture. The server computes some reference images and transmits them to the client that can be a PDA or a mobile phones. On the client side, navigation through a scene is performed by warping a reduced set of reference images. In this way, the rendering complexity is only dependent on the image resolution, not on the geometry complexity. A first implementation has proved the pertinence of the IBR approach. We are now addressing the following issues: progressive transmission, camera placement for selecting appropriate reference images, reconstruction, hole filling, use of meshes instead of images augmented with depths, etc.

6.2.4. Realistic Ocean Waves Rendering

Participants: Jean-Marc Cieutat, Jean-Christophe Gonzato, Pascal Guitton.

We collaborate with ESTIA (French Engineer School - Bidart - France) which develops a maritime training simulator. Simulating realistic water waves in real-time on a classical PC is a big challenge. As many factors have to be taken in account: wind, current, bathymetry, forces applied on the boat, etc. Our collaboration was focused on the development of a unique wave model based on the different physical theories – wind waves, swell, waves approaching the shore, breaking waves, wave refraction and diffraction – using a spectral model [1][11].

[10] http://iparla.labri.fr/softwares/automnt

6.3. 3D Interaction

Before working on mobile and connected devices, a main interest of our team was work on 3D interaction, and specially for virtual reality setups with large displays. In this section, we will introduce the results of our research for this domain. Even if the difference between the display areas is huge (30 m^2 vs 30 cm^2), we believe that part of our experience based on reality centers can be adapted on PDA. We will thus describe new interaction models (laser, video capture, CAT) and two possible applications (Interactive Theater, geomarketing).

Large-displays, used as collective visualization interfaces, allow several co-located participant to be immersed in virtual environments (VE). In spite of their potential for group works, large-displays are often under-used because the users can not interact easily and efficiently with the visualized VE. Bringing interaction possibilities to large displays VR environments must not suppress the users' movings. Thus, we don't want to use devices linked to computers using wires like DataGlove or Polhemus.

6.3.1. Mouse emulation using laser

Participants: Jean-Baptiste de la Rivière, Pascal Guitton.

We used 3 video cameras to track a laser dot on the large screen, where an application is displayed. The 2D positions of the laser spot onto the display were sent to the application running, and processed according to specific interaction techniques. Thus, our system allows users to directly interact with the application thanks to their laser pointer, without the need of an external operator who manipulates the model.

6.3.2. Real time gesture recognition

Participants: Martin Hachet, Jean-Baptiste de la Rivière, Pascal Guitton.

We are considering the goal to film one's hand or body in front of a large display in order to recover its posture. This data will then be interpreted according to a predefined interaction technique. While most of such systems rely on appearance-based approaches, we have chosen to investigate how far a model-based one could be efficient. The real-time algorithm we are developing modifies a 3D hand or body model pose in order for its projection to match the input silhouette. Other characteristics include the integration of constraints both on parameters values and parameters evaluation order. Occlusions don't lead the system to systematically fail, but adding cameras will help to disambiguate the current model pose. Great tracking speeds were reached [2][22][17][14]. Future improvements include the integration of classical image analysis techniques and development of specific interaction techniques.

6.3.3. CAT : a new 3D interaction peripheral

Participants: Martin Hachet, Patrick Reuter, Florence Tyndiuk, Pascal Guitton.

The study of the characteristics of the large-displays allows us to propose a set of recommendations for interaction with the VE. From these recommendations, we criticize the existing input devices, and propose a new input device: the CAT (Control Action Table) [12].

The CAT is a 6 degrees of freedom device mixing isotonic and isometric resistance modes. It consists of a freestanding sensitive top, which can be oriented in space. The manipulation of this top allows to perform 3D tasks (manipulation [17], navigation[5]). A tablet, fixed on the top, allows to perform 2D tasks (selection, system control). The CAT design favors a non-constraining, quick and efficient interaction for novice users.

A user study has shown that the CAT is more efficient than a standard 6 DOF rate controller for 3D manipulation tasks, and that the user preferences are in its favor. The CAT has been used for applications of project review and interactive theater. This new input device favors the development of real applications using VE visualized on large-displays [4].

6.3.4. Study of human factors involved

Participants: Florence Tyndiuk, Christophe Schlick, Gwenola Thomas.

The main object of this work is to understand the differences in human performances during travel and manipulation tasks in Virtual Reality. The better understanding of how subjects use virtual reality interfaces can help to construct interfaces more adapted to cognitive users' processes. We have settled a double experimentation that we have performed on one hundred subjects. For each subject, we measure a set of cognitive factors as attention and motor skills and their performances in two virtual reality tasks (manipulation and travel) with two distinct screens (large and small) and the CAT interactor. After a first analysis of the statistical data, a first interesting result dealing with the screen size influence have appeared. The preliminary conclusion is that subjects with lower motor or attentional abilities improve their performances with larger screens whereas the others do not show significant changes when they use distinct screens. With some small adaptations, the experiment can be performed for an analysis of interactions on small devices.

6.4. Applications

6.4.1. Interactive Theater

Participants: Martin Hachet, Jean-Baptiste de la Rivière, Pascal Guitton.

This project investigates the use of Virtual Reality (VR) technologies for interactive Theater. The classical theater scenery is replaced by a large-scale screen on which 3D models are displayed in real-time, allowing the actors and the audience to be immersed in highly interactive virtual environments (VEs). We put on a scenario where the clowns and the audience travel over a city and explore a mysterious planet. We developed software and hardware solutions for the generation of the VE and for the interaction with them. Using VR for new clowns allows the audience to feel new experiences [3]. It gives the theater a new field of investigation. Last but not least, it allows VR to be closer to the people.

6.4.2. 3D Geomarketing

Participants: Martin Hachet, Pascal Guitton.

These topics are with an industrial project: 3D Geomarketing. Geomarketing aims at the visualization of strategic information (financial, sociologicaletc.) on geographical support for decision making processes. The size and the complexity of the geomarketing data to be analyzed led us to use the power of Virtual Reality, for the visualization of 3D models as well as for the interaction with them. The 3D models are generated in an optimized way, enabling real time interaction with the environment using standard PCs.

7. Contracts and Grants with Industry

7.1. Easy-Do-It

Participant: Christophe Schlick.

Title: Visualization of tutorials and technical documentations on connected and mobile devices.
Dates: 2003-2005
Overview: The Easy-Do-It company is specialized in the creation and diffusion of multimedia contents for training. They provide the maintenance technician with the documentations and the animations that will optimize their interventions, and the general consumer with tutorials and how-to. Their technology is currently based on some video supports (VHS, SVCD and DVD).

The goal of this contract is to develop a client-server architecture and an adapted streaming algorithm for the diffusion of their multimedia content on PDA. This collaboration is also supported by the EITICA, a technology transfer organism of the Aquitaine Region.
Web: http://www.easy-do-it.com

8. Other Grants and Activities

8.1. Local grants

8.1.1. "Cognition and Virtual Reality"

Participants: Christophe Schlick, Florence Tyndiuk, Gwenola Thomas, Martin Hachet, Jean-Baptiste de la Rivière.

Grant: Conseil Régional d'Aquitaine
Dates: 2001-2003
Partners: Cognitive Sciences Lab (University of Bordeaux 2), IPARLA
Overview: The main goal of this project is to study the Human-Computer Interfaces in the context of Virtual Reality, with the help of cognitive sciences. The evaluation is based on two aspects: the navigation into an Virtual Environment, and the manipulation of virtual objects.

8.1.2. "Platform for the development of robust multimedia software on connected terminals"

Participants: Pascal Guitton, Xavier Granier, Jean-Christophe Gonzato, Gerald Point.

Grant: Conseil Régional d'Aquitaine
Dates: 2003-2004
Partners: Compose project (INRIA Futurs), Test Team (LaBRI), SOD Team (LaBRI), IPARLA
Overview: This project aims at conceiving a software platform for the development of multimedia applications on mobile terminals. We are focusing on the conception of a server which distributes data to the mobile terminals.

8.2. National grants

8.2.1. V2NET: "Networked Virtual Visit"

Participants: Kadi Bouatouch, Pascal Guitton, Patrick Reuter.

Grant: RNRT ("Réseau National de Recherche en Télécommunications" - French Ministry of Industry)
Dates: 2000-2003
Partners: France Telecom Research and Development, IRISA, Thomson Multimedia, IWI, LaBRI
Overview: This project aims at developing a first prototype of client-server based framework for navigating through urban and architectural 3D models. Our contribution was twofold: the development of a point-based rendering algorithm and the use of impostors. An impostor is an image (together with a depth map) whose role is to replace faraway complex geometry.
Web: http://www.telecom.gouv.fr/rnrt/projets/res_d90_ap99.htm

8.2.2. PERF-RV: "French Platform for Virtual Reality"

Participants: Pascal Guitton, Martin Hachet, Jean-Baptiste de la Rivière, Gerald Point.

Grant: RNTL ("Réseau National des Technologies Logicielles" - French Ministry of Research)
Dates: 2000-2004
Partners: IRISA, CEA LIST, Ecole des Mines Paris, Image Institut , LRP, LIMSI, ADEPA, Clarté, Dassault, EADS, EDF, Giat, IFP, PSA, Renault, PSA, LaBRI
Overview: This project aims at conceiving a technical platform enabling the development of Virtual Reality Applications. We are focusing on the 3D interaction tasks, and more precisely on the interaction with applications performed on large displays like Reality Centers.
Web: http://www.telecom.gouv.fr/rntl/FichesA/Perf-Rv.htm

8.2.3. EPSN: "Computational Steering Environment for Distributed Numerical Simulations"

Participants: Pascal Guitton, Christophe Schlick, Gwenola Thomas, Florence Tyndiuk.

Grant: ACI GRID ("Action Concertée Incitative Globalisation des Ressources Informatiques et des Données" - French Ministry of Research)
Dates: 2002-2004
Partners: Scalapplix (INRIA Futurs), IECB (Bordeaux 1, Bordeaux 2, CNRS, INSERM), SRSMC (UMR CNRS), SMEL (Montpellier 2), LaBRI
Overview: This project aims at conceiving a framework enabling the fusion between numerical simulations and Virtual Reality. We are focusing on the driving of the simulation using virtual reality techniques and peripherals.
Web: http://www.labri.fr/Recherche/PARADIS/epsn/accueil_eng.html

8.2.4. Show

Participants: Christophe Schlick, Patrick Reuter, Irek Tobor, Xavier Granier.

Grant: ACI "Masse de données" (French Ministry of Research)
Dates: 2003-2005
Partners: Grenoble, Nancy, Sophia, IPARLA
Overview: The goal of this collaboration is to develop an software architecture for the 3D visualization of very large dataset (more than hundred millions of polygons or points). IPARLA has in charge the client-server architecture for the data streaming, and also the point-based rendering.

8.2.5. Grappe

Participants: Pascal Guitton, Gerald Point, Xavier Granier.

Grant: GRID 5000 (French Ministry of Research)
Dates: 2003-2004
Partners: RunTime (INRIA Futurs), Scalapplix (INRIA Futurs), SOD (LaBRI), IPARLA
Overview: This project aims at developing a large PC grid on French territory. We are focusing on the development of a specialized PC cluster for the visualization of large and complex data.

8.3. European grants

8.3.1. ENTHRONE: "End-to-end QoS through Integrated Management of Content, Networks and Terminals"

Participants: Kadi Bouatouch, Gwenola Thomas.

Grant: PCRD 6 (6th -European Framework Program)
Dates: 2003-2007
Partners: Thalès, France Telecom, TDF, Optibase, EPFL, IPARLA, etc.
Overview: This project aims at developing an integrated management solution which covers an entire audio-visual service distribution chain, including content generation and protection, distribution across heterogeneous networks and reception on user terminals. Our contribution concerns the generation, transmission and rendering of 3D models. The 3D model representation will adapt to the network performances.

9. Dissemination

9.1. Participation to the Scientific Community

9.1.1. Participation to conference organization

Members of IPARLA have been involved in number of program committee and organizing committee for conferences:

- Eurographics 2003: program committee (Christophe Schlick)
- Shape Modeling International 2003: program committee (Christophe Schlick)
- Winter School on Computer Graphics 2003: program committee (Christophe Schlick)
- Virtual Concept 2003 - Biarritz (France): program committee (Pascal Guitton)
- Web 3D 2003 - Saint Malo (France): organizing committee (Kadi Bouatouch - Pascal Guitton)

They have also participated to the reviewing process for conferences (Eurographics Symposium on Rendering, SIGCHI, European Congress of Stereology and Image Analysis 2001, Siggraph 2003, Visualization 2003) and journals (Visual Computer, IEEE Computer Graphics & Applications, Revue Française de CFAO - AFIG special edition).

Christophe Schlick is also member of the editorial board of the journal Computer Graphics Forum (Eurographics).

9.1.2. Committees

Pascal Guitton is:

- in charge, in collaboration with Nicolas Holzschuch (ARTIS/GRAVIR-INRIA) of the RPT7 AS (for "Action Spécifique" - CNRS) Real-time Rendering
- member of the leading committee for RTP number 7 Image Synthesis, Visualization and Virtual Reality (RTP for "Réseau Thématique Pluridisciplinaire" - CNRS)
- member of the scientific committee of GRID 5000 projects[11](French Ministry of Research)
- member of the interview committee for CR2 (INRIA Futurs)
- member of the scientific committee of INRIA Futurs
- correspondent for the "formation doctorale" at the INRIA Futurs.
- member of the jury for the SPECIF PhD thesis award

Christophe Schlick is a member of the scientific committee for GDR Algorithmique, Langages et Programmation (CNRS).

Gwenola Thomas is a member of the administrating committee of the AFIG.

9.1.3. Expertise

The expertise of some members has been required for

- ACI "Masses de données": Pascal Guitton, Christophe Schlick and Gwenola Thomas
- ACI "Jeunes chercheurs": Pascal Guitton
- Regions "Bretagne" and "Pays de Loire": Pascal Guitton
- France Telecom Research and Development: Pascal Guitton
- Evaluation of the ARTIS Project and the EVASION Project (INRIA Rhône-Alpes): Christophe Schlick

9.2. Teaching

In complement of the normal teaching activity of the university member (at the University of Bordeaux 1 and the University of Bordeaux 2), Xavier Granier have participated to the "Image Synthesis" Master course.

9.3. Participations to Conferences and Seminars, Invitations

The project members have participated to number of international workshop and conferences (cf [4][8][5][1][3][2][16][17]) and national ones (cf [10][18]).

They also have been invited for seminars by the GRAVIR laboratory and INRIA Rhones-Alpes (Xavier Granier - "Acquisition end Rendering of real-world light sources").

10. Bibliography

Major publications by the team in recent years

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[2] J.-B. de la Rivière, P. Guitton. *Hand Posture Recognition in Large Display VR Environments.* in « 5th International Gesture Workshop », April, 2003.

[11] http://www-sop.inria.fr/aci/grid/public/

[3] M. HACHET, P. GUITTON. *Using Virtual Reality for "New Clowns".* in « Proceedings of International Conference on Virtual Storytelling », Springer-Verlag, 2003.

[4] M. HACHET, P. GUITTON, P. REUTER, F. TYNDIUK. *The CAT for efficient 2D and 3D interaction as an alternative to mouse adaptations.* in « Proceedings of ACM Virtual Reality Software and Technology (VRST'03) », pages 205-212, 2003, Best paper award.

[5] M. HACHET, P. REUTER, P. GUITTON. *Camera Viewpoint Control with the Interaction Table.* in « Proceedings of Virtual Reality International Conference (VRIC 2003) », pages 41–47, 2003.

[6] J. KRIVANEK, J. ZARA, K. BOUATOUCH. *Fast Depth of Field Rendering with Surface Splatting.* in « Proceedings of Computer Graphics International 2003 », 2003.

[7] P. REUTER, J. BEHR, M. ALEXA. *An improved adjacency data structure for efficient triangle stripping.* in « Journal of Graphics Tools », 2003, to appear.

[8] P. REUTER, I. TOBOR, C. SCHLICK, S. DEDIEU. *Point-based Modelling and Rendering using Radial Basis Functions.* in « Proceedings of the 1st international conference on Computer graphics and interactive techniques in Austalasia and South East Asia (Graphite 2003) », pages 111–118, 2003.

[9] B. SCHMITT, A. PASKO, C. SCHLICK. *Constructive Sculpting of Heterogeneous Volumetric Objects using Trivariate B-Splines.* in « Visual Computer », 2004, to appear.

[10] F. TYNDIUK, G. THOMAS, C. SCHLICK, B. CLAVERIE. *Modèles et facteurs humains en IHM : Application à la Réalité virtuelle.* in « formels de l'interaction, MFI'03 », May, 2003.

Doctoral dissertations and "Habilitation" theses

[11] J.-M. CIEUTAT. *Modélisation physiquement réaliste de sessions de simulation d'entrainement maritime.* Ph. D. Thesis, University of Bordeaux 1, Talence - France, December, 2003.

[12] M. HACHET. *Interaction avec des environnements virtuels affichés au moyen d'interfaces de visualisation collective.* Ph. D. Thesis, University of Bordeaux 1, Talence - France, December, 2003.

[13] P. REUTER. *Reconstruction et Rendu de Surfaces Implicites à partir de grands ensembles de points non-structurés.* Ph. D. Thesis, University of Bordeaux 1, Talence - France, December, 2003.

Publications in Conferences and Workshops

[14] J.-B. DE LA RIVIÈRE, P. GUITTON. *Silhouettes pour le suivi temps-réel basé modèle.* in « Atelier : Acquisition du geste humain par vision artificielle et applications », January, 2004, to appear.

[15] J.-C. GONZATO, B. PONT. *A Phenomenological Representation of Irisdescent Colors in Butterfly Wings.* in « WSCG (Winter School of Computer Graphics) », February, 2004, to appear.

[16] X. GRANIER, M. GOESELE, W. HEIDRICH, H.-P. SEIDEL. *Interactive Visualization of Complex Real-World Light Sources.* in « Proceedings of Pacific Graphics 2003 », IEEE, October, 2003.

[17] M. HACHET, J.-B. DE LA RIVIÈRE, P. GUITTON. *Interaction in Large-Display VR Environments.* in « Proceedings of Virtual Concept », November, 2003.

[18] J. POUDEROUX, J.-C. GONZATO, P. GUITTON. *Création Semi-Automatique d'un Modèle Numérique de Terrain.* in « Actes des 16èmes Journées de l'AFIG », pages 151-160, October, 2003.

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