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Preface

This volume contains the Industrial and Project Presentations for the 24th annual Conference of the European Association for Computer Graphics, EUROGRAPHICS´03, held in Granada, Spain, between the 1st and 6th of September 2003.

In the Industrial section, research groups from university and industry presented research projects with a direct application (if not yet done) in the industry. These applications have been presented as speeches during the conference.

Project description has been produced to accompany a track of research project presentations at the conference. The information requested is structured in the same way for all projects, and includes the organization coordinating the project, the project name, the objectives, a brief description of the project, the main results, and the identification of the project itself.

The full paper version corresponding to each Industrial and Project presentation presented in the conference is included in these proceedings and will be available on the conference CD-ROM. The number of papers proposed and the time limitation on the conference have driven to accept 3 papers.

The volume is arranged in two main sections, corresponding to the two presentation sessions at the conference. The first one is the presentation of the Industrial section. It includes the description of the 3 works presented within the industrial section during the conference. The second one includes the 83 projects. Some of them have been presented briefly during the conference.

Finally, we want to thank all of the authors for submitting their excellent works.

Felipe A. Lozano & Francisco Serón

September 2003.

Table of Contents

Industrial Presentations

Project Presentations

Austria

Wien

Belgium

Brussels

Heverlee

Louvain-la-Neuve

Denmark

Aalborg

France

Germany

Greece

Athens

Irakilio, Crete

Peania

Ireland

Dublin

Italy

Capannoli

Casalecchio di Reno (Bologna)

Genova

Milano

Pisa

Latvia

Riga

Portugal

Spain

Eurographics 2003

Industrial Presentations

RealReflect – Real-time Visualization of Complex Reflectance Behaviour in Virtual Protoyping

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Abstract

Conventional Virtual Reality (VR) is already being used in the design process for styling reviews on a daily basis, but until now only object shape can be assessed in a meaningful way, and neither the look and feel, nor the quality of surface materials can be adequately reproduced. Therefore, most interior design decisions in the automotive industry are still performed on expensive real prototypes. Apart from being costly and wasteful, this practice also significantly increases the time to market of the overall end products.

The RealReflect project is an endeavor to increase the realism of VR technology to levels where it can be used for meaningful qualitative reviews of real objects. The technology developed in the project covers all stages of an advanced image synthesis process, ranging from the acquisition and further processing of reflectance data over texture synthesis and compression of the measurement data to high quality light simulations and real-time image-based rendering. The resulting improved quality especially provides a considerable benefit to those VR users groups - such as the automotive industry or architecture - who routinely have to make important design decisions about object appearance long before the actual product is first assembled.

In this presentation, we will provide details both on the project's goals and the results that were achieved by the various participants – representing industry as well as research institutes – of the RealReflect project already.

Categories and Subject Descriptors (according to ACM CCS): I.3.7 [Three-Dimensional Graphics and Realism]: Virtual Reality; Color, Shading, Shadowing, and Texture; Raytracing

1. Introduction

Virtual Reality (VR) applications like Virtual Prototyping try to convey as realistic scenarios to the users as possible. Since the eye is one of the most important human sense organs, this especially requires visual realism of rendered scenes. The imagery shown on special output devices like head-mounted displays, caves or projection walls (which achieve immersion to a certain extend) is synthetic, but usually of rather low quality, especially with respect to physical realism. Reasons are the use of only very simple material representations like lit or bump-mapped textures and the inability to visualize global illumination results other than from radiosity algorithms in real-time. As a result, in such systems only the shape of objects can be correctly judged, not their overall appearance. Also, the atmosphere and impression of the light distribution in interiors cannot be rendered convincingly. As a consequence, not even radiosity-based VR systems permit the verification of safety regulations which strongly depend on specular reflections. Examples of such scenes, which are almost impossible to display convincingly using current VR technology, are the interiors of cars and buildings. Various other limitations limit the applicability of current VR systems even further.

The target of the RealReflect project – a project funded by the European Union comprising nine partners from universities and industry (the names are given in the acknowledgement section) that started in April 2002 – is to overcome these limitations by employing new techniques that get incorporated into a new, high-quality rendering pipeline. Realistic materials based on bi-directional texture functions (BTFs) replace the simple materials, accurate texture synthesis and texture mapping algorithms help applying these materials to the rendered objects. Physically more accurate light simulation by photon-tracing replaces the radiosity computations. The final rendering of results is achieved by Surface Light Field (SLF) rendering methods that highly depend on

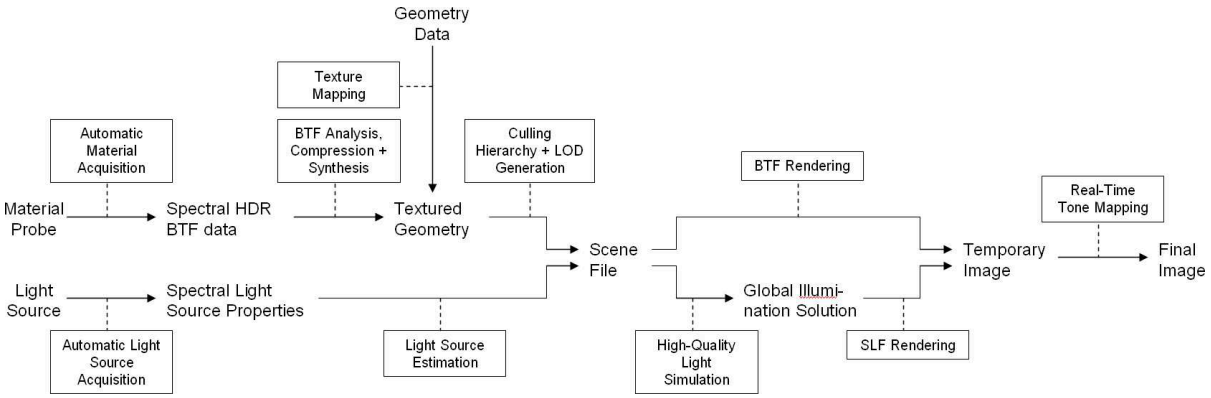

Figure 1: *The RealReflect rendering pipeline*

optimized level-of-detail (LOD) representations in order to achieve realistic results in real-time. Completely unknown to current VR systems, real-time tone mapping adjusts the colors of the rendered images to the visual properties of both the human visual system (HVS) and the properties of the display device.

Although various research results were presented for most of the tasks of the RealReflect project, three main challenges remain within the project.

- The scenes we need to face are big. While car models typically contain millions of triangles or tens of thousands of parametric surfaces, architectural models may contain hundreds of millions of polygons. Rendering of these scenes requires out-of-core algorithms due to the sheer amount of data – both geometry and material – required to represent them.
- The final rendering has to be done in real-time. While out-of-core rendering is a challenging problem by itself, real-time rendering of large scenes is even more demanding.
- The rendered results need to be high quality including both local and global lighting effects. In order to visualize the results of the high quality lighting simulation as realistically as possible, the whole new rendering pipeline requires high-quality techniques that are perfectly tuned to fit the needs of each other.

In the following sections, we will first describe our rendering pipeline (section 2). Afterwards its stages will be described in further details (sections 3, 4, 5, 6, 7, 8 and 9). In these sections, we also present some of the results that were achieved within the project already. In section 10, we briefly describe the integration of the rendering pipeline into the IDO:BASE VR system of IC:IDO (one of the industrial participants of the RealReflect project) before we finally conclude in section 11.

2. Rendering Pipeline

The final goal of the RealReflect project is to set up a new high-quality rendering pipeline for VR systems. Figure 1 depicts the pipeline and its stages which lead from acquisition of materials and light sources over texturing (synthesis and mapping) to LOD and occlusion precomputation, global illumination precomputation, interactive rendering and finally real-time tone-mapping.

The inputs to the pipeline are real, rather small material probes, real light sources and geometry files containing either triangular or trimmed NURBS based models. The first stages digitize the real input by automatically measuring reflectance properties of materials and light source properties. Next, the digitized materials are analyzed, compressed and texture synthesis algorithms are applied to generate arbitrarily large material textures. At the same time, the input geometry is parameterized to generate appropriate texture coordinates. The resulting textured models are simplified, culling hierarchies are generated, and the outputs are stored in a scene file. The stored scenes can afterwards be previewed using the BTF renderer, which utilizes approximations of the real light sources which are computed in the Light Source Estimation stage. Alternatively, the light distribution of the scene can be computed by the High Quality Light Simulation module and afterwards be rendered by the SLF renderer. Output images from both types of renderers finally get tone-mapped in real-time to yield the final output images.

Obviously the output of the pipeline can satisfy high-quality demands only if every stage of the pipeline achieves the highest possible quality by itself. As an example, the interactive SLF renderer cannot render realistic high-quality images if the inputs to the global illumination solver contradict reality because either low-quality material representations were fed into the system (resulting either from poor material measurements or bad texture synthesis algorithms) or because the texture coordinates do not minimize texture stretch or fail to represent natural texture orientation. As a

result, the quality of the rendered images is determined by the weakest link in the pipeline.

Similarly, all stages have to cope with large amounts of data. Accurate HDR material measurements result in many gigabytes of data, the same holds for spectral light source properties. As a results, texture synthesis also has to handle these huge amounts of data. Texture mapping has to cope with big models with many millions of polygons which puts strong restrictions on LOD and occlusion hierarchy construction algorithms as well. Obviously, the same holds for the global illumination solver and the final renderers. Unlike existing approaches they have to deal with both large geometries and huge amounts of material data.

In contrast to the quality requirements, not all stages need to meet special run-time requirements. Only the last stages (the BTF and SLF renderer, and the tone-mapping) have to be performed in real-time. In order to allow interactive changes to the scene, the LOD and hierarchy generation and the global illumination simulation should allow fast updates by exploiting coherence. The performance of the remaining stages is at most limited by application specific but rather long-term restrictions (e.g. for virtual prototyping of car interiors, few days are scheduled in between the reviews of different variants, thus processing the inputs for a single variant should take less than these few days).

As a special feature of the RealReflect pipeline, the pipeline is required to handle both triangular data and trimmed NURBS models as an example for parametric surfaces, since trimmed NURBS are the most common modelling primitive in automotive industry. An obvious solution to avoiding these two-fold inputs would be to tessellate the parametric surfaces upfront, but this possibly prohibits achieving realistic, high-quality solutions. We thus decided to implement different or mixed-mode variants for the affected stages (texture mapping, hierarchy and LOD generation, global illumination simulation and interactive rendering).

The following sections describe the individual stages in further detail and provide details on already existing results achieved within the project.

3. Data Acquisition

In the RealReflect project, data acquisition refers to the automatic acquisition of materials and luminaires (light sources). The acquisition of geometry models for virtual prototyping is typically a task of designers and therefore out of the scope of this project.

3.1. Material Acquisition

Tremendous improvements in rendering quality can be achieved by measuring the reflectance properties of real-world materials. These can be described by the six-dimensional Bidirectional Texture Function (BTF)

$$BTF_\lambda(\mathbf{p},\mathbf{l},\mathbf{v}) = BTF_\lambda(x,y,\theta_l,\phi_l,\theta_v,\phi_v), \quad (1)$$

which describes the appearance of every surface point $\mathbf{p}$ under varying light ($\mathbf{l}$) and view ($\mathbf{v}$) directions for a given wavelength λ. The angles θ and ϕ denote polar and azimuth angle for both light and view directions. The BTF representation was first introduced by Dana et al.[15] in 1997.

Figure 2: *Six views of a wallpaper from various view and light directions acquired by our automatic material measurement setup. The appearance of the material changes drastically which is correctly represented in BTFs.*

Previous approaches for measurement of real world BTF data described in literature (e.g. [16, 29, 63]) automatically or semi-automatically acquire pictures for the BTF representation. The need for automation was fixed in the RealReflect project, since not only huge amounts of pictures per material, but as well large numbers of materials have to be acquired.

The measurement procedure is similar to the method that was employed in order to build the CUReT[16] material database. We improved it in order to yield higher quality results by using more measured view- and light-directions, by employing better suited light sources and higher picture resolutions (for a more detailed description see [74]).

The results we achieved so far are depicted in figure 2. The pictures are of very high quality at the expense of large amounts of data. The raw, losslessly compressed measured data sums up to about 40 GB per material probe.

After applying an automatic rectification procedure (see [74]) which also cuts away large parts of the original pictures that do not show the material probe, our material is defined by a set of 6561 images of size 512×512. After lossless compression, the data requires about 5 GB per material – a significant reduction but not at all sufficient for later rendering. Further data reduction is performed according to the used BTF model (see section 8.1). Some of the measured materials are freely available and can be downloaded from the BTF Database Bonn[9].

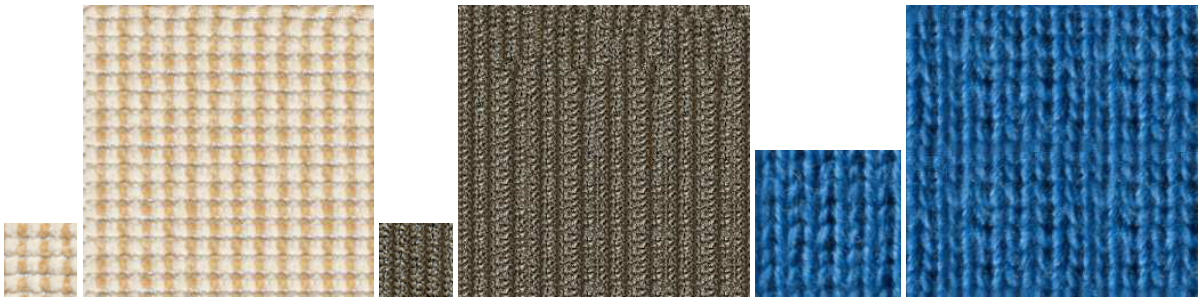

Figure 3: *Results from texture synthesis (left: Proposte, middle: corduroy, right: knitted wool). The small images represent exemplary views of the samples, the large images the according views from the synthesized images. For Proposte and knitted wool, the structure of the synthesized image closely resembles the original, for corduroy the random component of the algorithm destroys the original structure.*

In the future, we will extend our measurement procedure to spectral HDR measurements with the number of measured images dynamically adjusting to the complexity of the reflectance properties of the material. While spectral HDR materials further increase the realism of rendered results, data driven measurement processes like the one of Lensch et al.[58] minimize the amount of both measurement time and storage requirements.

3.2. Luminaire Acquisition

The automatic acquisition of light emission properties of real-world luminaires is not a primary, yet necessary goal of the RealReflect project since this data on the one hand is necessary for well-funded safety relevant decisions but on the other hand usually is considered an intellectual property of the manufacturer and is thus not published.

Few publications[5, 6, 76, 72, 47, 43] cover this topic, yet a recent publication by Goesele et al.[30] reflects the still lasting interest in this topic.

We will implement and experiment with the approach of Goesele et al.[30] in order to determine its suitability for our rendering pipeline and either extend it or propose different measurement techniques if necessary.

4. Texture Synthesis

Texture synthesis denotes the process of generating a large texture with desired appearance attributes (i.e. structure, color, etc.) but without obvious repetitions, which is inevitable for visualizing models with large, textured areas. In many approaches (e.g. [88, 26, 83, 89, 92, 93]) the desired appearance attributes are specified by a small example texture. Texture synthesis is an especially indispensable part of the RealReflect project, since the measured material samples have a size of 10×10 cm (and are typically not repeatable), whereas the rendered models have surface areas of several square meters.

The final goal of the project is the development of mathematical synthesis models for both color and BTF textures. These models are efficiently represented by a small set of parameters which tremendously reduces the storage costs for textures compared to digitized ones – especially helpful in the case of otherwise memory-intense BTF textures.

For the case of color textures, such models[40, 34, 41, 42], based on the Markov Random Field (MRF) method, were developed by the project partners already. The main challenge of BTF synthesis is the high dimensionality of BTFs compared to low-dimensional standard textures. It is thus highly questionable if existing results for textures can be extended to BTFs.

As an alternative, we will test existing and develop new BTF synthesis algorithms which are not based on mathematical models and therefore require far more storage. As a first step, we implemented a modified version[64] of the approach of Tong et al.[82]. Figure 3 shows that this approach produces good results for several BTFs (e.g. the highly structured Proposte material) but yields insufficient quality for others (e.g. Corduroy). We currently investigate these problems and work on improved synthesis algorithms.

5. Texture Mapping

Texture mapping, i.e. the process of applying a texture to a surface by assigning texture coordinates, is another key application in the RealReflect pipeline. The geometry used in virtual prototyping usually directly originates from CAD systems which typically either contain no texture coordinates at all or the texture coordinates resulted from simple planar projections. These coordinates neither minimize texture stretch (necessary for a uniform coverage of the surface) nor do they allow arbitrary texture orientation (reflecting real-world structure). In addition, the mappings are typically not bijective which is an essential requirement for the visualization of the precomputed global illumination solu-

tion later in the pipeline (i.e. computed Surface Light Fields are specific for every surface point).

Since the input geometries are either triangular or trimmed NURBS based models, two different kinds of texture mapping algorithms need to be implemented for the RealReflect project.

For triangular models, many algorithms were published already (e.g. [25, 27, 73, 45, 75, 20, 60, 52]). While some of these yield excellent results for special applications, the texture mapping algorithm to be employed should fulfill the following requirements:

- guaranteed avoidance of face flips
- as isometric as possible result mappings
- no fixed boundaries required
- fast computation

Since none of the existing algorithm can satisfy these requirements, n new approach was developed by Degener et al.[19]. The approach allows to balance the amount of angle and area preservation of the parameterization method by a single, intuitive parameter. Figure 4 provides a comparison between our method and the least squares conformal map method of Levy et al.[60], which targets angle preservation and thus can lead to arbitrarily large area deformations.

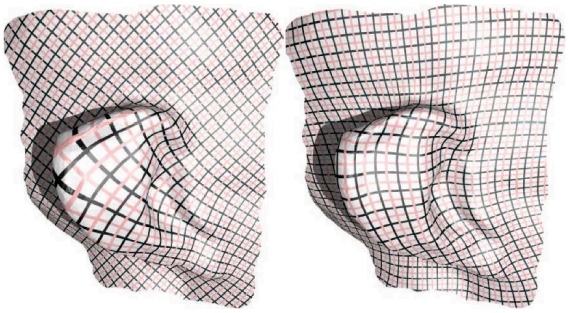

Figure 4: *A regularly patterned texture mapped by conformal map (left) and by a map computed with our approach. While the conformal map minimizes angular distortion, our mapping also accounts for global area deformation.*

For trimmed NURBS based models, no parameterization algorithm specialized for texturing existed so far although these parameterizations have a very nice feature: when generating texture coordinates with respect to the knot vectors that define the surface, one can compute texture coordinates for every surface point by simple evaluating the NURBS formula. This feature is especially suitable for LOD representations (e.g. adaptive or view-dependent tessellation). Guthe and Klein[36] developed such an algorithm that automatically generates a texture atlas, which requires three stages: Charting, Parameterization and Packing. The charting algorithm required for model cutting minimizes distortion and favors cuts along feature edges, thereby preserving the original

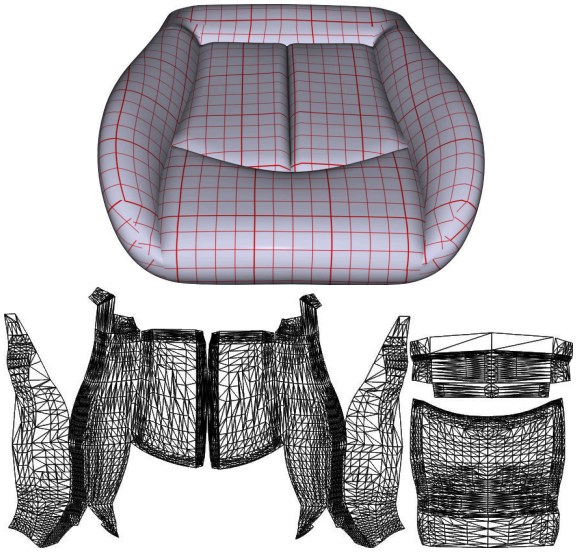

Figure 5: *CAD model of a car seat with generated texture atlas. The model is covered with a grid texture to show angle and edge length deformations.*

NURBS patches. The parameterization algorithm optimizes angle- and area-deformations simultaneously, and can additionally include constraints on texture direction. For packing, an algorithm similar to Sander et al.[73] is used. Results of the texture atlas generation method are shown in figure 5.

In the future, we will pay special attention to the parameterization of huge models containing either millions of triangles or tens of thousands of parametric surfaces, since these are typically out of the scope of algorithms published so far. Here, again, the main problems will result from the sheer size of the models, potentially requiring out-of-core solutions, parallelization and highly runtime-optimized algorithms while still achieving high-quality results.

6. Hierarchy and LOD management

As mentioned in the previous sections, the amount of data to be handled in the project is huge. Obviously, data reduction has to be performed in order to visualize it interactively. Besides the possibility of texture compression, the geometric data has to be handled, which is typically done by reducing the amount of objects to be drawn (culling) and adjusting the complexity of the drawn objects to the current precision requirements (LOD).

6.1. Culling Hierarchies

Probably the most important method for reducing the complexity of a large, rendered scene is the determination of the set of visible primitives. Unfortunately, solving this problem exactly is very time consuming. Therefore, approximations are used.

Hierarchical culling tries to determine the visibility of sets of primitives organized in hierarchies. Building these in an optimized way (i.e. such that as many rendering primitives are determined invisible in a short time) is a challenging task, especially if dependencies between objects are considered.

For triangular models, hierarchies are usually built by spatial subdivision. Many approaches rely on octrees (e.g. [84, 14]), others prefer hierarchies of axis-aligned bounding boxes (e.g. [7]) or arbitrary bounding volumes (e.g. [3, 85]), kd-trees (e.g. [80, 28]) or other schemes. These hierarchies are successfully and rather easily employed to perform view-frustum and backface culling in practically every large-scene renderer. The choice of the kind of hierarchy, though, strongly influences the performance of the rendering system. We did not choose a specific method for the RealReflect project, yet

For NURBS based models, culling primitives are either individual (trimmed) NURBS patches (the OpenGL Utility Library uses this approach, furthermore [38]), Bézier patches[55] or groups of them[56]. In the RealReflect project we currently employ the algorithm of Balázs et al.[2] which performs backface and view-frustum culling based on a hierarchy of axis aligned bounding boxes containing individual NURBS patches.

In the future, we will research opportunities to combine our rendering approaches with occlusion culling together with suitable occlusion hierarchies. Unfortunately occlusion is a view-dependent phenomenon and thus precomputation of occlusion information is both challenging and time-consuming (especially since rendered scenes are expected to be modified by the user rather frequently). In addition, run-time computation of occlusion information using either software algorithms like the hierarchical z-Buffer[33, 32] or occupancy maps[78], or hardware assisted algorithms like cPLP[53] employing the occlusion query[71] become rather intractable for huge scenes due to the large number of individual objects in e.g. environmental scenes. At least for architectural models, a portal[1] based technique will provide a suitable solution.

6.2. LOD management

Implementing LODs for a VR system that correctly models reflectance properties of objects and surfaces requires special care, since reflectance is very sensitive to changes in geometry and material. This topic gets especially important since one of the goals of the RealReflect project is the prototyping of safety relevant features of a car. Since both triangular and trimmed NURBS based models have to be supported by the pipeline, the partners from the RealReflect project have to implement methods for both representations

For triangular meshes, until recently, LOD generation and management was limited to small or mid-sized models of up to few million triangles (for a recent survey, see [62]). Newer publications almost exclusively concentrate on large model simplification (for a survey, see [77], furthermore [7, 13, 18, 46, 91]). While they can reliably handle huge objects, most of them do not focus on real-time rendering of the simplified objects. The remaining methods unfortunately cannot fulfill the demands of the RealReflect project for the following reasons. The approach of DeCoro and Pajarola[18] employs progressive meshes[44] which cannot quite achieve real-time frame rates for huge objects. The method of Lindstrom[61] bases its LOD structure on the vertex clustering operator, which generates meshes with bad quality. In addition, it performs an initial simplification step which makes it impossible to render the mesh at the highest possible resolution. The frame rates are interactive, but major popping artifacts are exhibited by the rendering-method. The method of Varadhan and Manocha[85] has a different focus since they concentrate on out-of-core rendering of large scenes containing many objects. They rely on HLODs which lead to significant popping artifacts, resulting in completely unreliable results for safety-relevant evaluations.

We therefore work on out-of-core simplification algorithms for triangular meshes as well, where we especially focus on possibilities to render them at high quality in real-time and were able to achieve promising results already. Borodin et al.[10] published a new high-quality simplification scheme based on generalized pair contractions. The scheme was employed by Guthe et al.[35], who published a high-quality, real-time out-of-core rendering system for huge triangular meshes. The basic idea of the approach is to subdivide the huge model into manageable parts and simplify them individually. At run-time, the small parts are rendered independently. Visible gaps between these parts are avoided using the fat borders technique[2]. A rendered result using this new technique is shown in figure 6. Finally, Borodin et al.[11] published an out-of-core simplification algorithm that achieves high-quality meshes using the generalized pair contractions technique mentioned above.

LOD structures for trimmed NURBS surfaces are still of big interest since they were and are the modelling primitive for automotive, airplane, ship and other industries. Since for final rendering all parametric surfaces have to be converted to triangles, a very simple approach is commonly used in existing VR systems which employs either uniform or adaptive tessellation of individual trimmed NURBS patches. In order to avoid the resulting visible cracks between NURBS patches, Kumar et al.[56] introduced the notion of super-patches which are sewed on the fly – which turns out to be a costly and error prone solution. A following publication by Kumar et al.[54] removes the on-the-fly sewing but deals with special configurations of trimmed NURBS surfaces only.

Within the RealReflect project, Guthe et al.[38] improved the above methods by employing a-priori sewing and the introduction of a LOD structure on the seams, which they call the Seam Graph. The method allows rendering of car mod-

Figure 6: *Results from the LOD rendering algorithms. Left: a car model consisting of about 8000 trimmed NURBS patches which are tessellated on-the-fly. Right: Out-of-Core rendering of the famous David model. Note that the missing part of the head was culled away since it lies outside of the view-frustum.*

els with several thousands of patches at interactive rates on a single, commodity PC but it suffers from a large memory overhead for the storage of the Seam Graph data structure. In a following publication, Guthe and Klein[37] improved the previous rendering method by employing normal maps to achieve better visual quality. In addition, they developed a new compression techniques for normal maps.

Another algorithm was developed within the project by Balázs et al.[2] which allows high-quality real-time rendering by employing vertex-shaders. Their method requires no specific LOD precomputations but works on individual patches. By guaranteeing a maximal screen space error using view-dependent, adaptive tessellation for each individual patch and extruding trimming loops by the screen space error using the vertex shaders, all gaps are closed at run-time. As a result, as far as the RealReflect project is concerned, the LOD problem for trimmed NURBS surfaces is solved. Figure 6 shows a rendered results. The normals from the normal map not only improve the overall appearance of the model, they as well serve to implement lighting by a HDR environment. The model in the picture renders at about 20 fps, which must be improved by future work.

7. High Quality Light Simulation

Virtual Prototyping applications that want to evaluate the appearance of complex scenes at any scale need to take global illumination effects into account. In current VR systems, solutions from radiosity algorithms are used for this task, which unfortunately entails some drawbacks.

- Radiosity algorithms assume diffuse environments. Unfortunately, especially for safety relevant evaluations of cars the specular reflections in the windshield are crucial, which cannot be captured by radiosity based algorithms.
- Radiosity algorithms require a subdivision of the scene into patches. In order to achieve approximately correct lighting results for interiors with arbitrarily complex material properties, the number of patches needs to be very high, resulting in unpractically long computation times.

Existing publications suggesting interactive or even real-time visualization of global illumination solutions not limited to diffuse environments can roughly be divided into two categories: approaches based on massive, parallel ray-tracing (e.g. [68, 70, 8, 86]) and algorithms that incrementally compute the global illumination solution (e.g. [87, 39, 81, 22]). While the first approaches were shown to result in interactive frame rates even for huge scenes, they sacrifice too much quality for speed (since they both limit the recursion depth and the number of light sources). The second kind of approaches achieves approximately physically correct results after periods where neither the view-point nor the scene changes. Unfortunately, intermediate rendering results representing approximations of the correct solution often show strong artifacts.

The RealReflect project therefore suggest to use stochastic particle tracing (namely photon-mapping[48]) in combi-

Figure 7: *Comparison of approximate bump-mapped texturing (left) and reflectance field based BTF rendering (right). The same light configurations were used in both pictures. Using BTF materials, the 3D structure of the corduroy material on the car seat appears realistic, while bump-mapping clearly misses the highlights for grazing light angles.*

nation with ray-tracing methods to compute realistic, high-quality global illuminations for static scenes. Since this obviously requires a preprocessing step, the solution is stored as Surface Light Fields (SLF) and rendered by a SLF renderer in real-time. Unfortunately, this prohibits changes to the scene, but approaches like Selective Photon Tracing[22] will help to reduce update times for small changes which might occur during virtual prototyping processes.

A completely new and challenging task of the RealReflect project is the combination of ray-tracing with accurate, measured material representations which – to our knowledge – has never been done before. In addition, it will be able to handle spectral input data in order to cope with real-world phenomena like metamerism, fluorescence and light polarization. Finally, our global illumination solver is supposed to work with both triangular and trimmed NURBS based models. Although this approach is not new, it promises higher quality results than ray-tracing of a-priori tesselated trimmed NURBS surfaces at the expense of a more complicated and possibly less optimized implementation.

8. Interactive Visualization

In this section, the algorithms for the two different rendering paths of the RealReflect pipeline are described. While both approaches rely on similar principles, they need to fulfill very different quality criteria.

Please note that this section is not concerned about rendering the underlying geometries since this topic is covered in section 6 already.

8.1. BTF rendering

The BTF rendering is supposed to offer a preview mechanism for the scenes before the actual global illumination solution is computed. Although resulting images include all local effects captured in a BTF like inter-reflections, self-shadowing, subsurface-scattering and self-occlusion, they lack global effects beyond simple shadows cast by point- or directional light sources. In order to show the big difference between simple lit or bump-mapped textures and BTF rendering, figure 7 provides a comparison of a car seat model lit by a single light source, once rendered with a bump-mapped surface and once with a measured BTF.

In the field of real-time BTF rendering, few publications exist so far. Kautz and Seidel[50] proposed to factor the pixelwise BRDFs – given as factors of simple reflectance models – into two-dimensional functions and storing the values in textures that are evaluated with hardware supported operations and dependent texture lookups. Unfortunately, their rendering algorithm yields unsatisfying results for more complex reflectance models which are not easily separable. Suykens et al.[79] improved this approach by a more accurate factorization method, but besides using just synthetic BTFs which lack important realistic effects like subsurface scattering, they unfortunately do not provide any error evaluations. Kautz et al.[51] rendered spatially varying BRDFs using spherical harmonics by simply employing higher-dimensional look-up tables. McAllister et al.[63] published a method that approximates the BTF by pixelwise Lafortune[57] models, which can efficiently be evaluated in current graphics hardware. Daubert et al.[17] published a similar approach for rendering synthetic cloth BTFs, but additionally modulate the pixelwise Lafortune models with a view-dependent factor in order to cope with occlusion effects. Though both algorithms yield good results for materials with low depth range, they prove inadequate for more structured, measured materials. Sattler et al.[74] described a high-quality BTF rendering method based on principal component analysis (PCA), but

Figure 8: *Cloth covered with Wallpaper and a perfectly round sphere covered with Stone. The left image was rendered using a lit color texture while the other images resulted from BTF rendering based on the local PCA method.*

they require more than 320 MB per BTF material and their rendering algorithm yields interactive frame-rates for small models only.

In the course of the project, the partners therefore developed more appropriate BTF rendering algorithms. In order to improve the rendering quality for materials with high depth-range, Meseth et al.[64] proposed to implement BTF rendering based on interpolating surface reflection fields, which are stored for a number of fixed view directions. Their algorithm can be implemented as vertex- and fragment-shaders, and achieves real-time frame rates and good rendering quality for most materials. An image rendered using this technique is shown in figure 7. A main drawback of the algorithm is the storage requirement per BTF material, therefore requiring clustering to render arbitrary materials with both high- and low- frequency structure.

In order to compensate the shortcomings of the above approach, Müller et al.[67] published a method based on local PCA[49], which tremendously reduces storage requirements (typically to about 14 MB per material) and achieves excellent rendering quality. The approach can as well be implemented as vertex- and fragment-shaders, but it performs worse than the approach of Meseth et al. since it requires much longer fragment shaders. Figure 8 compares the visual impression of a simple cloth model one time textured with a color texture and the other time with a wallpaper BTF. Please note the correct highlight of the BTF covered cloth and the correct depth impression of stone covered, perfectly round sphere (which especially results from the correct shadows which are inherently part of ever measured BTF).

In a recent publication, Meseth et al.[65] compared existing BTF rendering methods with respect to approximation quality, space and run-time requirements. They also suggested application areas for the different approaches, i.e. they suggested which algorithms to use for specific kinds of materials.

In the future, we plan to extend our BTF rendering algorithms to balance approximation quality, storage requirements and rendering speed even better. We also want to evaluate existing techniques with respect to human perception.

8.2. SLF rendering

The Surface Light Field (SLF) rendering algorithms have to visualize the global illumination solution that includes all global effects in addition to the ones already captured by the accurate BTF materials. Therefore, they have to achieve much higher quality and effectively turn out to be the more challenging task.

SLFs are special versions of Light Fields, which were first introduced simultaneously by Levoy and Hanrahan[59] and Gortler et al.[31]. Other than Light Fields, they are parameterized over surfaces and were first introduced by Miller et al.[66], who employed a JPEG-like compression in order to reduce the storage amounts of the images representing the SLF. Following publications [90, 12] concentrated on the application of different data compression schemes.

Unfortunately, the only interactive SLF rendering algorithm published so far by Chen et al.[12] sacrifices too much rendering quality for real-time demands. The main reason for the loss of quality is that it employs principal component analysis but only few components for rendering. Therefore it usually fails to reproduce high-lights, which contradicts the high-quality needs of the RealReflect project. We therefore plan to develop new SLF rendering algorithms that better preserve rendering quality while still achieving real-time frame rates by employing features of modern graphics boards like vertex- and fragment-shaders. In addition, we will optimize our rendering algorithms to HDR SLFs.

We thereby have to pay special attention to the underlying amount of SLF data, which is expected to be too big to be stored in RAM completely (assuming commodity PCs). Therefore, we need to extend culling methods to account for the material data as well. We will also investigate LOD techniques for SLF data, which has never been done before.

9. Tone Mapping

The final step of the RealReflect rendering pipeline is tone mapping, which denotes the task of mapping a high-dynamic range image (here represented as floating-point valued RGB values) to a low-dynamic range image which can be displayed on the output device (e.g. 8 bit RGB values for standard monitors). This mapping should be optimized for the human visual system (HVS), i.e. the perception of humans should be taken into account.

Tone mapping is an important stage of the RealReflect pipeline since both BTFs and results from the global illumination solver are required to include HDR color values to correctly simulate reality. Simply clamping or incorrectly mapping these values to the low dynamic output luminance range would prohibit realistic judgement of reflectance behavior and especially prohibit safety relevant decisions to be made.

During the last years, many tone map operators were introduced to the computer graphics community (for a survey, see Devlin et al.[21]). Existing approaches can be divided into local operators, which apply a spatially varying mapping to the image, and global operators, which apply a single mapping to the pixels. Generally, due to their greater flexibility, local operators produce more compelling images than global operators, but they are significantly more expensive, which potentially limits their applicability to real-time settings.

A first report of the project partners comparing seven tone mapping operators was published by Drago et al.[23], which evaluates the realism of images tone-mapped by the various algorithms. Based on the results of the evaluation and the need for realistic yet efficient tone mapping including the characteristics of the HVS, Drago et al.[24] published such a new tone-mapping operator. The operator can easily be implemented as a small fragment shader program, which makes it highly suitable for real-time tone mapping. Unfortunately, the algorithm requires knowledge about the average and maximum luminance of the high-dynamic range image. Extracting these values in a naïve way by reading back and evaluating the frame buffer is a very time consuming task.

This problem was addressed by the approach of Artusi et al.[4], who suggest reading back a fixed number of random samples in order to acquire statistics of the image to be mapped. By evaluating the correct tone mapping operator for these samples and applying tone mapping to all other pixels by linear interpolation, they achieve interactive frame rates not only for the approach of Drago et al., but for arbitrary global tone mapping operators.

The combination of the tone mapping operator of Drago et al. with the speed-up method of Artusi et al. was combined with the BTF renderers from section 8.1 already and will be easily integrated with the SLF renderers in the same way.

For future work, the tone mapping operator will be extended to match the HVS more closely. In addition, we plan to examine the suitability of local tone mapping operators. Furthermore, since a sequence of tone-mapped images usually shows flickering artifacts due to abruptly changing input data, we require an adaptation algorithm that mimics the function of the HVS.

10. Integration into VR System

One of the main engineering challenges in the RealReflect is the integration of the rendering pipeline into the IDO:BASE system, a product of IC:IDO, one of the industrial partners within the project. The specifics of integration will obviously not be discussed here, just an overall idea will be provided.

The first main challenge is imposed by porting the IDO:BASE system to the OpenSG[69] scene graph system, which was designed to support current demands like portability and support for multi-threading and distributed rendering. In addition, it was designed to easily include support for features of modern graphics boards like vertex- and fragment shaders.

While on the one side new nodes need to be implemented that support specific VR interaction devices, the BTF and SLF renderers and the tone mapping algorithms, the IDO:BASE scene editor has to be extended to the new features of the RealReflect rendering pipeline and modified to handle the OpenSG scene graphs on the other side. Additionally, the abilities of OpenSG for stereoscopic and multi-channel rendering need to be employed and adjusted to existing output devices.

11. Conclusions

In this document, we presented the goals and current achievements of the RealReflect pipeline. The main target of the project is the setup of a new rendering pipeline allowing for high-quality, real-time Virtual Prototyping. As pointed out, the problem faces enormous challenges by coping with huge amounts of data, requiring ever stage of the pipeline to produce the highest possible quality (be it acquisition, texturing, LOD and culling hierarchy generation, global illumination simulation, rendering or final tone mapping) and real-time behavior of the rendering stages.

The solutions achieved so far cover large parts of the pipeline already, but lots of future research has to be done to implement the remaining stages, to improve existing ones,

to tune them to perfectly fit each other and to integrate them into the target VR system.

As another task for the future, we plan to evaluate the results of the new rendering pipeline with respect to real-world situations.

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VISUAL-GAMA
Graphical data visualization and monitoring for maritime container terminals

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Abstract

We present a contribution to the development of visual applications for planning, monitoring and integral management of container terminals. We introduce a system that improves on current commercial applications by providing real time access and visualization of the container terminal. Our system is accessible using modern wireless devices and an event based transaction engine. We show how the integration of different technologies creates a final product that outperforms other systems for container terminal management.

Key words: *Container terminal, graphic user interfaces, wireless devices, OpenGL, Web, XML.*

1. Introduction

Container terminal are a great environment for developping visual tools for management, planning and monitoring where all the information involved in the processes might be graphically and clearly presented. Normally, those container terminals use to have an information system that displays data by using poor alphanumeric interfaces without the ability to adapt to the changes like advanced graphical user interfaces.

In the last three years we have been involved in the development and installation of integral management system of a terminal container. It automates most of the production processes of such enterprises (GAMA[7]). Currently the system is being exploited by Marítima Valenciana, S.A., one of the greatest container terminals of Europe, with about two million movements of containers/year on an extension of 3 km^2. Some applications concern with computer graphics and have relationship witn other fields such as XML, web, GUI, multithreading, etc. We show here the problems we have found and the solutions we have choosen, particularly in those applications with a relevant graphical content.

2. Visualization problems

The real-time visualization of large out-of-core models presents some problems that can be solved with innovative techniques like the ones we present here. Those techniques solve the two fundamental problems: the real-time visualization of very big datasets and the modification of the data in applications designed with an event oriented model.

Other issue is vessel loading and discharging (stowage planning): a list composed of univocal associations among a yard location (container) and a ship position (slot). Thus, we must show an elevated number of elements at the same time, and for each one, it is necessary to show a great amount of information simultaneously in a reduced area while the user needs the maximum information available to reduce the number of permissible errors.

Other problem we had to solve was the remotely information acquisition to support mobile platforms such Pocket PCs and SmartPhones and eventually to emit the information out of the enterprise. Ours objectives were to develop real-time system, with advanced GUI's and adaptability to the terminal changes, maximizing the graphical representation with forms and colors with filtering, and giving support for wireless devices.

3. Navigator

Navigator is a 2D 1/2 visualization application that represents everytime the state of the container in the terminal, showing graphically containers, vessels, trucks and other mobile elements. The application is highly customizable and scalable and fits easily on existing information systems. It adapts itself to the topological characteristics of any container terminal with a powerful and simple graphical user interface.

Navigator visualizes in real time the state of the totality of mobile and static elements. These are respectively located by means of tracking devices and reference positions. Other visualization systems lack of this advanced feature [5,6]. To do that it uses a completely event oriented model disconnecting it from the system data base. On one hand it loads the necessary data structures to make up the graphical representation, loading the position of the containers and location of the machines. On the other hand it builds a map of precompiled OpenGL[2] command lists of geometry representing, among others, the static container groups using different coloring policies. It also precompiles vessels and cranes, buildings, road marks, etc. Everything is also located in the UTM coordinates calculated from the GPS projection of the container terminal.

The precompiled GL lists are stored in a hierarchical structure that allows us to find quickly which of them are needed to be represented at the same time. Navigator compiles only the GL list that has implied some modifications by external events, balancing the computing cost of geometrical compilation.

To achieve a true real-time visualization system was necessary to make Navigator multithreaded so that the process of external events as well as the geometrical compilation did not delay the representation of the visualized information. The geometrical compilation is carried out in a separated execution thread whose work is simply to regenerate GL lists based on new external events of changes on position or state of elements. At the same time, the main thread of the application reads the precompiled GL lists of geometry making decissions about which GL lists has to visualize. It represents them in the viewport and processes the user interface events.

We had some problems to solve since the render context of OpenGL were shared by both execution threads. The first thread (the one who is compiling the GL lists) uses the lists of the render context in WRITE ONLY mode, whereas the second (the one who represents in the viewport) uses these lists in READ ONLY mode. The solution was to associate to each GL list a flag. It informs about if the list was involved in an reading operation, a writing operation or it did not have an active operation.

When the viewport needs to be painted the reading thread determines which compiled GL lists must represent, being based the decision on the parameters of the application like visible layers and level of detail. Next it determines which GL lists fall within the viewing frustum by using frustum culling techniques based in the bounding boxes of each GL list. Once it has determined the potentially visible set of objects (in this case the set of potentially visible OpenGL lists) it carries out its representation reading the flag associated with each list and delaying the execution of the lists involved in an operation of writing and prioritizing those that are not being compiled. Figure 1 summarizes this process.

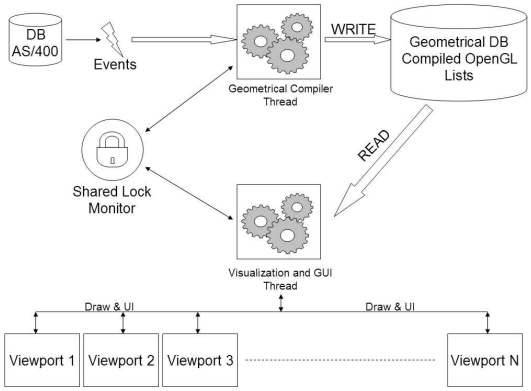

Figure 1: *Threads synchronization for shared GL contexts.*

4. SMES

SMES is a stowage planning system based on a 2D front-end, a sequence engine and a database. The stowage planning process is made manually, which implies a high degree of interaction with the user. In addition, SMES is feeded with information from a database resident in a server. This implies a multilayer architecture, with the application at the top, the planning engine at the middle and the database server at the bottom. Thus, we have focused on offering a simple and intuitive interface to the user, which allows us to change others modules with no effect on the visual layer.

The visual interface uses multiple views to show different information. The main views are: a *Yard View* to visualize the containers grouped by hierarchical structures as the real organization of the terminal; a *Vessel View* to show the content of a cross-sectional section of a ship (<deck-covers-hold>); a *Text Info View* to give detailed textual information, making the user easier to trace the sequence

We have solved the problem of visualizing a great amount of stowage information in a reduced area by using a graphical language based on iconography, coloration and partial changes in the morphology. Thus it is possible to visualize up to ten items simultaneously, without stretching excessively the painted area. On the other hand, this information is practically static, since changes use to be on the states of

the elements, and not on the amount of elements to visualize. It led us to choose a 2D representation method with precalculated geometry. In order to avoid the blinking problem, we have used the technique of double buffer over the native drawing API[8].

5. TReS

The need to operate with containers in a more suitable graphical form give us the idea of creating a reutilizable view that could be componentized and integrated in more applications. Taking that into account we developed an application (TReS) to make uploads and downloads of containers from a graphical view. From TReS the user can upload a container from a truck or download from a crane, all visually made and synchronized to the system database. Crane operation is visualized in real-time and the productivity is highly incremented.

The application precompiles geometrical information in a 2D form updating it with the external events arrivals and uses double buffer for its representation. The topological information is read from a XML representation and the application creates an efficient data structure for updating and finding information. The compiled geometry is customizable by other XML files that configures the data, aspect, colors and symbols and such information is used for creating the new compiled bitmaps by events arrivals. Figure 5 shows a screenshot of this application.

6. System Monitoring and Web Interface

An very important agent of our development is the system operation monitor. Its objective is the knowledge generation and its distribution to other agents. It compounds performance counters for the different machines that operates in the terminal. In addition, it offers real-time information for the predictive control of the machines that move the containers and evaluates the benefits of the system.

In addition to the software agents involved in the terminal operative, we wanted to give support to management decision of human operators who consumed this information in a more suitable graphical form. For it we developed a set of web applications with the objective to offer this information by means graphical user interfaces and intuitive forms. The monitoring information is presented as bar charts or pies as usual.

Developed architecture is based on the DNA client/server model of three layers[1] where the generation of dynamic graphs is made in the server side. Normally the web applications have been developed by means of techniques based on CGIs where server generates HTLM dynamically. However, the images (GIF, JPG) associated to these pages are not generated dynamically: usually they are a resource (files) stored locally in the server.

Our system allows us to create dynamically not only content HTML of the pages, but also the associated graphs of monitoring information as figure **??** shows. The application server chosen to deploy the web applications of monitorization was Jakarta Tomcat and the language used for the implementation was Java by using the Servlets API[4] and J2 Enterprise Edition API[3].

We did not consider other possible solutions of implementation like sending the information in XML from server to clients delegating the processing and the generation of graphs to the clients. This would have invalidated very popular potential platforms of development such SmartPhones and PDAs that practically does not have hardware processing resources.

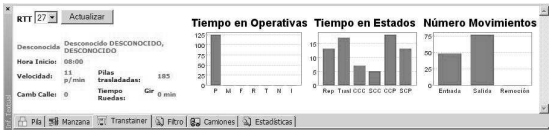

Figure 2: *Graphics server-generated and consumed by other agents.*

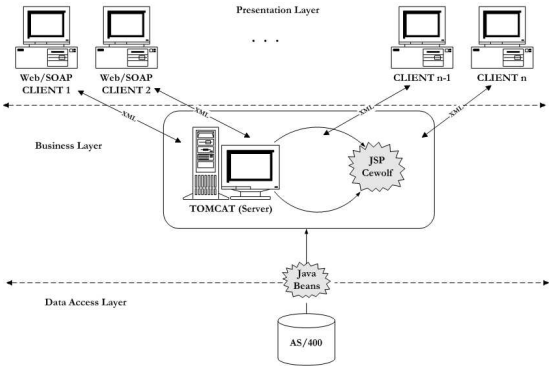

Figure 3: *Web Interface Architecture.*

7. Wireless Devices Support

Container terminal's workers are in permanent mobility: container's manipulators, trucks and cranes drivers and yard agents are moving around the terminal without possibility of using a PC but with the same requirements of access to the information system that the rest of users. One good solution would be to provide them with graphical tools similar to the developed desktop applications. The main task was to find a solution to the problem of the accessibility of the information remotely.

We developed a system based on the three layers client/server model (figure 2). This allows to acquire the information using standard Internet protocols. The client applications developed over mobile platforms (Pocket PC, Em-

bedded Linux, Java Applets) can send and receive messages using XML, by means of a contractual language of access to remote objects.

Developed architecture.

Web Service (PDBCServer): The system data base is accessible by means of native software librarys or through bridges ODBC. We created for it a web service that maintains its connection with the data base and publishes certain access methods to the information. This service runs in an web application context under a Jakarta Tomcat server[4].

Publication of remote access methods: We qualified a mechanism by means of it is possible to invoke a certain method of the web service remotely and client platform agnostic. To do that we codified in the URL the name of the method and the arguments of execution like parameters of a request HTTP/GET.

Consumption and presentation of the information: We carried out the development of graphical applications that represent the information of the container terminal with similar features to the desktop applications. In order to make the access to the remote methods easier we created a library DLL (PDBCClient) that publishes methods that the web service implements. Those methods do the task of parameters serialization of HTTP requests, making the connection over TCP/IP and deserializing the returned XML data.

Developed mobile applications use the services of this library and display the information graphically over platform Pocket PC using GDI. The great advantage of this visualization system is its transparent scalability and the availability of the information in a heterogenous form since it is based on open Internet protocols.

Figure 4: *Pocket PC Navigator.*

8. Conclusions

Big enterprise environments like container terminals need new solutions to new visualization problems. Our development is implanted and currently running in one of the biggest container terminals of Europe. Our work makes the following contributions: it makes real time visualization of these environments possible by using OpenGL, it supports rendering very large amounts of data organized graphically and it allows using wireless devices by generating the graphics on the server side. Our results have been used to increase the productivity at the container terminal.

Acknowledgements

The GAMA project is being supported by grants 1FD97-2158-C04-01 and TIC2002-04166-C03-01 from the European Community and the Spanish Ministry of Science and Technology. We thank GAMA-team for their work and collaboration. We are also grateful to Maritima Valenciana for their support of our research efforts and especially to Eduardo Orellana for his faith in our work.

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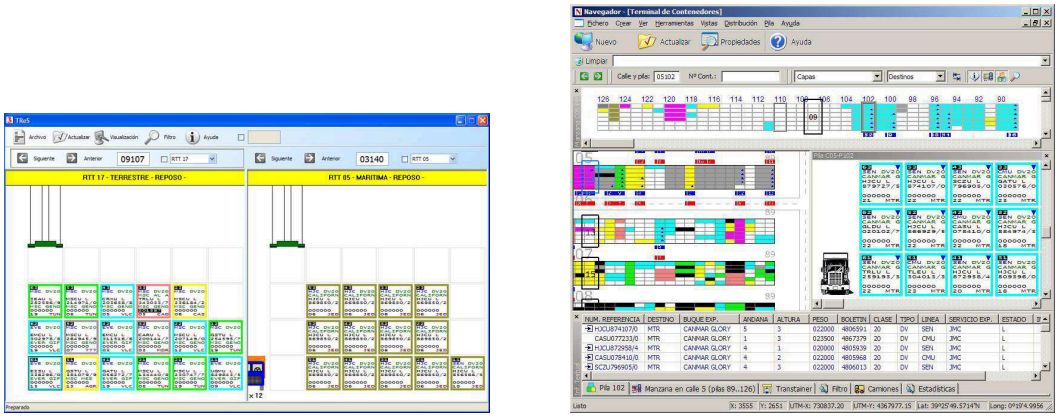

Figure 5: *TReS and Navigator applications.*

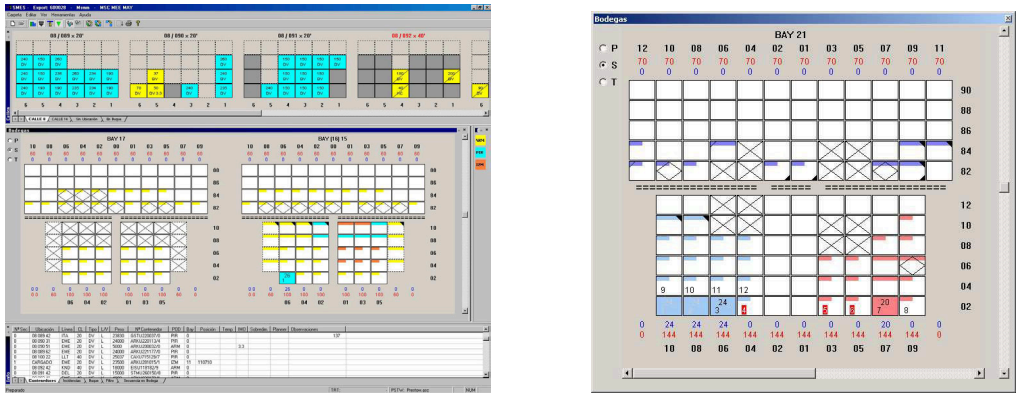

Figure 6: *General View of SMES, and detail of a Bay.*

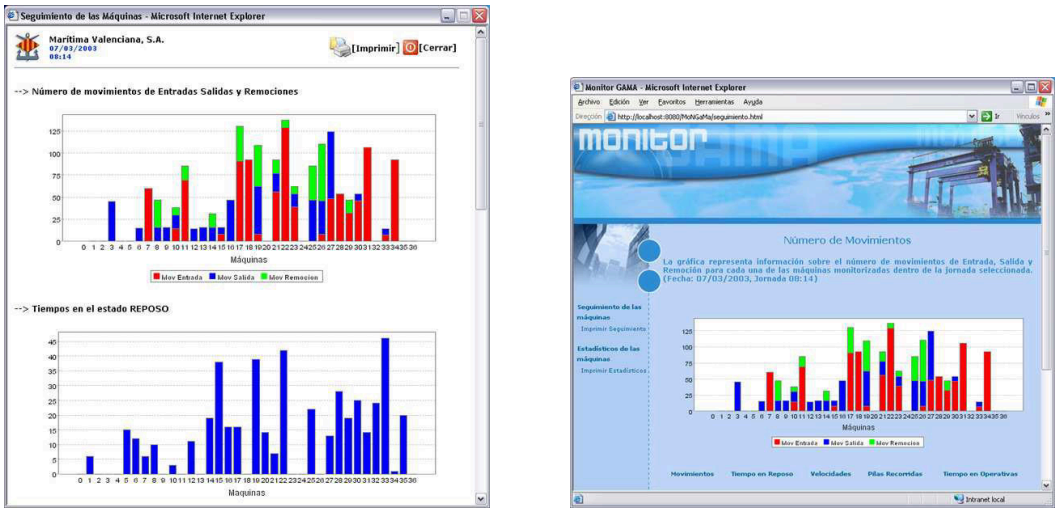

Figure 7: *System Monitoring Web Interface.*

CREATE: Mixed Reality for Design, Education, and Cultural Heritage with a Constructivist Approach

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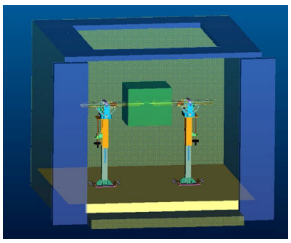
URL: http://www.cs.ucl.ac.uk/create/

Reconstruction of Place Massena in Nice, and insertion of virtual vegetation, tramway, and pedestrians.



Left: Integration of the haptic interface in one of the immersive display of the project. The green cube refers to the workspace that will be available for interaction. Right: View of the archaeological site, the ancient Messene Temple, for the Cultural Heritage case study, as photographed for the CREATE data capture.

1. Introduction

The global scope of the CREATE project is to develop a mixed-reality framework that enables highly interactive real-time construction and manipulation of photo-realistic, virtual worlds based on real data sources. This framework will be tested and applied to cultural heritage content in an educational context, as well as to the design and review of architectural/urban planning settings. The evaluation of the project is based on a human-centered, *constructivist approach* to working and learning, with special attention paid to the evaluation of the resulting mixed reality experience. Through this approach, participants in an activity "construct" their own knowledge by testing ideas and concepts based on their prior knowledge and experience, applying these to a new situation, and integrating the new knowledge gained with pre-existing intellectual constructs.

Compared to previous research and design in virtual worlds, the CREATE project uses a high degree of interactivity, and includes provision for other senses (haptics and sound). The applications developed in CREATE are designed to run on different platforms, and the targeted running systems are SGI and PC driven, with immersive stereo-displays such as a workbench, a ReaCTor™ (CAVE-like environment), and a wide projection screen.

2. Development system and interaction tools

In order to provide a good basis for constructive activity, the simulated environment must be *authentic*, meaning that it must reflect as truly as possible the familiar-to-the-user situation of the surrounding environment.

2.1. Capture

The first step in creating realistic mixed reality environment is the capture of real scenes. The approach we have chosen is to acquire the existing site data that will form the basis for construction and reconstruction of the virtual sites for each of the case studies. Detailed 3D reconstructions of the existing cultural or urban environment site as it is today are constructed by capturing the real scene with modeling-from-images technologies and creating appropriate 3D models. The models are then further enhanced with additional modeling to correct possible errors and complete the model.

2.2. Interaction Tools

a) We are developing a haptic interface (HI) specifically for this project that fits the tasks the user must achieve. The interface is aimed to be used by a wide range of users including children and usable in immersive stereo displays. The resulting design [1] is a resizable

and robust HI's, with a large workspace and two-contact points, that enables actions, such as grabbing, rotating objects, and edge recognition, and to give the user the sense of weight, collision and roughness.

2.3. Virtual Environment Enhancement

To achieve a high quality immersive experience, we are developing in five main directions, that intersect to provide a coherent environment.

First, the captured data of real scenes results in a unique 3D model and a set of textures from several distinct viewpoints. To render this correctly we have implemented a prototype display application for this algorithm, which performs the correct choice of texture and the appropriate blending.

The environment is enhanced with vegetation which is a challenge for any VR display system, since it represents a high load in polygons, and thus slows down the system. We have adapted the solution presented in [7], in which complex geometry of trees and other vegetation are replaced by points and lines when their screen projection is small with respect to the viewpoint.

An important requirement of high-quality rendering is consistent lighting between virtual, inserted elements and the geometry captured from real objects. For this we have integrated the illumination from a sky and sunlight model [6], and adapted perspective shadow maps [8].

For the user interacting within a virtual city, it would be unnatural that this city is empty of life. We populate the reconstructed sites with crowds and vehicles. The population is rendered using an image-based approach [9], and lighting effects are added on vehicles [4]. We have also developed new algorithms [3][5] to represent the motion, providing more natural and smooth trajectories, consistent with the changes in the environment. The simulation is accelerated using a new occlusion culling method [2].

Finally, the inclusion of 3D spatialized sound is paramount to achieve a truly convincing mixed-reality experience. In the environments used in the CREATE project a very large number of sound sources are present. Our solution [10] is to map a large number of sound sources to a limited number of hardware channels, and is based on perceptual masking, sound source clustering and the use of graphics hardware for audio pre-mixing operations.

3. Applications of the CREATE project

3.1. Understanding ancient Greek architectures

The temple in the archaeological site of ancient Messene in Greece is being reconstructed. The site is chosen due to its cultural, educational, and symbolic significance. We identified the users of an archaelogic system to be both professional and novice users. Restoration architects and archaeologists (especially archaeology students) could use CREATE as a tool for the exploration and validation of varied reconstruction hypotheses. A highly realistic interactive environment developed through CREATE can also provide engaging experiences for students and the general public interested in learning more about history and archaeology. However, novices will most likely be attracted by the interactive learning aspects of CREATE, where the learning-by-doing and hands-on approach provides a motivating reason to visit a museum and learn in an intuitive way.

3.2. Urban planning application

Urban planning is a complex process involving a large number of stakeholders such as planners, developers, city administrators, community and environmental groups. Using a tool such as the one proposed through CREATE could allow stakeholders with opposing interests to explore what-if scenarios in an active and visual manner and possibly facilitate them to reach consensus on complex social, economic and environmental issues The site we have chosen is Nice in France, where an actual engineering project, the planning and development of the Tramway going through its center, is currently at the end of the public tender phase. The system will allow the presentation of several designs, allowing decision makers and local inhabitants to investigate or mix these alternatives by directly manipulating the elements concerned (pavements, traffic lights, stations, buildings, etc.).

4. Future work

CREATE has now been running for a year, and a first prototype is under development. In the next two years of the project, we will complete the current developed techniques and algorithms, and perform the evaluation of the system and of its learning potential.

5. Acknowledgements

CREATE (IST-2001-34231) is a 3-year RTD project funded by the 5th Framework Information Society Technologies (IST) Programme of the European Union.

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Eurographics 2003

Project Presentations

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Project:

A Net Environment forn embodied emotional Conversational Agents

Objective:

We propose to develop a system in which people can engage in social behaviour by proxy. This behaviour might have a practical purpose, like buying a car, or asocial purpose, like making friends. The idea is that instead of engaging other people directly, the user of the system can create and instruct digital agents which serve as intermediaries. For instance, instead of human buyers and sellers talking by videophone or web chat, they instruct digital agents - or avatars - which negotiate on their behalf. The digital agents are modelled as human-like characters exhibiting personality and emotion. They are able to employ verbal and nonverbal channels for communication, including fine-tuned interaction of text, speech and body language. The agent's behaviour is determined automatically according to a personality model and the agent's role in a particular situation.

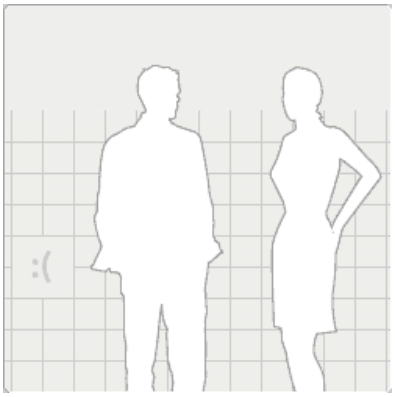
Objectives:

The NECA project will develop a new generation of mixed multi-user / multi-agent virtual spaces populated by affective conversational agents. The agents will be able to express them through synchronised emotional speech and non-verbal expression, generated from an abstract representation, which can be the output of an affective reasoner. This is the first time that such expressive capabilities are featured in Internet applications. The agents' usefulness will be evaluated in two concrete application scenarios. From a technical point of view, the emerging NECA platform will provide a confederation of dedicated components including an affective reasoner, co-ordinated generation, and emotional speech synthesis, thus providing a basis for the development of new Internet applications with emotional agents.

Work description:

NECA promotes the concept of multi-modal communication with animated synthetic personalities. A particular focus in the project lies on communication between animated characters that exhibit credible personality traits and affective behaviour. The key challenge of the project is the fruitful combination of different research strands including situation-based generation of natural language and speech, semiotics of non-verbal expression in situated social communication, and the modelling of emotions and personality. The work plan comprises tasks for the development of dedicated components, such as components for emotive speech synthesis, generation of combined speech and nonverbal expressions, and components, which perform reasoning about a character's emotional disposition. The components form the building blocks of the generic NECA application platform. This platform will provide the basis upon which specific applications can be built. To demonstrate and assess the feasibility and usefulness of the NECA concept, different application scenarios will be developed. The first, the Flirt boat, is a new approach for bringing Internet users in contact with each other. The users choose among a set of available agents, instruct them about their personal preferences and send them as passengers on the Flirt boat where the agents will try to date as many other agents as possible and determine whether any like them enough to meet them again. The second demonstrator, the eShow Room, is a prototype of a new showroom for the products of online shops. The visitors of the showroom will receive product information

by watching two or three agents discuss the product among value dimensions relevant for the product. In order to minimize risks due to the fast-moving sector of Internet-technologies, especially in relation to speech synthesis, the NECA consortium proposes a two-stage development cycle.



Milestones:

The core end products of NECA will be:

1) the NECA platform which allows for the development of applications with affective conversational characters;

2) the Flirt boat, a multi-user web-application in the social domain;

3) the eShow Room which demonstrates a novel approach to the presentation of products in eCommerce applications. The project will also make significant contributions to research on conversational synthetic characters, multi-modal communication, and affective speech synthesis.

Start Date: 2001-10-01

End Date: 2004-03-31

Duration: 30 months

Project Status: Execution

Project Cost: 2.28 million euro

Project Funding: 1.50 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: CPA2: User friendliness, Human factors, multilingual, -modal dialogue

Project Reference: IST-2000-28580

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.ai.univie.ac.at/NECA

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Project:

REAL time visualization of complex REFLECTance behaviour in virtual prototyping

Objective:

In current Virtual Reality systems there is only a very limited set of possibilities to visualize the appearance of different materials and to simulate safety relevant aspects of the design like blinding the driver by interior lights in a night driving situation. This project aims at developing physically correct simulation of light distribution and reflection as well as an image based real-time visualization technology for synthetic objects with complex reflectance behaviour. This new technology will be integrated into an existing VR-system and tested in different application scenarios in automotive industry, like the simulation of safety and design aspects in the automotive industry as well as photorealistic VR simulations in architecture.

Objectives:

Based on the acquisition of real reflectance properties of materials, the objective of RealReflect is to develop a novel image based physically correct visualization technology for VR-systems. The overall system addresses two hot issues in Virtual Reality: photo realism through visualization of real reflectance behaviour of surfaces and a sophisticated light simulation that allows for a highly accurate determination of light distribution and reflection behaviour.

The industrial fields this project is focused on are:

1. Virtual prototyping, ergonomic investigations, and safety simulations in the automotive industry;

2. Virtual interior design in architecture by correctly visualizing the atmosphere of a building interior. Such a Virtual Reality system is currently not available anywhere worldwide.

Work description:

The research and development which will performed is divided into the following parts:

1) The user contribution, consisting of requirements specification and validation of results that will drive the work of the project to the expected goals;

2) Set-up of an acquisition system that allows the automatic measurement of the reflectance properties, especially the spectral bi-directional reflection distribution texture (BTF), of the different materials used in automotive Industry and architecture;

3) A standardized format for the import and export of the reflection properties;

4) Algorithms for mapping and synthesizing the BTF onto the virtual 3D-geometry, including the development of the world-wide first BTF texture model capable of texture synthesis;

5) A visualization module for geometry with complex reflectance properties for interactive examination of different materials and light sources in virtual environments, including a surface light field viewer and its integration into an established Virtual Reality System;

6) Algorithms for LOD management for surface light fields on 3D geometry;

7) A novel sophisticated model that allows for a highly physically accurate simulation of light distribution and reflection behaviour;

8) Development of novel tone mapping algorithms suitable for interior design, and evaluation against real scenes;

9) Integration of the system that will deliver the novel Virtual Reality system which is able to simulate and visualize real materials and reflectance behaviour in real time;

10) Validation of the prototypes in automotive industry and architecture;

11) Specification of an exploitation plan.

Milestones:

Milestone 1 (Month 6) System Design is settled down. Implementation starts from here on.

Milestone 2 (Month 18) First materials are measured and preliminary prototype of the interactive visualization is available. Industrial validation starts from here.

Milestone 3 (Month 24) A preliminary prototype of the light simulation module is available and its industrial validation starts from here.

Milestone 4 (Month 36) The novel visualization technology is built and validated by the industrial partners. Its exploitation and commercialisation starts.

Start Date: 2002-04-01

End Date: 2005-03-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.33 million euro

Project Funding: 2.40 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities and new imaging frontiers

Project Reference: IST-2001-34744

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://cg.cs.uni-bonn.de/project-pages/RealReflect/default.html

BELGIUM — Brussels

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Project:

Virtual Animation of the Kinematics of the HUMan for Industrial, Educational and Research Purposes

Objective:

We aim to develop a service to improve the working environment of fields that use computer models of human joints. These fields need high-quality data to perform their tasks correctly. These tasks are, for example: modelling of human joints, prosthesis design, car-crash simulation, medical education, biomedical research. All of these tasks use anatomical and kinematics data, but they all encounter the same problem: no data reflecting the high percentage of morphological variations in the human species is easily available. Frequently only normalised models are produced - hence the real relationships between the morphology and kinematics of a specific subject cannot be foreseen with high accuracy. We propose to develop a database to allow interactive access o a broad range of data of a type not currently available, and to use this to create tutorials on functional anatomy. The data will be made available to Industry, Education and Research.

Objectives:

A source of high-quality data of both morphological and kinematics models of human joints will be created. The data will be collected by novel techniques developed by the proposers. These techniques will allow data to be obtained that is of potential interest in related fields across industry, medical education and research. At present, little accurate or reliable data concerning joint modelling is available, which often leads to simplification. Once created, the data will be available via the Internet to allow users to gain new knowledge on functional anatomy. Raw data will be available for downloading to allow industrial users to improve their own products and competitiveness. The interface will employ state-of-the-art multimedia techniques and 3D simulations in a virtual reality environment to demonstrate joint behaviour. Electronic tutorials will be supplied to help medical staff and students to better understand functional anatomy.

Work description:

The project is divided into several components; these are overlapping and consist of several general tasks described below. The Project Co-ordinator will supervise all aspects of the project and monitor the circulation of the results and data between the partners.

Discussion will take place with potential users throughout the development.

1. COLLECTING THE DATA.

(a) Morphological data will be acquired for bones (including joints), and also for muscles and ligaments. Analysis will be made of a large number of musculo-skeletal structures and a variety of individual morphologies, including female and male subjects of several different ages.

(b) Kinematics data will be collected experimentally in parallel with the morphological data using novel methods.

2. BULDING THE COMPUTER MODELS.

(a) Morphological models will be created using modern 3D reconstruction techniques including geometrical surface modelling and finite element methods.

(b) These models will be animated using the kinematics data (see 1b).

3. DEVELPING THE SERVICE TOOLS.

Two forms of service will be offered to the end user. Industrial users will want access to the raw data (morphological, finite elements, kinematics) - this will be of a quality currently not available. Educational users will have he opportunity to interact with 3D joint models; they will be able to select the level of educational support supplied with these interactively. They will also be able to view tutorials presented by eminent physicians discussing and demonstrating interesting cases and to test their knowledge using on-line "questionnaires".

4. DISSEMINATION.

Demonstrators will be presented to potential users who have expressed interest. They will be invited to a meeting organised as part of the Accompanying Measures Programme.

5. EXPLOITATION.

Exploitation of the data will be performed by an industrial partner for its specific needs and by academic partners for educational and research purposes.

Milestones:

Accurate modelling of joint kinematics will allow us to gain new knowledge and a better understanding of joint behaviour. The quality of the expected results should provide an opportunity to develop unique services (described above) for the potential user. This project will focus on the development, dissemination and the initial exploitation of the complete method and will apply it on the lower limb. Further developments of the database are planned for the future.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 1.48 million euro

Project Funding: 1.10 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Access to scientific and cultural heritage

Project Reference: IST-1999-10954

Contract Type: CSC (Cost-sharing contracts)

BELGIUM Brussels

Vrije Universiteit Brussel

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Project:

COMRIS: co-habited mixed reality information spaces

Objective:

The COMRIS project aims to develop, demonstrate and experimentally evaluate a scaleable approach to integrating the Inhabited Information Spaces schema with a concept of software agents. The COMRIS vision of co-habited mixed-reality information spaces emphasises the co-habitation of software and human agents in a pair of closely coupled spaces, a virtual and a real one. However, this project does not pursue the perceptual integration of real and virtual space into an augmented reality. Instead the coupling aims at focusing the large potential for useful social interactions in each of the spaces, so that they become more manageable, goal-directed and effective.

Work description:

The COMRIS project uses the conference centre as the thematic space and concrete context of work. The conference centre is a structure of places for registration, presentation, refreshment, and so on. At a conference, like the Annual Esprit meeting in Brussels, people gather to show their results, see other interesting things, find interesting people, meet EU officials in person, or engage in any kind of discussion. The possibilities of interaction at such an event are enormous, it is very information-intensive, and the great diversity of topics and purposes that are being addressed make it difficult to get everything done. This clearly motivates our aim of focusing a large potential for interaction such that effectiveness of participation to such or another large event is enhanced.

In the mixed-reality conference centre real and virtual conference activities are going on in parallel. Each participant wears its personal assistant, an electronic badge and ear-phone device, wirelessly hooked into an Intranet. This personal assistant - the COMRIS parrot - realises a bi-directional link between the real and virtual spaces. It observes what is going on around its host (whereabouts, activities, other people around), and it informs its host about potentially useful encounters, ongoing demonstrations that may be worthwhile attending, and so on. This information is gathered by several personal representatives, the software agents that participate on behalf of a real person in the virtual conference. Each of these has the purpose to represent, defend and further a particular interest or objective of the real participant, including those interests that this participant is not explicitly attending to.

The project brings together ideas from different backgrounds (software agents, virtuality, networking, robotics, machine learning, social science) into a coherent concept and technical approach. Hardware challenges (e.g. the parrot on wireless Intranet) are complemented with software challenges.

COMRIS pursues a radical information push model, in which information is actively imposed upon the user in its concrete minute-to-minute context of activities. The virtual space and its inhabitants is explicitly designed to facilitate this. In particular its notion of 'space' is defined as potential for interaction; not physical interaction as in real space, but interest-relating interaction. Techniques of 'interest based navigation' bring together those virtual agents whose interests are likely to fit into a productive social process. Their interactions accumulate an information context, mined from a variety of structured and unstructured sources, and related to the different interests involved. At all times, techniques of 'competition for attention' focus the interactions

and in particular the stream of information towards the user.

Milestones:

Two major milestones, in which feasibility is demonstrated, are complemented with a series of concrete and rigorous experiments, in which the scaling properties are investigated. After two iterations, in which the COMRIS vision and demonstration objectives are gradually extended, the project will have achieved an integrated package of results, accompanied by a series of recommendations for post-project extension, technical implementation, and exploitation. Throughout the project communication and dissemination, as well as active interest gathering will further the impact and assure material support for full-scale demonstration.

Start Date: 1997-10-01

End Date: 2000-09-30

Duration: 36 months

Project Status: Completed

Project Cost: 1.77 million ECU

Project Funding: 1.25 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Proactiveness

Project Reference: 25500

Contract Type: ACM (Preparatory, accompanying and support measures)

BELGIUM — Heverlee

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Project:

Visualisation across networks based on graphics and the uncalibrated acquisition of real datauncalibrated acquisition of real data

Objective:

VANGUARD is a project that aims at flexible methods for 3D scene modelling. The first central issue is the user-friendly acquisition of models of real objects and their surroundings. Traditionally, such modelling is based on stereo vision or active triangulation. Both methods require a level of investment that is not straightforward when large groups of users are to be considered. Stereo vision would require at least two cameras with a specially designed rig to position them. Active triangulation requires special projection apparatus. In both cases, painstaking calibration processes are involved, to obtain the required precision of reconstruction. This calibration is not straightforward and renders the approaches unattractive for the user. VANGUARD will replace these techniques by reconstruction from uncalibrated image sequences. What this means is that a single camera can be carried around without further requirements from the user who wants to model a scene. Reconstructions are formed from the sequence, although no information on camera parameters or the camera motion is available. The theoretical foundations underlying this plan have been laid out by the consortium already.

A second focus is the realistic rendering of the real data from arbitrary viewpoints, i.e. including those not seen by the camera that acquired the data. Work on this topic includes the extraction of realistic surface reflectance models from the sequence (e.g. different colouring of diffuse and specular reflections), the creation of shadows if light sources are virtually moved, the introduction of artificial field of view and unsharpness, etc.

A third topic is the integration of real and synthetic data. Again, issues such as shadowing, interreflections, etc. are raised, but also natural type of interactions between real and synthetic shapes are to be investigated. Artificial gravity will allow users to "drop" synthetic objects into the scene, where they will obtain a stable pose, to "drag" them over flat surfaces, to constrain these motions such as not to violated impermeability constraints, etc.

Work description:

A substantial part of the work carried out under VANGUARD has to do with the development of new theoretical insights on how scenes can be reconstructed from uncalibrated video data. The main mathematical vehicle is geometry, although issues of robust implementation, computational efficiency, and numerical stability take a fair share of the time. VANGUARD exploits fully the latest insights developed by the computer vision community in the realm of geometry, such as the role of constraints that govern the position of features in several images or the existence of certain fixed structures in images such as the absolute conic. All these concepts are new compared to the principles that have been exploited previously for calibrated reconstruction.

The project is designed as to gradually evolve towards higher levels of automation in the processing, on the one hand, and more complicated types of shapes and scenes, on the other.

VANGUARD plans the following demonstrations:

Stereo visualization

The objective is to take a monocular video sequence and generate a stereo sequence, forming the images that would have been seen

had a stereo camera platform moved along the same path. The result has greater utility than simply using a 'stereo camera', since new viewpoints can be generated and "look around" is possible.

Hybrid real/virtual scene visualisation

This demo will show an augmented reality system which integrates real-world models and graphics. It combines 3D interactive graphics, distributed event handling, real-world models for seamless interaction between real and virtual objects for users at remote sites. The planned area for demonstration is a "tele-auction", where potential buyers would be able to have a 3D view of the objects. The users will be able to manipulate the objects themselves. This facility can naturally be performed using models and scenes at different sites, with the information transmitted in a high level form across a telecommunications network

Tele-exhibition

The manipulation of the 3D world from 2D imagery includes the capability to generate synthetic images of the real world. Key frames from a video sequence are stored and are later manipulated for synthesising the tour - or even another tour whose route can differ from the original route. The applications of this basic paradigm include visualisation, telecommunications and Internet applications.

Augmented reality.

Of course, a lot of ground work remains to be done at the level of developing efficient and effective reconstruction algorithms from uncalibrated image sequences. VANGUARD strives to obtain metric reconstructions from as few images as possible, for instance, in order to safeguard a maximal practicality.

Milestones:

It is expected that VANGUARD will generate novel, generic technologies for three-dimensional scene reconstruction. An important advantage over traditional techniques will be easier operation by the user, who no longer has to take care of precisely calibrating cameras or measuring camera motion. Also GUI's will be developed that allow users to "play around" with the acquired 3D descriptions, to merge them or let objects blend into environments where they have never been.

Actual achievements include:

automatic generation of VRML 3D models from image sequences for polyhedral shape. theoretical foundations for uncalibrated reconstruction.

algorithms for software steadycam. visualisation of generated 3D models on autostereoscopic display.

automatic facial feature extraction from dynamic 3D face reconstructions.

submission to MPEG4-SNHC for 3D geometry-based texture mapping.

Expected Impact

VANGUARD hopes to produce the kind of 3D reconstruction techniques that would bring them to virtually anybody's fingertips. Anybody who has a camcorder would be in a position to supply the reconstruction algorithms with the necessary input. This would bring 3D acquisition into the realm of the consumer market. From there on, things can start developing very quickly! Also note that 3D reconstructions could be generated from existing video footage.

Start Date: 1995-09-01

End Date: 1998-08-31

Duration: 36 months

Project Status: Completed

Project Cost: 2.89 million ECU

Project Funding: 2.09 million ECU

Programme Type: 4th FWP

Programme Acronym : ACTS

Subprogramme Area: Multimedia services

Project Reference: AC074

Contract Type: CSC (Cost-sharing contracts)

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Project:

Architecture and authoring tools for prototype for Living Images and new Video Experiments

Objective:

The goal of the project is to develop an architecture and a set of tools, both generic and application dependent, for the enhancement of narrative spaces. This will be achieved in testing the two aspects of this goal: telepresence (inclusion of real objects into virtual worlds) and augmented reality (inclusion of artificial object into real worlds).

Objectives:

Art.Live will bring together towards these very specific goals image processing engineers, AI computer scientists and multimedia authors. The trials will broadcast recent innovations in the field of intelligent distributed video processing among the authors and artists community. The latter shows indeed a growing interest in the World Wide Web, as a new media able to distribute in an easier way their production and to offer new narrative spaces. The goal of Art.Live will be to implement this interaction and demonstrate it into specific experiments: "enhanced" comics and a festival/event.

Work description:

The Art.Live project will conduct the following tasks:

- Management and co-launching of a possible spin-off company,

- Requirements, functional analysis of the multi-camera system and the authoring tool in close cooperation with the artistic community,

- Multi-Agent architecture, FIPA compliant and real-time oriented,

- Secure distributed resources management, for the agent platform and the user interface agents,

- Model-based and blind segmentation,

- 3D reconstruction of background and objects,

-Implementation of a part of the software on real-time intelligent cameras for optimal decentralized computing,

- MPEG-4 and MPEG-7 coding of the video and data flows for genericity,

- Scene composition and rendering from the direct video flows and objects in the database,

- Dynamic database management,

- Design of an authoring tool for telepresence and augmented reality,

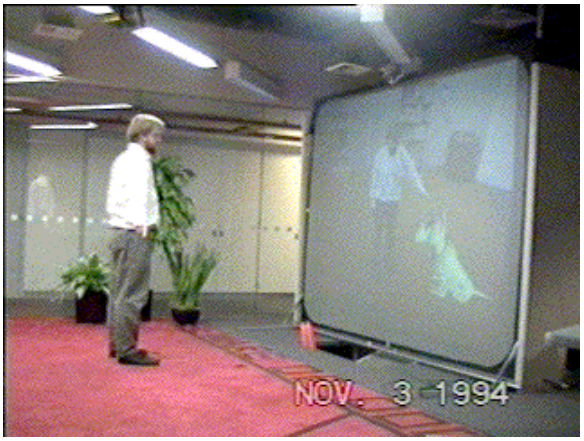
- Scenario, narrative spaces and trial definition (including artistic creations),

- Integration of the prototype into an effective authoring tool that will be tested during the public trials,

- Self-evaluation of the project after the first trial in order to refine the requirements,

- Update of the scientific state of the art throughout the project,

- and attendance to major mixed-reality workshops and conferences where the presence of European countries was until now very poor.



Milestones:

The Art.Live project has two major milestones: mid-term and end-term demos. The expected results will then be an effective authoring tool, successful public trials, WWW enhanced narrative space publications and the possible launching of a spin-off. At the signal processing level, we can foresee an efficient model-based segmentation, a mixed 2D-3D scene reconstruction and a dynamic database system for objects based on MPEG-7. The ALIVE project will design a secure distributed agents architecture.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 3.58 million euro

Project Funding: 1.80 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Large scale shared virtual and augmented environments

Project Reference: IST-1999-10942

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.tele.ucl.ac.be/PROJECTS/art.live/

DENMARK — Aalborg

Aalborg Universitet

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Organisation Type: Education

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Project:

Being There - Without Going

Objective:

The project will investigate and further develop novel camera technologies into an innovative mediation system that allows close to photo realistic 3D real-time visualisation of REAL (and possibly known) places for a moving observer. The visualisation will provide a high degree of impressiveness and support new types of empirical studies of the feeling of presence in a REAL scenario that is made artificially available for perceptual inspection. This is hard or impossible with conventional VR. Using this new technique in varying combinations with advanced versions of augmented reality, the project will contribute with empirical evidence to the development of a general multilevel interpretation of presence, on the basis of a context otherwise not available. The interpretation will provide a reference for empirical studies to optimise the technology in respect of aspects of presence found important for observation.

Objectives:

The project shall act as a melting pot for mixing novel technology, that allows real-time visualisation for a moving observer of recorded REAL PLACES, with ideas of researchers from diverse fields to develop new tools for empirical and theoretical studies of presence based on the concept of the observer's embodiment in the computationally created virtual environment. As real places (possibly known to the observer) with man-made and/or organic objects (like trees, foliage etc.) are otherwise hard to represent in a virtual environment, the aim is to bring about new insight into presence, when also comparison to real presence is possible.

Work description:

Tools for Presence: The project will develop and explore new recording and visualisation technologies enabling people to experience presence at REAL and possibly known places - without actually having to GO to those places. The experience will be based on true-to-life visual and auditorial sensory information presented in real-time. The technology will be designed to support the observer's active exploration of the visual and auditory space, thus adding an intuitive physical dimension to the experience. This physical dimension is paramount to achieving embodiment, i.e. the observer's sensation of being bodily grounded in an environment. The new technology of Image Based Rendering does not require a reconstructed geometrical model of the scene. It bypasses an important technological problem and presents a break-through, but large amount of image data needs to be stored, and recalled for real-time visualisation. Through augmentation, visually and auditorily, a sense of life can be added including objects for interaction. Projection technologies will range from HMD to large screens incl. 6-sided CAVE.

Milestones:

The empirical research will exploit the possibilities to investigate the experience of 'being there' 'When we refer to REAL places and possibly a place which the observer knows from previous real presence. The theoretical framework will be based on the concept of embodiment in conjunction with presence and investigate how it arises from e.g. fidelity of experience and presentation, domain specific

elements, the sense of place, and physiological and neurological aspects like consistency of sensory-motor co-ordination. The framework will be developed in close interaction with, and as a guide for, technical development by focusing on the particular aspects that the technology offers as well as on its weak points. Feed-back from empirical studies will form an essential part of the project.

Start Date: 2002-10-01

End Date: 2005-09-30

Duration: 36 months

Project Status: Execution

Project Cost: 2.00 million euro

Project Funding: 2.00 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Generic activities: Future and emerging technologies - Presence Research: Cognitive sciences and future media

Project Reference: IST-2001-39184

Contract Type: CSC (Cost-sharing contracts)

FRANCE	Boulogne Billancourt

Regienov

Organisation: Regienov

Organisation Type: Other

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Project:

Integrated Technology for Dynamic SimuLation & Advanced Visualization of Human Motion in Virtual Environments

Objective:

Although simulation/visualisation of human motion is nowadays employed to a great number of applications related to human/systems interaction, there is still quite limited knowledge and simulation capabilities, especially in cases where dynamic effects must be taken into account. The project aims to acquire the knowledge and develop an advanced technology to pass from kinematics of passive robot-like systems to a dynamic and realistic simulation/visualisation of human motion in virtual environments. The project will develop/ enhance and integrate a number of modelling techniques and simulation technologies, including multi-body inverse-dynamics, mechanics & biomechanics, mathematical modelling, dynamic motion control, a Macro Language and Augmented Reality. The main technical output of the project will be a prototype coupled software system for simulating human motion in a way very close to the real human behaviour, and advanced system-human interfaces.

Objectives:

The project aims to acquire the knowledge and develop an advanced technology to pass from the current state-of-the-art (kinematics of passive robot-like systems) to a dynamic and realistic simulation / visualisation of human motion in virtual environments. In technical terms, the objectives refer to taking into account not only physical aspects but also physio-biomechanical aspects of human motion, controlling the mannequin postures and movements through predictive modelling methods, determining new discomfort criteria based on mechanics and biomechanics, and integrating advanced Augmented Reality interfaces for visualisation and force feedback. Through the development / enhancement

Work description:

The structure of the workplan is based on the employment of a three cycles approach towards the core technical work, namely from movements reconstruction to software integration.

In WP0 "Project Management", the activities required for the project organisation & management will take place.

In WP1 "synthesis of Requirements & Scientific Published Results", a synthesis of the information experience coming from the project's preparation phase, in terms of requirements & prior art, will be carried out.

In WP2 "Multi body reconstruction & inverse dynamic simulation of real motion", data from experiments on human motion will be recorded, respective scenarios will be reconstructed using multi body simulation technology, and internal joint data will be estimated using inverse dynamics.

In WP3 "Discomfort modelling & simulation", criteria and simulation models of human discomfort will be defined based on subjective and physiological / biomechanical factors.

In WP4 "Define Movement Behaviour strategy Models", models for simulating movement

behaviours and strategies, will be identified, developed, and refined.

In WP5 "Development of Macro Language", the functionalities and the formalism of a Macro Language will be developed for the definition of movement strategies, objectives and constraints in human tasks.

In WP6 "Software Integration", a prototype of an integrated system, consisting of multi body simulation software, control software, human modelling software and digital mock-up software (DMU), will be specified, implemented, tested and refined.

In WP7 "Augmented Reality Interfaces", the development of a user interface for the integrated software tools will take place, to allow a more natural communication between the user and the simulation environment.

In WP8 "Exploitation and Dissemination", activities will be undertaken to prepare and support the exploitation and dissemination of the project results.

Milestones:

The project milestones are: assessment of Cycle 1 preparation; assessment of Cycles 1, 2 and 3 results on multibody reconstruction, criteria definition, modelling & software integration, Mid Term Review, Final Review.

The project's expected results are:

a prototype of an integrated software system consisting of multibody, control and human modelling software,

a demonstrator coupling the prototype with a digital mock-up software, and Augmented Reality system - human interfaces.

Start Date: 2001-08-01

End Date: 2004-01-31

Duration: 30 months

Project Status: Execution

Project Cost: 3.96 million euro

Project Funding: 2.52 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Real-time simulation and visualisation technologies and services

Project Reference: IST-2000-29357

Contract Type: CSC (Cost-sharing contracts)

FRANCE **Clamart**

CS Systemes d'Information

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Project:

The Virtual Planet.

Objective:

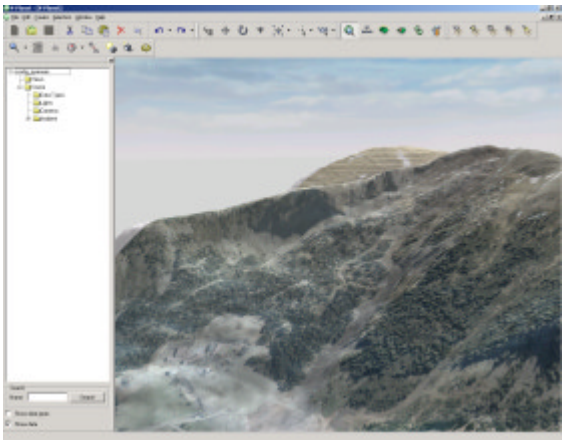
The Virtual Planet project aims at developing a worldwide leading product, named the V-Planet Explorer and based on cutting-edge innovative Virtual Reality techniques, for browsing very high-resolution 3D geographic information in real-time on mainstream personal computers. This will enable a large number of persons, experts or common people, to explore and interact with the vast amounts of natural and cultural information gathered about the Earth. The V-Planet explorer should be compared to a Web browser while the Digital Earth database should be compared to the Internet. The consortium has the unique privilege of having early access to the SRTM Mission database and to very high-resolution city models captured with state-of-the-art operated airborne sensor. These databases will be used for tuning, test and validation purposes on real cases.

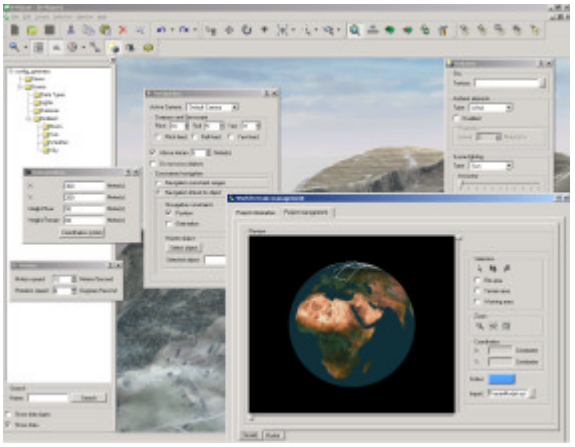
Work description:

V-Planet will provide a product at the end of the project, therefore end-users will be deeply involved in the project throughout its iterative development cycle. It has been decided, in agreement with the end-users of the V-Planet consortium, to have three cycles in order to provide three successive releases of the V-Planet Explorer, the alpha, beta and final releases. The V-Planet software architecture will be opened and modular. It will allow the development and integration of external components or plug-ins developed by third party developers. Along with an object-oriented architecture, these features minimize the development risk if the development of a component fails. The implication of final end-users in this project is critical although difficult to set-up because of the broad range of potential end-users. This is the reason why the greatest attention will be paid to organising and using the V-Planet Special Interest User Group as an important provider of requirements and advices. The V-Planet consortium will enable this SIUG to follow the project activity thanks to an e-forum, a mailing list, an attractive and interactive website and workshops organised by the project. The consortium could have involved "final" end-users but they would have been a minor representation of all the organisations that could benefit from the V-Planet outcomes. The consortium has preferred to integrate 3 major "intermediate" end-users because of their excellent knowledge of the over-all end-users' needs and because they will own the state-of-the art high-resolution data which won't be available for most of the final end-users before the end of the project. The consortium will select, for validation purpose, some real-world cases proposed by final end-users in the following fields: Telecommunications, Military, Mapping and GI, Planning and construction, Science and security, Simulation and training, Education and entertainment.

Milestones:

M4: State-of-the art;
M6: V-Planet Explorer alpha release specification and design;
M14: alpha release available;
M16: alpha release validated, new end-user requirements;
M18: refined specification and design for beta release;
M20: real-world applications selected by end-users for validation;
M24: beta release available;
M26: beta release validated, new end-user requirements;
M28: refined specification and design for final release;
M34: V-Planet Explorer released;
M36: V-Planet Explorer ready to market.





Start Date: 2001-09-01

End Date: 2004-08-31

Duration: 36 months

Project Status: Execution

Project Cost: 5.40 million euro

Project Funding: 2.70 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Information access, filtering, analysis and handling - Information visualisation

Project Reference: IST-2000-28095

Contract Type: CSC (Cost-sharing contracts)

FRANCE	Clamart

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Project:

Virtual Studio for Digital Storytelling

Objective:

VISIONS aims at developing a multi-platform Virtual Reality software product dedicated to the virtual prototyping and authoring of various forms of stories. The virtual prototype of a story will be used for its full-life management, from the authoring to the production phases. VISIONS will be designed to encourage authors to conceive stories visually, and then enable them to output a dynamic and persuasive virtual mock-up of their work. It will help any kind of authors, directors or producers to go beyond the illustrative capabilities of traditional storyboards, scenarios and scripts. VISIONS will output data under different formats: as a digital video for fund raising and marketing phase, as storyboards, scripts and sketches for the production team or as a 3D interactive story for electronic publication. VISIONS will provide a "desktop VR" interface. It will be modular and available on low cost platforms.

Work description:

The project will focus on the development of an interactive solution using VR technologies for authoring and prototyping stories. The implementation will be as generic as possible in order to adapt several domains such as cinema, television and multimedia. End-user partners coming from these complementary domains will be deeply involved in the project from the specification to the evaluation phases thus ensuring the success of the development and its user acceptance. The development will follow an iterative cycle where 3 releases of the system will be successively developed and evaluated.

The evaluation reports provided by end-user will be used for the next release specification refinement. 3 pilot applications, which will serve as tutorials for the final system will be produced by end-users (the authoring of a TV drama, the prototype of a movie part, and a 3D cartoon series featuring a virtual Pinocchio).

The system will be composed of:

-the core layer, providing common features (sound management, inteoperability modules, 2D and 3D GUI, 3D interactive rendering, multimodal dialogue engine, speech recognition engine, non-linear scenario editor, etc.).

-the SDK allowing the development of external plug-ins.

-the application bringing the core component together to a standalone solution.

-2 plug-ins dedicated to virtual character casting and animation.

-a library of 3D objects, sounds, images and backgrounds reflecting the European culture and dedicated to real-time interaction.

These elements will serve as basis for the creation of stories. It is worth noting that the partners involved have world-class complementary skills.

Milestones:

-end of the product definition (month 5),

-release of the alpha version (month 11),

-release of the beta version (month 17),

-release of the final version (month 22),

-release of the pilot applications/tutorials (month 23)

Expected results:

-a report detailing user acceptance conditions and needs, and the market state

-a complete product for virtual storytelling

-3 pilot applications (in the domain of cinema, television and multimedia)

-a business plan and the creation of the VISIONS EEIG.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 3.73 million euro

Project Funding: 1.60 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Authoring and design systems

Project Reference: IST-1999-11556

Contract Type: CSC (Cost-sharing contracts)

FRANCE — Grenoble

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Project:

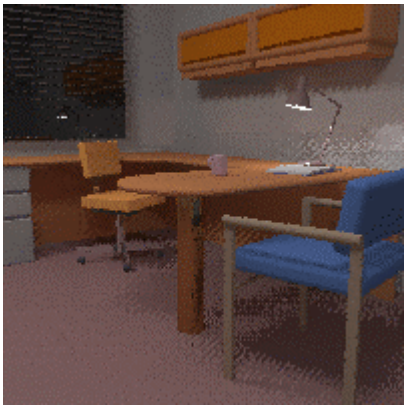
Realistic simulation of light for general environments

Objective:

In this project we will study and present solutions to these problems by developing new state- of-the-art algorithms allowing the treatment of general materials and participating media. A second major objective is the construction or working prototype demonstrators for real applications in collaboration with industrial and other end user partners.

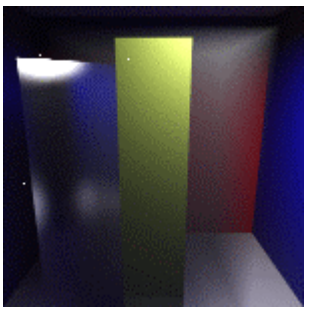
Approach to Achieve the Objectives

The problems we address are unsolved research issues. In Phase 1 we will develop and attempt to validate new algorithmic solutions, with a strong emphasis on integration into existing software platforms. Prototype plug-in software components will be developed that will be integrated into the partners software bases, exploiting their expertise and the capacity to provide extensible and reusable software incorporating significant technological advances. Phase 2 will include further development and extension of the new algorithms and collaboration with industrial partners for the creation of working prototype demonstrators of the new technology in real applications.



Work description:

Lighting simulation technology has made large advances in recent years, passing the laboratory stage and finding its way into commercial products. Such systems permit the use of realistic lighting simulation in many different applications, such as architecture and product design in general (digital mock-ups), simulation (road safety) and more recently in such domains as virtual/augmented reality (virtual studios, surgical planning etc.). Despite important advances, the technology is limited since existing practical algorithms are based on very simplifying assumptions on the world they can simulate. Most notably, the representation of shiny or glossy materials is very limited, as is the treatment of participating media such as smoke or fog.



Milestones:

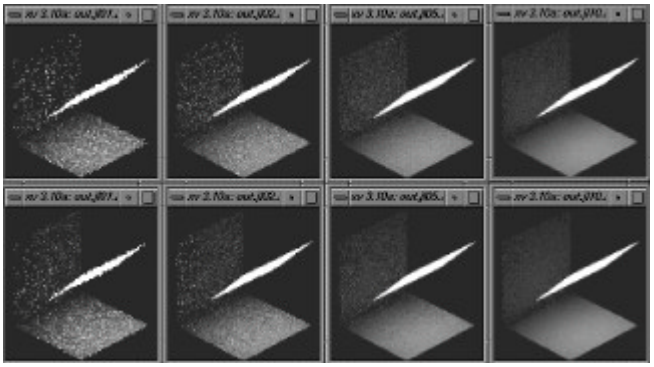
By permitting the treatment of a much wider range of materials (glossy and shiny surfaces) and environment types (fog, smoke) the use of realistic lighting simulation techniques will become more widely applicable. As a result, designers and simulation experts in application domains such as architecture and interior

design, luminaire design, road safety or driving simulation will become potential users of realistically lit digital mock-ups. This will permit higher quality pre-fabrication design and a large reduction in (re-)design costs.

Interest expressed by potential users show that the goals of the project could be applied indomains such as luminaire design, road safety, CAD/CAM etc..

Prototype plug in software components (available to the partners initially), will be provided in Phase 1. Phase 2 will result in the construction of prototype demonstrators used by potential industrial partners.

Publications in technical reports, scientific journals and conferences will be used to disseminate the new research ideas developed. Web sites and presence in trade fairs for the presentation of prototype software components in commercial R&D packages.



Start Date: 1997-10-15

End Date: 1998-10-14

Duration: 12 months

Project Status: Completed

Project Cost: 99617.00 ECU

Project Funding: 99617.00 ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Long Term Research - Openness to Ideas

Project Reference: 25772

Contract Type: ACM (Preparatory, accompanying and support measures)

Project URL: http://www-imagis.imag.fr/SIMULGEN/SIMULGEN.html

FRANCE	Grenoble

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Project:

Minimal Invasive Interventional Imaging

Objective:

Minimally Invasive Interventional Imaging (MI3) project is intended to develop the second generation of Computer Assisted Surgery systems in the domains of dentistry, orthopedics, ENT surgery. MI3 proposes an integrated solution that combines hardware innovative imaging devices (including silicon x-ray sensors), specific augmented reality technology, new imaging algorithms, new integrated knowledge data bases, and optimised surgical protocols. MI3 is managed by 4 fully European SMEs, which have complementary activities and strong commercial synergies. The global strategy is to introduce Information Technologies in the Operating Room using attractive hardware equipment (first market of several ME) in order to propose multiple services and software products in the Future (second market of several tens of ME). 5 universities and 5 clinical centres will provide a unique expertise in innovative software, algorithms and clinical protocols. For 1,000,000 orthopedic interventions per year, reducing the loss of wok-days by only 1% using MI3 could save more than 50 ME per year in the EC. MI3 will also reduce x-ray dose delivered to patients while offering accuracy, reliability and minimally-invasive access.

Objectives:

Objectives of MI3 are to develop an innovative medical integrated system for treatment in the area of orthopaedic surgery, maxillo-facial surgery, ENT surgery and dentistry. The clinical objective of MI3 is to optimise surgical protocols from image acquisition to surgical action in order to reduce the global cost of interventions, the time of each operation, the duration of stay of the patient in the hospital, the x-ray dose delivered to the patients and the medical staff, the complication rates including patient pain, the invasiveness of surgery, the stress of the surgeon, the inaccuracy of surgical acts and the variability of results between different surgeons. The industrial objective of MI3 is to create the second generation of Computer Assists Surgery products, by proposing first very attractive hardware integrated platforms (market of several ME) and then a variety of services and software products (market of several tens of ME). The scientific objective of MI3 is to develop and refine new components necessary to MI3 systems (3D reconstruction algorithms, innovative user interfaces, new surgical protocols, model-based registration methods).

Work description:

MI3 will combine the best technology that can be found in European companies and universities to build MI3 products:

- New digital x-ray imaging detectors of TRIXELL (the only European Company in this highly strategic domain)

- Multi-applications software of PRAXIM for Computer Assisted Surgery (CAS)

- Electro-mechanical systems of QR for 3D imaging systems

- Extended DICOM of GEMETEC for CAS data bases

- 3D reconstruction algorithms of VUB (solving the data truncation problems and enabling randomrajectories)

- Model-based 3D reconstruction and registration methods of UJF and UoL.

- Ergonomic design and evaluation tools of HIA.

MI3 will offer strategic technology. It constitutes the basis of complete solutions, with infinite extensions to integrated knowledge systems and databases on which can be plugged any kind of servicing in the Operating Room. Fully integrated solutions will be a breakthrough that will help Information Technology to penetrate the Operating Rooms at a large scale. This or technology will be fully exploited by designing new surgical protocols adapted to specific cases, indications or techniques. Optimising the surgical protocols from image and data acquisition to surgical acquisition will have tremendous consequences to the patients and the society. MI3 is a project driven by 4 SMEs in collaboration with 5 Universities and 5 Clinical Centres. This consortium represents a unique world wide expertise in this area that should give to Europe a good position with respect of United States who have just invested 35 M$ on a programme of Computer Integrated Surgery merging leading US universities with hospitals and American SMEs. MI3 project is highly innovative and cannot be addressed by other European, American or Japanese groups within the next 5 to 10 years. The project model of MI3 includes the technical specification from user needs and available technology, the development of hardware and software components, the integr

Milestones:

After 12 months, MI3 will show two types of initial results:

- Optimised clinical protocols for dental implant surgery

- A first prototype of intra-operative system with a static digital detector for orthopaedics.

At the end of the project (M36), the MI3 system integrating a dynamic detector will demonstrate on patients its efficiency. The most representative surgical procedures will be tested and evaluated during the clinical validation. SMEs of the consortium have already defined coherent strategies for the final exploitation plans of MI3 highly profitable for all partners.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 2.66 million euro

Project Funding: 1.51 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Health - Clinical, biological, managerial and ***imaging*** systems for health professionals

Project Reference: IST-1999-12338

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://mi3.vitamib.com

FRANCE	Guyancourt

Thales Optronique Sa

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Project:

SysTem Using Augmented Reality for Maintenance, Assembly, Training and Education

Objective:

The STARMATE project will specify, design, develop, and demonstrate a product dedicated to computer-guided maintenance of complex mechanical elements.

The system will provide two complementary functionalities:

(1)user assistance for achieving assembly/de-assembly and maintenance procedures and

(2)workforce training to assembly/de-assembly and maintenance procedures.

The system will rely on augmented reality technology to provide more flexibility in working methods while preserving user mobility in context where access to conventional documentation is cumbersome.

.It will improve work environment user-friendliness.

.It will allow user to access full documentation and manuals directly registered to his working environment.

.Visual and audio augmentation will be used to guide the user through the right procedure to apply.

.Work will be achieved according to ISO certification of implied industrials.

.Each partner will be responsible for providing well-circumscribed elements of the system.

.The system will be developed from off the shelf SW and HW where possible. In particular, display devices and voice recognition system will be purchased on the market.

.The product will be developed into several releases of incremental functionalities. Hence, several integration phases are foreseen in the project.

During the project it will be used in three different contexts, optronics and aeronautics construction, and nuclear maintenance. Moreover, its overall design will be made in order to reach a high degree of generality allowing widening the range of applications after the project.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.64 million euro

Project Funding: 1.80 million euro

Programme Type: 5th

Programme Acronym : IST

Subprogramme Area: Flexible, mobile and remote working methods and tools - Team work

Project Reference: IST-1999-10202

Contract Type: CSC (Cost-sharing contracts)

FRANCE — Mayenne

Association Laval Mayenne Technopole

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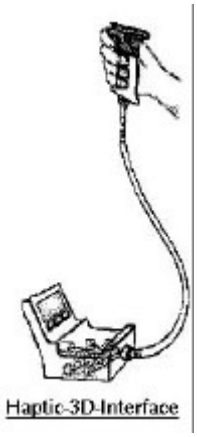
Project:

Multi User Virtual Interactive Interface

Objective:

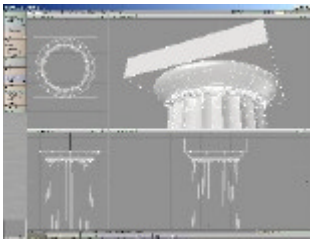


The project objectives is to develop on one hand new Man-Machine-Interface Devices featuring haptic feedback, the Haptic-3D-Interface, and in the other hand two prototypes of innovative integrated products using these devices : the Immersive-Theatre and the Interactive-Kiosk. The MUVII project addresses the provision of intuitive ways to capture, deliver and interact with systems. It includes the development and integration of advanced sensor, actuator and display technologies. The focus will be on the haptic device technologies common to several applications and the development aims at mid-term to reach a mass-market. The project will demonstrate this new interaction paradigm on two advance demonstrators dedicated to professional use in cultural, entertainment and training application fields.

Objectives:

The objectives of the MUVII project are :- To develop a new kind of haptic-3d-Interface- To design a shape compatible with a commercial product for both the consumer and the professional market- To link the H3DI with an efficient digital sound-system- To adapt Virtual Reality contents to the new H3DI- To develop a immersive theatre demonstrator of the H3DI- To develop a kiosk demonstrator of the H3 DI- To validate the demonstrators in real situation- To create a new start-up company for the exploitation and the dissemination of the new interfaces.

Work description:



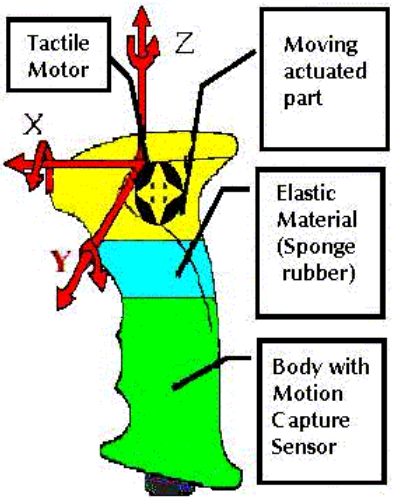
The project objective is to develop on one hand new Man-Machine-Interface Devices featuring haptic feedback, the Haptic-3D-Interface, and in the other hand two prototypes of innovative integrated products using these devices : the Immersive-Theatre and the Interactive-Kiosk. At mid-term, the general public Man-Machine-Interface devices will integrate haptic feedbacks for a very large panel of applications, especially e-trade on the WEB allowing to touch and feel the texture of the products sold. The innovative haptic devices developed in this project for professional applications in entertainment and museum would be able to evolve in the medium term to general public market. For such a Personal Interface, the Haptic-3D-Interface concept is a very good candidate as it can accept communication time delays (due for instance to Internet communication), and can be mass-produced at a very low cost. In the project two demonstrators will be developed in order to demonstrate two very different applications and

cover a market as broad as possible. This first step is necessary for three main reasons:
- these demonstrators are by themselves the prototypes of future products with a known and fast growing professional market- these applications are able to accept the cost of devices produced in a first time, in small series;
- these applications are in contact with the public and sufficiently reactive to produce quickly a validation feedback to specify future adapted mass-products.

The two demonstrators are:1 The immersive Theatre demonstrator. Here the goal of the project is to enhance the immersion of each spectator in the virtual world using haptic feedback;
2- The Haptic Interactive Kiosk. This prototype will enable the demonstration of complex scientific or cultural experiments.

Milestones:

M0+6: Specifications;
M0+12: Ergonomic study, multi-user interactions management software library Specifications;
M0+14: test device for separate modalities, user study;
M0+15: Marketing assessment;
M0+22: Motion capture subsystem;
M0+24: Fully functional prototypes, pre-integrated 3-D sound sub-system;
M0+28: Immersive Theatre Demonstrator, interactive Kiosk Demonstrator;
M0+30: Demonstration workshop in immersive theatre, evaluation report, industrialization assessment.



Haptic-3D-Interface Concept For Immersive Theater

Start Date: 2001-09-01

End Date: 2004-02-29

Duration: 30 months

Project Status: Execution

Project Cost: 3.70 million euro

Project Funding: 2.20 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: CPA2: User friendliness, Human factors, multilingual, -modal dialogue

Project Reference: IST-2000-28463

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.hpclab.ceid.upatras.gr/muvii/

FRANCE — Paris

EADS CCR

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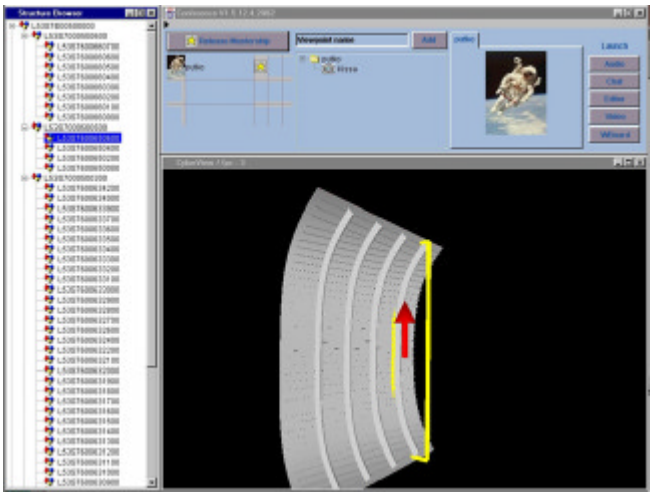
Project:

Advanced Information Technology Virtual Early Prototyping Open Platform

Objective:

The project focuses on the design of complex products within a virtual environment during the concept phase when most of the decisions are taken.



It aims to define and demonstrate a large-scale virtual reality framework over the Internet for product virtual early prototyping. Communication systems and applications will be set up in order to achieve interactive co-operative design and real-time distributed simulation within a geographically widespread product team.

Objectives

The first objective is to develop communication systems, which enable:

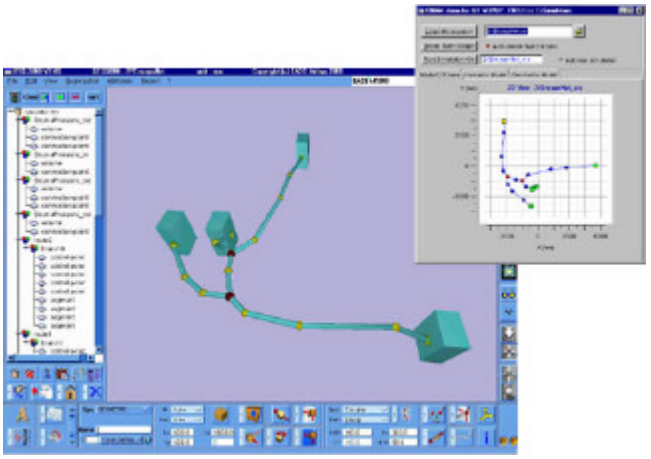
1) virtual conferencing, collaboration on 3D engineering data, parallel work;

2) interactive consistent distributed simulations.

The second objective is to build up and assess prototypes, for structure and system engineering, integrating these communication systems.

The third objective is to set, starting from the experiment feedback of prototypes, an Internet communication standard proposal that will enable different virtual environments and simulators to inter-operate.

Work description:



1) Requirements specifications and state of the art.

In the context of concept design, specifications will define both the needs for interactive co-operative work and distributed simulations in multi-partner organizations, and what is necessary for effective team working and human computer interactions.

A state of the art will survey best group work practices for concept design. It will also list and evaluate existing standards and software

environments for interactive co-operative design or interactive simulation.

2) Architecture specifications.

These specifications will define the architecture of two communication systems that support interactive co-operative design with enhanced real-time awareness and real-time distributed and integrated simulation with different simulators.
They will also recommend new methods for group interactions in a virtual 3D-shared environment.

3) Prototypes and demonstrations.

Communication systems will be developed. They will be integrated in prototypes dedicated respectively to structure design (including space allocation) and system engineering (e.g. hydraulic, air, electrical). The prototypes will be tested on real cases on collocated and distant configurations.

4) Standardization.

The architecture, services and protocols of the communication systems will be enhanced following the prototype experiences. Their detailed formal descriptions will be used as input to Internet standardization processes.

Expected results:

A communication framework for virtual early prototyping;
- Prototypes for structure and system engineering;
- A proposal of communication standard for virtual reality systems.

Milestones:

T0+6: specification review;

T0+13: mid term review with demonstrations;

T0+23: prototype demonstrations and standard submission;

T0+24: final review.

Start Date: 2000-08-02

End Date: 2002-08-01

Duration: 24 months

Project Status: Completed

Project Cost: 2.12 million euro

Project Funding: 1.25 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Real-time simulation and visualisation technologies

Project Reference: IST-1999-13346

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://ait-vepop.oulu.fi

FRANCE — Paris

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Project:

PortalS Of Next Generation

Objective:

Portals is a new term, synonymous with access point to resources and services on the Web. Typical services offered by portals include directory of resources, search facility, news, e-mail, phone, map information, and sometimes a community forum. These services generally rely on point-and-click on structured information like characters, still pictures or 2D graphics. The project intends to investigate, develop and standardize the building blocks for the next generation of portals. These building blocks include existing Web technologies, but also 3D computer graphics elements as in computer games, intelligent agents embodied in realistic avatars, new user-friendly interfaces and real-time audiovisual communications. The project will demonstrate how these EW technologies, integrated in a sample e-commerce application, allow an easier and more natural access to resources and services.

Objectives:

To develop building blocks for the next generation of portals and to demonstrate in a real-time application how they allow a more natural access to services. The building blocks are: 1) shared, dynamic and real-time virtual spaces; 2) Animation of realistic synthetic faces and bodies; 3) Software agents capturing human characteristics and learning user profiles; 4) Intuitive interfaces for navigation and interaction in information spaces; 5) Delivery of information with QoS monitoring.

The application is an E-commerce application allowing navigation in synthetic real sites populated with shops. In these sites, users can inspect goods, communicate with virtual or real humans and make transaction.

Work description:

The project is organized in two areas of work (1) the development of a technology and (2) the development of an application. These two areas are linked by an integration activity that releases periodically a consistent technology platform on which the application can be built. The five technology WPs will use heavily standards and contribute requirements, technical specifications and software to MPEG-4, FIPA and IETF. The project will also monitor other standardization activities from Web3D, W3C and ITU. The WP on multi-user technology will develop a unified approach for conferencing and sharing information in real-time virtual spaces and develop specific plug-ins on top of it. The media representation WP will implement and extend MPEG-4 representation to allow the construction of integrated portals, including talking virtual humans and synthetic music. The WP on software agents will adapt and extend the FIPA technology for the project's applications, and allow an MPEG-4 embodiment of agents. Human-compute interfaces, with their physical (vision system, motion system, integrated Hypermedia Interface) and scene description (extension of MPEG-4 BIFS) counterparts will be developed in a dedicated WP. Finally, the WP on Delivery will provide the needed mechanism to deliver the related information with management of QoS (Quality of Service) by extending existing infrastructure (ex: RTP/RTCP). The application WP will produce and maintain the technology platform in an Open Source fashion.

It will develop the application as follows:

1) Specification of application and user requirements;

2) Application development, with the latest release of the technology platform. Feedback to the technology platform developers;

3) Test and validation of the application in a realistic environment. Feedback to the application and technology platform developers.

Milestones:

T0+2: First Requirements. Technology development starts;

T0+6: First technology platform release, integrating state of the art technology. Applications development starts. Releases of the technology platform every six months with new tools developed by the project. Application releases every six months demonstrating functionality supported by the platform;

T0+21: Application beta release. Tests and evaluation begin. Fine tuning of application and technology platform;

T0+24: Project ends.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 7.24 million euro

Project Funding: 3.50 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interfaces making use of the various senses - Adaptable multi-sensory interfaces

Project Reference: IST-1999-10192

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.octaga.com/SoNG-Web/

FRANCE	Vanves

Symah Vision

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Project:

Enhanced Reality For The Video

Objective:

The ENREVI project proposes new development for the enhancement of a video sequence captured on a real scene with real-time rendered 3D objects. Emphasis is put both on real time and on economically affordable solutions. Research and development objectives include: Fundamental research will provide tools for tracking in unknown environment. Software real time engine that could render 3D synthetic image on affordable hardware platform. Format to generate, store and retrieve data in accordance with existing and future standards. New generation of chroma key product, software configurable. Integration of all different modules in a real life environment, under the specification and control of the end-user.

Objectives:

The ENREVI project proposes new development for the enhancement of real time video of real scene with real-time render 3D objects. Emphasis is put on economically affordable solutions.

This generic technology will open a wide range of applications were Virtual object need to be merged into the real scene:

* For a better understanding of action on television,

* For aesthetics and creative additions on Tv programs,

* For environmental impact analysis,

* For Pre-visualisation of Cad/cam result in natural environment,

* For Pre-visualisation of special effects in the movie industry,

* For future Internet and Interactive television applications,

* Some application in training and in medical imaging can also be considered.

Work description:

The ENREVI consortium plan to focus on the following points:

1) Fundamental research will provide tools for tracking in unknown environment in real time. It includes: Hyper tracking system, feature system and tracking system and exploration of tracking without markers in arbitrary environment. These tracking solutions should be compatible with operational conditions and combination of sensor based and image based method will be investigated for a real time 3D tracking.

2) A software real time engine will e developed that could render 3D synthetic image on an hardware platform with a target price 10.000 EURO. The 3D rendering engine will be based on databases compatibles with the 3D design industry standards. It will also deliver broadcast quality graphics in particular in the anti-aliasing process and allow seamless mix with the video image. PC environment is a must.

3) Analysis of MPEG, DVB and Video Internet standards to specify format to generate, store, retrieve in accordance with existing and future standards. This format should allow frame synchronisation and frame variable position of inserted object.

4) A new generation of chroma key product, software configurable, which will include: algorithmic auto set-up, setting associated to a portion of the image, settings adjustable in real time by external date, selective softness dependent of picture content.

5) Integration of all different modules in real life environment: after co-ordination of specification taking into account users requirement, GUI will be developed, tracking solutions will be validated and ported to real time industrial environment, communication between modules will be checked and a minimum of two demos in two different environments will be organised under users specifications.

First Milestone is in month 8 with system specifications, triggering subsystem specifications.

Next milestones are deliveries of three subsystems:

* 3D Real time rendering prototype in month 15,

* Keying subsystem Prototype in month 15,

* Tracking subsystem Prototype in month 18.

Milestones:

First Milestone is in month 8 with system specifications, triggering subsystem specifications.

Next milestones are deliveries of three subsystems:

* 3D Real time rendering prototype in month 15,

* Keying subsystem Prototype in month 15,

* Tracking subsystem Prototype in month 18.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 4.17 million euro

Project Funding: 2.08 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Large scale shared virtual and augmented environments

Project Reference: IST-1999-11185

Contract Type: CSC (Cost-sharing contracts)

FRANCE — Yvelines

EADS Systems & Defence Electronics

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Project:

CROwd Simulation System for Emergency Situations

Objective:

This project deals with Simulation and Training and intends to develop advanced simulation system for outdoor urban emergency situations. The three dimension environment will be constructed using real imagery (aerial and on the ground) as well as virtual models. Acoustic simulation from sound samples and sound modelisation as well as graphic representation of people and crowd will guarantee a detailed realistic description of the situation. Specific developments on crowd representation, crowd behaviour modelling and control connected to acoustic corresponding effects will complete this dynamic simulation and training system. The foreseen application so far, concerns the training through advanced simulation to emergency situations such as an incident on a Chemical Plant in a suburb, with rehearsing of an evacuation plan, or validation of any safety procedure.

Objectives:

The objectives of this project is to provide Virtual Reality tools for training people to efficiently respond to urban emergency situations, given the need to be prepared and trained to these emergency situations to limit the side effects due to inappropriate behaviour and plans the foreseen application so far, concerns the training through advanced simulation to emergency situations such as an incident on a Chemical Plant in a suburb, with rehearsing of an evacuation plan, or validation of any safety procedure. We intend to demonstrate the use of a simulator to get prepared to these situations by recreating an actual area with high degree of realism (static 3D environment with dynamic smart objects, dynamic crowd and sounds) so that efficient and useful training to dynamic situations and scenarios can be performed (through global and immersive interaction).

Work description:

The project will start with the user requirements expression and a general system definition tasks aimed at specifying the architecture for the simulation systems and the interfaces of the subsystems for an efficient system integration.

Given a realistic simulation scenario we will then proceed to the real City modelling (or the construction of the 3 dimension static environment). The acquisition and collection of real high-resolution imagery will allow to build a whole suburb with a high level of realism. Then a few buildings as well as smart virtual objects (doors, windows) will be extracted very precisely from higher resolution aerial colour images and digital video acquisitions on the ground.

In parallel, from the acquisition and collection of sound samples and people samples we will develop efficient tools to easily produce a virtual crowd to < populate > the city with auralised feeling of presence.

Definition and modelisation of typical crowd behaviour in specific situations, and translation into virtual crowd behaviour with a sociological approach will allow to demonstrate virtual crowd behaviour representative of the actual crowd behaviour observable on similar real situations.

Demonstrations of the high level of realism of these simulations will be achieved through a first

experimentation aimed at evaluating the performances issues and the level of details necessary for real situations training. Realistic sound representation (related to the graphic representation) and sound control of a crowd n 3dimension environment (with ambient sound and sound effects) will be evaluated. The actual definition and set up of behaviour for these smart object and crowd would allow to play simulation scenarios either dealing only with virtual crowd, or dealing with virtual crowd interacting with avatars corresponding to actual trainee.

With the final experimentation, the coherent integration of sound and dynamic graphics along with the advanced User Interface used (headphones with head trackers and large screen-visualisation), will demonstrate efficient immersive training.

From the different experimental systems and the scientific advances of the project we will explore the potential simulation and training market through the end user and potential uses in the domains.

Milestones:

After user requirements definition, we will first demonstrate technology achievements in delivering a real 3dimension city model at different level of details, representative population (crowd) dynamic simulation within this real environment, and graphical and acoustic crowd behaviour simulation with a high degree of realism.

We will then set up a first experimentation to evaluate these different modules and their integration within a simple scenario, in order to deliver at end the project a second experimentation on a real site with a real situation with full integration of the different tools developed for an efficient use.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.75 million euro

Project Funding: 1.80 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Large scale shared virtual and augmented environments

Project Reference: IST-1999-10510

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://ligwww.epfl.ch/~thalmann/crosses.html

GERMANY — Darmstadt, Kreisfreie Stadt

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Organisation: Zentrum fuer Graphische Datenverarbeitung E.V.

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Project:

ARTNOUVEAU - On the transition to the digital era of arts and culture

Objective:

The artnouveau project intends to devise new visions for the presentation of arts and culture. It will foster the exchange of information and experience between all relevant parties in arts, culture, research, and industry by establishing a working group. This working group will identify requirements and demands for innovative technological applications in arts and culture on the one hand and potentials and limits of technology in this domain on the other hand. By accompanying hands-on demonstrations of mixed reality and human-computer interaction techniques the value of its utilisation as enabling technology in the cultural and artistic context will be evaluated and the gap between the technical/industrial and the cultural/artistic community will be diminished. Finally, extensive research roadmaps dedicated to the cultural heritage domain reflecting both, the user's and the technology perspective will be developed.

Objectives:

The artnouveau project aims at defining new user centred approaches to experience arts and culture in a lively, individual and user-friendly way. Public access, interaction, personalisation and education will be the key aspects of the concepts enabled through innovative technologies such as human-computer interaction, virtual and augmented reality. Current advances in theses fields will be analysed and evaluated with respect to their potential for overcoming he "untouchable arts" paradigm. Necessary activities in all related fields will be pointed out yielding roadmaps for the CH and RTD communities. The consortium constitutes a core-working group of partners in research, industry, and cultural heritage, each providing their specific experience about the subject. Together with further associated members to be recruited relevant topics will be identified and investigated, new concepts and methods will be defined and possible research and application scenarios derived and evaluated.

Work description:

The project consortium constitutes a core working group with partners from research, industry and cultural heritage. After the initial set up of the project recruiting further organisations, institutions, research projects and individuals as associated members will extend this working group. Project results will be achieved in several consecutive phases. First of all a thorough state-of-the-art analysis will be carried out. It aims at documenting the current status quo in the cultural heritage and technologies field. Existing services, products and applications as well as methods and techniques will be gathering and evaluated. This process will be rounded off by the compilation of the individual visions and needs of the respective working group members, serving as a "user requirements" analysis for the following phases. Second, this individual vision will be merged into one common and agreed upon vision of the future directions including new methods, concepts and techniques.

Based upon the state-of-the-art analysis roadmaps for the communities involved will be devised. These roadmaps will be presented to the wide public in general but particularly to the respective communities, to be evaluated and

commented on by the experts of these fields. Finally, possible research and application scenarios will be defined to support the new vision. These scenarios are intended to serve as proofs-of-concept and provide a far less abstract foundation for fertilising discussions among experts. Furthermore they directly allow first-grade hands-on experiences and experiments for a wide audience. All these actions will be escorted by diverse dissemination and exploitation activities spreading the projects' results, especially the new concepts and visions, in the various communities and spawning further worldwide activities such as novel applications, services and last but not least research projects of the future.

Milestones:

MS1 - State-of-the-art analysis on cultural heritage presentations, scientific and market activities;

MS2 - The new vision describing innovative concepts, methods and plans for the future;

MS3 - Evaluation of the research and application scenarios derived from the new vision. The overall result will be the development of new visions and concepts, common to researchers, technicians and cultural heritage people, serving as roadmaps for the future activities of the CH and the RTD community.

Start Date: 2002-09-01

End Date: 2003-11-30

Duration: 15 months

Project Status: Execution

Project Cost: 638291.00 euro

Project Funding: 638291.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: IST support activities - Networks of Excellence and working groups in IST

Project Reference: IST-2001-37863

Contract Type: THN (Thematic network contracts)

GERMANY Darmstadt

Zentrum fuer Graphische Datenverarbeitung E.V.

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Project:

GEneric plAtForm for the CreaTion of interactive ART experience in mixed reality

Objective:

The project art-E-fact covers the development of a generic platform for interactive storytelling in Mixed Reality that allows artists to create artistic expressions in an original way, within a cultural context between the virtual ("new") and the physical ("traditional") reality. The platform will be used to actually build a compelling Mixed Reality installation that facilitates the access to a knowledge base of inspirational material of art history - reflecting the way humans created art since at least 4000 years. Finally, a showcase will be created within an interdisciplinary team that can be used for the evaluation of artistic methods, as well as for the diffusion and exploitation of the results, leading to more accessible tools for artistic expression in the future.

Objectives:

art- E- fact develops a generic platform for interactive storytelling in Mixed Reality. Targeted particularly at artists, it will serve as an experimental platform to create art exhibits with mixed reality objectives: Providing interactive storytelling dialogue structures by integration of story models. Enabling the design of holistic spectator experiences by integration of 3D graphics, autonomous avatar representations, their interaction modalities and used hardware. Identifying artistic approaches and incorporating them into the system. The consortium will also build an art exhibit as a case study: Interactive conversation of museum visitors with virtual characters about viewpoints of art.

Work description:

In art-E-fact, a unique form of interdisciplinary team play between artists and software developers leads to a generic platform, as well as to a Mixed Reality art piece that serves for evaluation and exploitation. Imaging methods for data acquisition on art paintings will be used to generate knowledge bases connected to the system, and authoring interfaces will be built. Also, evaluation results have to be achieved on the interdisciplinary process itself, as well as on exploitation possibilities. From beginning on, artists will be involved, cooperating in the definition of the system and in generating digital or non-digital prototypes prior to the actual creative production phase. After technical specifications, technical developments include: Generation of the art knowledge database. Ontology generation and access facilities to the knowledge base for artists/authors of interactive storytelling. Development of a Mixed Reality platform - in detail, integration of software components with well-defined interfaces, such as image import filters, device and media management, a VR system with multi-modal anthropomorphic interaction means, and a storytelling engine with an avatar animation platform. Development of authoring interfaces for interactive storytelling, making use of an ontology concept, image interaction editors, story models and autonomous character models, and dialogue templates with a rule editor. Then, the actual creation process for designers with the platform includes scriptwriting, 3D modelling and animation, physical props building, integration and programming, and building of exhibitions on-site. Finally, big emphasis is on evaluation and dissemination measures, including: workshops and courses to communicate the work, usability tests, exhibitions, experience reports on

interdisciplinary achievements, further exploitation plans and business model.

Milestones:

MS1 (6) : Technological concept for the generic platform, artistic treatment;

MS2 (15) : Production start of art piece (first version of prototype platform);

MS3 (24) : Art piece ready for exhibition, tested in internal workshops;

MS4 (30) : Dissemination, evaluation of exhibits and the artistic process, and exploitation plan The overall expected result is a software platform that builds the foundation for further exploitation and leads to new ways of creating art.

Start Date: 2002-09-01

End Date: 2005-02-28

Duration: 30 months

Project Status: Execution

Project Cost: 2.54 million euro

Project Funding: 1.56 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Cross Programme Actions (CPA) - CPA15: Technology platforms ***for*** cultural and arts creative expressions

Project Reference: IST-2001-37924

Contract Type: CSC (Cost-sharing contracts)

GERMANY — Hamburg

Technische Universitaet Hamburg-Harburg Technologie Gmbh

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Project:

Non-linear model-based analysis and description of images for multimedia applications

Objective:

The objective of the project is to develop new nonlinear model-based descriptions of images and image sequences. The large amount of image-data in multimedia applications makes it necessary to code the information in a model-based symbolic form. A high measure of compactness in the data representation can be foreseen if the power of nonlinear models is taken into account. Beside the potential for image coding purposes a high-level description is an absolute prerequisite to support the application of higher level functions like model-based browsing and navigation, keying, image sequence interpolation, tracking and finding salient regions, querying (similarity measures, indexing, fuzzy similarity measures).

A high measure of compactness in the data representation can be foreseen if the potential of nonlinear models is taken into account like: polynomial models, motion models, Markov models, set-based models (rank-order, morphological, region growing like watershed etc.), stochastic and chaotic models, genetic algorithms and fuzzy models, canonical frames with invariants, 3D models, models for interpolation. The methods must be applied to still images as well as to image sequences. Another point of interest is data fusion in multimedia applications, i.e. to combine features in different representations (e.g. audio and video) to increase the database for searching and classification.

Current models were mainly developed for image coding purposes. They are rather simple and far away from being optimal and do not contribute to more complex tasks like those needed in image databases. The research will focus on standard video sequences; however, more advanced tasks for future standards like stereo pairs and 3D images (virtual reality) will also be investigated.

Start Date: 1996-01-01

End Date: 1998-12-31

Duration: 36 months

Project Status: Completed

Project Cost: 2.11 million ECU

Project Funding: 1.39 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Long Term Research - Reactiveness to Industrial Needs

Project Reference: 20229

Contract Type: CSC (Cost-sharing contracts)

GERMANY — Muenchen

Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V.

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Project:

Augmented Reality Image Synthesis through illumination reconstruction and its integration in interactive and shared mobile AR-systems for E-(motion)-commerce applications

Objective:

The goal of the ARIS project is to provide new technologies for a seamless integration of virtual objects in an augmented environment, and to develop new visualisation and interaction paradigms for collaborative AR-applications.

Two application scenarios will be developed:

1) an interactive AR- system, where the end-user can easily integrate 3D product models (e.g. furniture) into a set of images of his real environment, taking consistent illumination of real and virtual objects into account;

2) a mobile AR-unit, where 3D product models can be directly visualised on a real site and be discussed with remote participants, including new collaborative and shared technologies. Both approaches will be validated in end-user trials, addressing the new application area of e-(motion)-commerce. In addition to existing e-commerce solutions, e- (motion)-commerce enables the presentation of the products in the context of its future environment.

Objectives:

ARIS intends to overcome limitations of current AR-solutions to open up new business opportunities by providing:

1) easy-to-use methods for 3D reconstruction and camera registration;

2) precise camera tracking, using vision methods with AND without markers;

3) tools to reconstruct illumination and material data from images (incl. day light);

4) seamless integration of virtual and real scenes through consistent illumination between real AND virtual objects in interactive update rates;

5) psychophysical evaluation and new tools to adjust the augmented visualisation to the brightness conditions of the real environment for see-through systems;

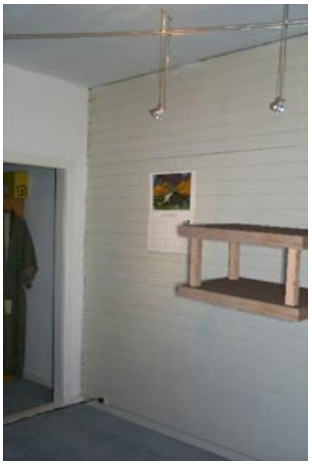
6) new collaboration components, including interaction and communication methods to enable discussion with external users in an augmented environment;

7) clear validation of the results through end-user trials.

Work description:

Description of the work (maximum 2000 characters)The work plan is structured in 7 work packages and one additional work package for the management of the project. The first 4 work packages cover the research and development of the basis technology (geometry and illumination reconstruction, combined lighting simulation and perceptual evaluation), which are needed for the interactive and the mobile ARIS

systems. The application scenarios, the application systems and the validation trails are defined as WP 5, WP 6 and WP7. Combined lighting and semi-automatic reconstruction of geometric and photometric properties implies new approaches, which are not obvious to the end-users from the beginning. Demonstrators and mock-ups of the new technologies and their application opportunities will be developed first, before an ultimate decision of the application system will be taken. Therefore, the first 9 months of the project are dedicated to the development of first prototypes of the new algorithms, which will be presented to all consortium members. In parallel, the user requirements, survey of existing systems and the scenario descriptions will be prepared, yielding to the important system decisions at the end of the first year. Based on the final system specifications, the developments will be combined and extended, resulting in the prototyped solutions, which will be tested and validated at the test trials of the project.



Milestones:

three milestones are planned:

technology demonstrators (month 9: M1) used for requirement definitions;

first prototype (month 24: M2) used for end-user-trials;

final system (month 36: M3).

Two systems are expected:

- interactive AR-system: the user can place 3D product models in the reconstructed image space and see the direct and indirect lighting effects;

- mobile AR-system will allow to present 3D products on-line in its future environment, supporting new collaboration components.

Start Date: 2001-09-01

End Date: 2004-08-31

Duration: 36 months

Project Status: Execution

Project Cost: 4.84 million euro

Project Funding: 2.91 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities & new imaging frontiers for innovative applications

Project Reference: IST-2000-28707

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://aris-ist.intranet.gr/

GERMANY — Muenchen

Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V.

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Organisation Type: Research

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Project:

Avatar based Conferencing in Virtual Worlds for Business Purposes

Objective:

In the age of a global economy, intense and efficient communication within companies or between different companies is essential in order to compete successfully in the market. Recent investigations have shown that the intensity of communication correlates directly with the geographical distance between the communicating parties. Here exists an enormous potential for intensifying collaboration between project partners and thus for improving the efficiency and effectiveness of the work itself. Conferences held online, offering all the conveniences of a real conference, help to save time and costs. Effective teamwork, bringing together the expertise of specialists from all places of the world, is crucial for the success of each project. Effects of synergies can be made use of and projects can be realised in much shorter time. This may contribute to shorter innovation cycles. AVATAR-Conference aims to develop a toolkit for the set-up and administration of virtual online conferences in which users are represented as avatars, i.e. as animated 3D-figures. The AVATAR_Conference system will be designed as a scalable, modular application, offering a large number of supportive functions, like multimedia multi-user real-time communication, speech and voice recognition facilities, online translation services, user representation through 3D-avatars within virtual worlds, multi-user 3D-manipulation and whiteboard, application sharing facilities and clients on PC and Interactive-TV.

The AVATAR-Conference system provides the means for spontaneous, intuitive and intense communication between project partners. The system will especially be characterised by its high usability.

Start Date: 2001-01-01

End Date: 2002-12-31

Duration: 24 months

Project Status: Execution

Project Cost: 4.55 million euro

Project Funding: 1.74 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Flexible, mobile and remote working methods and tools - Smart Organisations

Project Reference: IST-2000-26173

Contract Type: CSC (Cost-sharing contracts)

GERMANY	München, Kreisfreie Stadt

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Project:

Automatic radiosity simulation for complex and dynamic environments

Objective:

The goal of this project is to overcome the current limitations to the use of realistic radiosity-based lighting simulation systems by making radiosity usable, thus opening the way to widespread usage of realistic digital mock-ups.

Components of a robust and usable lighting simulation system will be developed, addressing:

- Data acquisition and processing: tools will be provided to allow the use of unmodified end-user data bases as well as support for application-dependent output and results.

- Treatment of complex models, allowing efficient lighting simulation of very large scenes.

- Automatic control of the simulation eliminating the need for expert parameter selection.

- Interactive manipulation of changing environments for which lighting is simulated.

The development of a practical computer graphics lighting system will allow the use of realistic lighting simulation with digital mock-ups in a wide range of applications such as architecture, design, broadcasting, etc. Large-scale savings will result, first by shortening the development cycle in all domains of design using realistically lit digital mock-ups, and in the architectural field by allowing more energy-efficient designs thanks to the effective use of lighting simulation.

Work description:

Realistic lighting simulation is an important emerging technology with many applications. By simulating shadows and secondary lighting effects the quality of virtual reality and design systems based on computer graphics is greatly enhanced. Products using realistic lighting simulation (based on the so-called "radiosity" method) have only recently begun to appear, most notably in architecture and broadcasting. The use of this technology is currently limited mainly by the inability of current systems to treat realistic models and also the difficulty of their use (which usually requires technical knowledge and experience). As a result, only highly-trained experts are currently capable of using realistic lighting simulation techniques. The great potential of realistic synthetic imagery lies in the creation of "digital mock-ups", which have direct applications in many domains: industrial and lighting design, building and public works industry, as well as many other sectors in which applications are currently emerging.

Milestones:

New Products: the technology developed in ARCADE will be incorporated into a working prototype, and from there potentially integrated into the industrial partner's system.

Dissemination: the methods and techniques developed will be made public through scientific and research publications as well as at trade fairs (e.g., Computer Graphics Expo, CeBIT). A web site containing information, technical reports and demonstrations will be made available.

Start Date: 1997-10-01

End Date: 2000-09-30

Duration: 36 months

Project Status: Completed

Project Cost: 2.54 million ECU

Project Funding: 1.27 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Long Term Research - Reactiveness to Industrial Needs

Project Reference: 24944

Contract Type: CSC (Cost-sharing contracts)

GERMANY	München, Kreisfreie Stadt

Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V.

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Project:

Digital Artistic and Ecological Heritage Exchange transcontinental Guidance and Exploration in globally shared cultural heritage

Objective:

Intuitive access to information in everyday environments is becoming a central concern of new information society technologies. Cultural heritage content has been developed during recent years but is yet not made available in public shared spaces in an immersive and emotional way. Virtual Reality technology provides means to interactively and individually explore cultural and natural content thus as offering personalized sight-seeings and guided journeys thru landscapes, architecture, literature and music. Content authoring and production is exploiting more automative techniques from computer vision for reducing costs. High-speed networks like GEANT and TEIN interconnect citizens from various cultural origin for a global information exchange. Thus, the new generation of digital collections will allow citizens all over the world to commonly share existing and future cultural heritage archives by immersive telepresence.

Objectives:

The DHX project aims to establish a networked virtual reality infrastructure and content development for museums and cyber theatres for mutual exchange of digital cultural and natural heritage. European and Asian partners are participating for transcontinental shared immersive experience in a global scale using high bandwidth trans Euro-Asian networks.

The objectives are as follows:

- providing a distributed IT infrastructure for globally shared immersive experience;

- improving the authoring tools for digital storytelling by computer vision methods in cultural and natural heritage;

- developing distributed cultural heritage experiences as next generation of digital collections;

- accessing existing multi media knowledge bases and digital libraries for detailed information and education;

- presentation and demonstration of human heritage to large scale networked audience for interactive exploration, edutainment and education;

- launching new business areas for cultural heritage exhange.

Work description:

Existing high bandwidth European networking infrastructure (GEANT) is used to interconnect virtual reality type large screen presentation facilities in museums, research institutes and in public spaces for virtually shared exploration of cultural content, remotely guided virtual sightseeing tours and remote education in history. It is intended to expand this European infrastructure to a global scale and to connect to Asian high bandwidth networks such as TEIN accessible for the anticipated applications. For large heritage content exchange, content production and development is significantly

improved by adding automatic techniques to current production chains, such as computer vision based 3D reconstruction and data base generation methods as well as motion modelling of animals.

Cultural and natural content of various type from different European and one Asian region is generated by making use of advanced techniques in digital storytelling, new paradigms in digital dramaturgy and collaborative interaction to offer educational content in a highly interesting and exciting immersive way. These demonstrators will also show a range of technical and scientific complexity - starting from avatar-like remotely guided shared sightseeing tours to multi-site multi-user interactive explorative and collaborative experiences. Furthermore, multi media data bases are accessible from immersive sessions out of the virtual reality presentation.

Finally, public presentations and installations of the content developed so far is undertaken: at first in 2-site distributed locations, later in transcontinental multi site installations between the European partners and the Asian partner. The display systems used for these demonstrations will vary from single channel large screen stereo displays to multi channel surround displays and will allow individuals as well as groups to virtually share an cultural heritage experience.

Milestones:

DHX will establish, demonstrate and use a stable application based high bandwidth interconnectivity between the project partners. Digital natural and cultural heritage content for distributed immersively share experience will be developed and the computer vision tools for content production and the virtual reality tools for content presentation will be extended. Finally, the content is installed in museums and cyber theatres and publicly used over high speed networks by citizens.

Start Date: 2002-04-01

End Date: 2005-03-31

Duration: 36 months

Project Status: Execution

Project Cost: 5.23 million euro

Project Funding: 2.40 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Heritage for all

Project Reference: IST-2001-33476

Contract Type: CSC (Cost-sharing contracts)

GERMANY	München, Kreisfreie Stadt

Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V.

Organisation: Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung E.V.

Organisation Type: Research

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Project:

Virtual Showcases-presenting hybrid exhibits

Objective:

Showcases belong to the standard equipment of museums and other exhibitions. They are used to display artifacts to the public, to make them available to a larger audience, and to protect them against detrimental effects of the environment. With Virtual Showcases, we want to introduce a new medium that allows to present hybrid (mixed: real and virtual) exhibits. Thereby, real pieces are superimposed with stereoscopic 3D computer graphics within a (for museum visitors familiar) showcase-like setup. Thus, virtual and real objects are optically combined in such a way that they appear three-dimensionally conjunct to the observers. Virtual Showcases also allow a number of observers to see and to interact with different or the same graphical content within the same spatial space.

Objectives:

The Virtual Showcase project aims at developing the knowledge and technology for Virtual Showcases to become standard equipment for museums and other public exhibitions spaces. Recent and anticipated advances in computer and graphics systems, projection systems, tracking technology, input devices, and networking technology form the basis for realising this vision. The three main objectives of the Virtual Showcase project are:OB1: Develop the hardware and software technology for Virtual Showcase systemsOB2: Develop the knowledge and technology to design and implement Virtual Showcase scenariosOB3: Evaluate the Virtual Showcase setup in real-world environments.

Work description:

The Virtual Showcase project cycle is user-centred and consists of five core R&D workpackages whose components will be developed in parallel: -basic rendering (development of novel rendering methods and the adoption/extension of existing basis rendering concepts that allow the combination of traditional display devices with half-silvered mirrors of different topologies and configurations)-advanced rendering (explore and develop advanced graphical algorithms for displaying VS content in particular for AR scenarios, such as image-based approaches, light fields)-interaction (develop user interface tools and interaction styles for Virtual Showcase systems: support for a large variety of input devices, development of interaction styles appropriate for a showcase in a public setting, and a software architecture for convenient specification of input events and the system's reaction to user input)-content management (deploy all the necessary work to specify and implement the database for Virtual Showcases, implementation of an application for the database interface, management and retrieval of information, interfacing with the rendering modules)-authoring (develop standards and tools for authoring VS content and applications, that can be shared by multiple demonstration scenarios, and allow exchange of data among different demonstration scenarios.)An analysis and design workpackage will give continuos input to the core R&D workpackages, while the core workpackages will give internal feed-back to the analysis and design workpackage. Two succeeding application workpackages will apply

the results from the core R&D workpackages to realise SW- and HW-prototypes, which are used for evaluation (e.g. as proof-of-concept prototypes in a preliminary stage of the project, or as application prototypes in a final stage).

Milestones:

Month 6: Analysis, preliminary design finished; Month 13: Final design finished, technical feasibility proved (preliminary HW/SW proof-of-concept prototype/demonstrator);

Month 24: Final hardware prototypes, rendering, interaction, authoring and content-management components are completed;

Month 30: HW Prototypes and application scenarios are operational at the museum sites;

Month 36: Evaluation is completed and final report is ready.

Start Date: 2001-09-01

End Date: 2004-08-31

Duration: 36 months

Project Status: Execution

Project Cost: 2.73 million euro

Project Funding: 1.75 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - **Virtual** representations of cultural and scientific objects

Project Reference: IST-2000-28610

Contract Type: CSC (Cost-sharing contracts)

GERMANY — Muenchen

Siemens Aktiengesellschaft

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Project:

Services and Training through Augmented Reality

Objective:

STAR, the Service and Training through Augmented Reality project, will focus on developing Mixed Reality techniques with a view to developing commercial products for training, documentation and planning purposes. To this end, the project will focus on the following issues: automated reconstruction of industrial installations by 3D reconstruction or mosaicing, interaction between human operators and mixed reality environments, and the introduction of virtual humans in the mixed reality environments. STAR will advance the Augmented Reality state-of-the-art and, under the leadership of its industrial partners, will strive to develop technology adapted to the industrial world. An integrated Augmented Reality platform will be developed. The industrial partners will evaluate this platform with a view to possible commercialisation.

Work description:

For on-site work, three-dimensional modelling will be performed and used to generate augmented-reality animations of the factory. For on-line remote training, our system will produce training animations based on mosaics, which can be hosted on a web server, streamed through the Internet and visualised on a remote client. The produced 3D-models can also be used for planning.

To achieve these goals, we will develop the following capabilities: Automated reconstruction of industrial installations, Animating mixed reality scenes, Manipulation of mixed objects by virtual humans, Automated view selection and camera hand-over STAR partners will integrate all these tools into an integrated Augmented Reality platform.

The platform will be evaluated in planning and training situations. From these studies we will gather evidence as to the potential of Augmented Reality techniques compared to more traditional techniques. In these studies we will consider the service and training needs of both SME and larger corporations.

Milestones:

STAR will develop an integrated Augmented Reality platform. A first demonstrator will be available to all the partners by mid-project. A second demonstrator will be ready at the project's end. It will be made available to trusted customers of the industrial partners for validation of the concept. It will then form the basis for potential commercialisation.

Start Date: 2001-07-01

End Date: 2004-06-30

Duration: 36 months

Project Status: Execution

Project Cost: 3.45 million euro

Project Funding: 1.35 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities & new imaging frontiers for innovative applications

Project Reference: IST-2000-28764

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.realviz.com/STAR/

GERMANY — Sankt Augustin

GMD - Forschungszentrum Informationstechnik Gmbh

Organisation: GMD - Forschungszentrum Informationstechnik Gmbh

Organisation Type: Research

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Project:

Augmented Round Table for ArcHitecture and URban Planning

Objective:

ARTHUR aims at the development of an interactive task oriented collaboration environment based on augmented reality technology. An augmented round table scenario will enhance the physical working environment by manipulate virtual components, preserving existing verbal and non-verbal communication and natural interaction mechanisms. ARTHUR will provide a user-friendly environment by the development of new projection glasses and intuitive non-intrusive user-interface mechanisms. We will provide natural mechanisms to interact with virtual objects by using arbitrary real-world items as tangible interfaces. While providing a platform for a wide range of applications, we will demonstrate the power of the approach in the area of architecture and urban planning. The overall approach will be based on standard and lightweight components to ensure usability, user-friendliness and affordability for a wide range of commercial and private users.

Objectives:

ARTHUR contributes to action line IV.4.2 Mixed realities and new imaging frontiers for innovative applications and services. It will bridge the gap between real and virtual worlds by enhancing the users' current working environment with virtual 3D objects. Our development will focus on providing an intuitive environment, which supports natural interaction with virtual objects while sustaining existing communication and interaction mechanisms. Real world objects will be used as tangible interfaces to make 3D environments attractive even to non-experts. ARTHUR will develop new types of user-friendly see-through displays, non-intrusive object tracking mechanisms and intuitive user interface mechanisms within a location independent multi-user real-time augmented reality environment. It will focus on affordable components to address a wide area of applications.

Work description:

ARTHUR will develop a new type of augmented reality environment in order to support common round table meetings. Virtual 3D objects will be projected into the common working environment of the users by wearable stereoscopic 3D displays. Within the project see-through stereoscopic displays will be developed and enhanced to meet the requirements of the users concerning the quality of the visualization, the weight, size and handling of the display, and the usability in a common working environment. ARTHUR will also develop new interaction mechanisms based on arbitrary real world objects to realize tangible and intuitive interfaces for the manipulation of 3D objects. For this purpose we will realize the concept of interaction units, which are based on the principal of visually superimposing real world items by virtual objects. This presumes a flexible and sophisticated object tracking mechanism. We will develop tracking mechanisms based on computer vision, which will additionally allow us to recognize user gestures without disturbing the user in his or her natural behaviour by cumbersome hand tracking devices. In order to support common round table meetings involving several people, the developed AR environment will provide multi-user capabilities to guarantee consistent views among the participants.

Additionally a network based persistence mechanism will ensure that the round table environment will be accessible anytime and anywhere. The power of the augmented round table approach will be demonstrated by an architectural design and urban planning application. This application will support the intuitive collaborative design of multiple users. The application scenario will also be used as a starting point for a commercial exploitation of the environment with CAD and architecture software houses.

Milestones:

The result of this project will be an AR environment based on advanced semitransparent stereoscopic displays combined with innovative and intuitive interaction mechanisms. This will be achieved through three milestones: year one results in a first demonstrator based on enhanced existing components; year two results in the first prototype of the AR environment including some application specific functionalities; after year three the application prototype and the evaluation will be available.

Start Date: 2001-08-01

End Date: 2004-07-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.85 million euro

Project Funding: 2.54 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities & new imaging frontiers for innovative applications

Project Reference: IST-2000-28559

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.fit.fraunhofer.de/projekte/arthur/index_en.xml

GERMANY — Sankt Augustin

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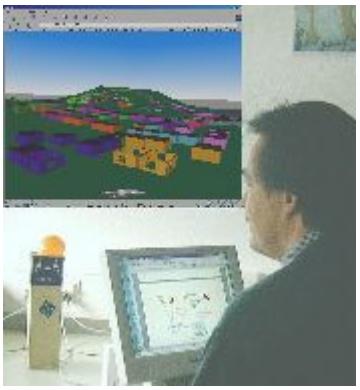
Project:

Theatre of Work Enabling Relationships

Objective:



The TOWER project will develop a new cooperative environment and work-space to enable new ways of working over distance for synchronous as well as asynchronous working modes. It will augment existing groupware systems through sensors and agents, which recognise awareness information. Presence, movement and actions of other people in a shared environment will be made perceivable in a "theatre of work" and become effective to the social process. This "Theatre of Work" will integrate symbolic acting of avatars in a dynamically created spatial 3D environment as well as ambient displays in the physical environment. This aims to overcome the social isolation of distributed team members and to improve team cohesion. Developments will be iteratively evaluated in close cooperation with users.

The result will be an environment that enhances awareness about cooperative actions; that allows people to perceive team activities; enables reactions to situations and thus reduces the effort for planning synchronisation and coordination.

The project will develop a model of symbolic acting to deliver the right balance between awareness and intrusion, uni-directed sharing, privacy and simplicity. An Internet-based infrastructure will form the underlying basis for TOWER. New ambient displays will be integrated into real working environments to create tangible effects of activities in virtual and real spaces. History mechanisms will enable users to recapture the activities that have happened during a temporal absence.

Start Date: 2000-01-01

End Date: 2002-06-30

Duration: 30 months

Project Status: Completed

Project Cost: 3.80 million euro

Project Funding: 2.10 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Flexible, mobile and remote working methods and tools - Workplace design

Project Reference: IST-1999-10846

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://tower.gmd.de

GERMANY — Stadtverband Saarbrücken

Max-Planck-institut fuer Informatik

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Project:

Virtual Heritage: High-Quality 3D Acquisition and Presentation

Objective:

The ViHAP3D project aims at preserving, presenting, accessing, and promoting cultural heritage by means of interactive, high-quality 3D graphics. Nearly all of our cultural heritage is inherently three-dimensional, and furthermore 3D computer graphics in conceived more and more as the most powerful medium for virtual representation of all kinds of complex data. Specifically, the project aims at the development of new tools in the following three problem areas:- 3D scanning for the acquisition of accurate and visually rich 3D models,- post-processing, data representation, and efficient rendering for the detailed interactive display and inspection of such models even on low cost platforms,- virtual heritage tools for the presentation and navigation in high-quality digital model collections.

Work description:

The work is structured in seven work packages. The actual development work (WP 3 - WP 5) centres around the three areas mentioned above:

Work on 3D scanning (WP 3) will provide a complete, integrated high accuracy scanning system for small and medium-scale objects. The system will support acquisition of 3D shape, and at the same time capture and reconstruct surface attributes, such as texture and spatially varying reflection characteristics.

Work on post-processing, data representation, and efficient rendering (WP 4) will exploit mesh processing techniques, multi-resolution surfaces and surface attributes (texture, reflection) in combination with hardware-accelerated rendering.

Work on the development of virtual heritage tools (WP 5) will develop a set of virtual presentation tools for the presentation of cultural heritage model collections that can be used with off-the computer and graphics components. In addition there are work packages on project management (WP 1), functional specification (definition of the requirements and functional specification of the tools to be designed) (WP2), assessment of acquisition and presentation (WP 6) and information dissemination and take-up of results (WP 7).

Milestones:

3D Scanning: Scanner design and prototype, appearance acquisition algorithms, acquisition planning algorithms.

Post-Processing: data representation, efficient rendering: rendering algorithms, post processing and representation algorithms and tools.

Virtual heritage tools: first and second release.

Assessment: results from scanning system / presentation tools assessment.

Start Date: 2002-03-01

End Date: 2005-02-28

Duration: 36 months

Project Status: Execution

Project Cost: 2.47 million euro

Project Funding: 1.40 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural **heritage** - Next generation digital collections

Project Reference: IST-2001-32641

Contract Type: CSC (Cost-sharing contracts)

GREECE Athens

Athens Technology Center S.A.

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Project:

Developing Common Standards for the Integration of 3D Body Measurement, Advanced CAD, and Personalised avatars in the European Fashion Industry

Objective:

The main objective of eT Cluster is to bring together the main key players in Europe and cluster European and National projects to propose a framework of standards, enabling the seamless integration of 3D scanner, CAD and Avatar technologies, thus homogenising innovative infrastructures for Virtual retailing services of customised clothing and possibly other related services.

Further important objectives of the Cluster will be:

.To develop and maintain efficient links with important standardisation bodies and other relevant organisations related to the proposed work on standards

.To disseminate the proposed standards and the resulting infrastructure to the Technology Community (CAD suppliers, 3D scanner suppliers), under the responsibility of Lectra, as well as to the garment and fashion retail industry, under the responsibility of EURATEX.

e-T Cluster will support & complement E-TAILOR & Fashion-Me(2 IST projects) & 3D Centre for Electronic Commerce(a major UK project), in order to propose a framework of standards enabling seamless integration of 3D scanner, CAD & Avatar technologies, homogenising innovative infrastructures for Virtual retailing services of customised clothing. Three suppliers of 3D whole-body scanners will develop standards for generic 3D body & measurements exported from various scanner systems, enabling development of configurable interfaces to CAD & Virtual-try-on systems. Two main EU Apparel CAD manufacturers will develop CAD interoperability standards, enabling electronic interchange of data sets between different modules of Made-to-Measure applications of different suppliers. The standards will be tested at various configurations, linking systems developed in supported projects. Links to standardisation bodies & the standards wide dissemination activities will be affected. The project will be open to further participation of other related projects or organisations.

Work description:

The Workplan is structured in the form of Thematic Blocks, which will develop in parallel as reflected in the structure of the workpackages.

Three main Technical workpackages include:

WP2: Development of CAD Interoperability Standards,

WP3: Development of Standard 3D Body and measurements' representations, &

WP4: Testing Standards in Common Testbed Pilots.

There are three major phases, related to the evolution of the work in the Technical workpackages:

P1: Definition of Requirements,
P2: Design and Implementation of Standards,
P3: Integration in Common Testbeds.

During Phase1 (Month 1- Month 8) work in WP2 will focus on the definition of the interoperability concepts & the detailed methodology to be followed. During the same phase, work in WP3 will focus on the identification of requirements, acquisition & analysis of 3D sample data from different scanners & review of existing formats.

During Phase2 (Month 9 - Month 15) work in WP2 will focus on the identification of data flows from ordering to production, preliminary & final design of the interoperability standard & pilot implementation. During the same phase, work in WP3 will focus on the preliminary & final definition of the 3D body standard.

Finally the integration phase (Phase3) will include the design and specification of the tests, the set-up of the test beds, carrying out the tests & evaluation of the test results.

Liaison activities will include co-operation with the supported projects, & co-operation with relevant standardisation bodies (e.g. h-anim group, Web3D Consortium, European Sizing Co-operation).

Wide dissemination & standard promotion activities will include: the set-up of a forum via e-T Clusters' website, a Workshop after the Kick-off Meeting, which will contribute to the forging of links with the industry & standardisation bodies, promotion of the standards to the CAD & 3D scanner industrial communities, & dissemination of the results to the Apparel & Fashion Retail Community.

Milestones:

The following milestones are anticipated during the project:

M1: End of Specifications Phase (WP3) - Requirements for 3D data Standards - Acquisition of sample scans from different scanners (Month 6)

M2: End of Specifications Phase (WP2) - Identification of data flows (Month 8)

M3: End of Development Phase (WP3) - Final Standard definition (Month 12)

M4: End of Development Phase (WP2) - Development of coded messages (Month 15)

Start Date: 2001-01-01

End Date: 2002-12-31

Duration: 24 months

Project Status: Execution

Project Cost: 999461.00 euro

Project Funding: 999461.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Work spanning KA2 - Specific Support Measures

Project Reference: IST-2000-26084

Contract Type: ACM (Preparatory, accompanying and support measures)

GREECE — Athens

Mellon Technologies

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Project:

Cultural Heritage Attractions Featuring Real-time Interactive Scenes And Multi-functional Avatars As Theatrical Intelligent Agents

Objective:

Aimed at, but not limited to, the development of new forms of Cultural Heritage Visitor Attraction, CHARISMATIC introduces drama, story-telling and live interactive dialogue capability into Virtual Environments Acquisition of Performing Arts and transition of the digitised results into smart, multi-functional high fidelity Avatars or Virtual Humans, means that VR based simulations will acquire many of the current entertainment capabilities of theatre, film and television, but with the added values interactivity and immersive experience.

The CHARISMATIC consortium combines the talents of researchers, innovators and practitioners in the fields of Computing Science, Theatre, Film and TV, Computer Image Generation Graphic Design, Multi-Media Content Creation, Video Gaming, Historic Preservation , Archeology and Virtual Reality. CHARISMATIC's ambitions to create a new paradigm for 21st Century Entertainment and Infotainment, reflects the fact that European Cultural Heritage Values lie as much in the language, and artistic creations of its diverse peoples, as in its multiplicity of historic buildings and sites or antiquity.

Objectives:

CHARISMATIC will develop essential technologies enabling theatrical (audience group) enjoyment of high fidelity virtual environments, populated by intelligent virtual humans. The project aims to boost introduction of advanced image and display technology in Europe's cultural heritage and associated tourist industries, and thereby stimulate growth in those industries.

Through introduction of traditional speech and movement-based Performing Arts into Virtual Environments, via advanced forms of Avatass and Synthespians, CHARISMATIC will create entirely new interactive entertainment forms as a paradigm for 21st Century drama. Although initially targeted at Cultural Heritage Visitor Centres, the paradigm is by no means limited to such subjects, but encompasses all types of future Location-Based Entertainments and E-visitor Attractions.

Work description:

The Objectives demand Research into, and Development of:

-Virtual environments powerful enough to provide high fidelity walk-through VR simulations of European historic towns and Cities, together with new cost-effective tools and methods, with which to create them.

-Advanced Avatars or Virtual Citizens, capable of speech.

-Expression and conducting drama scenes for historic portrayal or re-enactment.

-Intelligent Virtual Agents, capable of conducting interactive dialogue with human audience elements or e-sitors.

-Artificial Intelligence elements enabling autonamous, spatially-aware virtual guides, able to understand spoken instructions and respond via a combination of natural language and database memory.

-A powerful new form of software image render ad multiple entity controller, able to execute complex populated virtual scenes at the required Fidelity and Frame rate.

-A variety of new model virtual theatres (or Reality Centres) custom-designs and proven specifications to cater for both new forms of audience, and new forms of entertainment.

-Additional user interfaces and devices to allow individual intranet-based access to the new VR entertainment material Single-user access includes Augmented Reality options.

Start Date: 2000-01-01

End Date: 2002-06-30

Duration: 30 months

Project Status: Completed

Project Cost: 4.98 million euro

Project Funding: 3.20 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Authoring and design systems

Project Reference: IST-1999-11090

Contract Type: CSC (Cost-sharing contracts)

GREECE Athens

Mellon Technologies

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Project:

Fashion Shopping with Individualized Avatars

Objective:

FashionMe aims to enable fashion shopping with individualized avatars in virtual 3D environments. Customers can take advantage of the possibility to generate a lifelike avatar of themselves and use it to test designs and models of clothing in virtual fitting rooms via the Internet. Furthermore there is not only the possibility to try on standard confections but to use the lifelike avatars to order measure-to-measure products from retailers world-wide over tele-service connections like the Internet. All consortium partners are professionals in their working area: technology providers, researchers, software and application developers, and fashion retailers. Together in the consortium a FashionMe virtual fitting room prototype will be developed and presented to the public as a result of the project work.

Objectives:

The FashionMe consortium will develop and produce a concept and toolset of a virtual fitting room which will be scalable for the customers' needs and wishes, and also the technical equipment. FashionMe will offer the possibility of Fashion Shopping with individualised 3-D Avatars interacting and moving in virtual 3-D environments in the Internet, as well as a CD-Rom based 2-D selection toolset, and scalable applications between this high-end and low-end solutions. The main objective is to find possibilities to offer personalised fashion shopping environments to select different styles and models, and to enable the customer to order made-to-made clothing without travelling and several try on sessions. The personal individual avatar gives enough information for the producer to make clothes, that fit.

Work description:

FashionMe will produce a customer application for a virtual fitting room with individualised avatars and animated articles of clothing, which will be sold upon completion of the project as a concept and toolset to suppliers and producers in the fashion industry. Thus, FashionMe will offer the possibility of Fashion Shopping over the Internet, with individualised 3D avatars interacting and moving in virtual 3D environments, as well as a CD-ROM based 2D selection toolset, and scalable applications between these high-end and low-end solutions. By the end of the project the FashionMe application will be available both on-line, and as an off-line version for the mail-order catalogue market, with the possibility of using the tool Avatar Studio of Canal plus. Using this tool, one

can individualise an avatar and then try on fashion items from the CD-ROM Avatarmodell, and also on-line via Internet interactive TV terminals with the PC. Thus, the information and shopping selection of FashionMe will be shown in real time. Alternatively, the AvatarBooth of AvatarMe will be used to supply the customers on the spot with a "genuine 3D-Modell" Avatar and will represent a high-end solution for the clothing market.

- The FashionMe consortium intends to co-operate closely with the consortium of the IST project E-Tailor, since the two research projects complement on another:

- E-Tailor focuses on the general development of standard modules and the linkage of 2D and 3D scan data with the tailoring production. FashionMe focuses on the interface between customer and provider particularly the creation of realistic colour rendering and animations of people with new clothing, and the development of concepts and tools. Research work on the usability, attractiveness and application of tools and concepts for this market is the central focus point of the project.

With the combination of these two projects in the framework of IST, a unique platform will be developed which will provide a substantial competitive edge in the global market for the European clothing industry. The possibility of offering tailored clothing for the world-wide market with the good reputation and high quality materials and manufacturing of European providers, could open an enormous sales potential for the enterprises involved.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 2.24 million euro

Project Funding: 1.20 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Management systems for suppliers and consumers - Enhanced consumer-supplier relationships

Project Reference: IST-1999-11078

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.fashion-me.com

GREECE — Athens

Petrakopoulos Nicolaos (Mellon Technologies) Ae

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Organisation Type: Industry

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Project:

Virtual reality electronic shopping system

Objective:

The objective of VRShop is the creation of an integrated toolset for the set-up of interactive virtual reality malls on the Internet, which encompasses the latest technology in electronic commerce, VR, VRML, 3D multi-user worlds, and multimedia, enhanced, adapted, and integrated into a single environment.

Work description:

VRShop produces two complementary products:

- VRMall, a set of tools for setting up, administering and maintaining a VR mall on the Internet, and

- VRStore, a set of tools and templates for setting up, administering and maintaining a VR store on the Internet.

To produce the above, VRShop takes advantage of emerging technologies and trends in order to create virtual reality life-like trading environments. Currently, there are no such integrated tools in the market.

To create and validate the two VRShop products, the project develops:

An integrated Tools Environment for the easy setup of VR malls on the Internet. This environment includes tools for the creation and management of VR stores, and tools for the creation of an overall VR mall on the Internet, enabling customers' interaction and communication with each other, as well as with shop representatives through avatar technology. The following tools and functions are integrated and/or developed: VRML and interactive world technology for the Internet; VR model design and development tools and methods; electronic commerce tools and procedures; multimedia and management tools; digitising and cataloguing tools; telecom and site administration tools.

VRShop templates, including guidelines and methodology for setting up VR stores, based on the above tools. These include: templates for various stores, and tools for inserting (new) consumer products in a VRShop (including 3D representation); templates for electronic ordering and payment; templates for various avatars (3D body icons), in order to represent the current visitors 'walking' into a VR store, virtual electronic guides through the store, which give assistance for the store consumer products, virtual electronic clerks, which establish communication between a real store clerk, and the buyer; applets for consumers' assistance (like a calculator for various currencies, or a private goods basket to check what has already been bought, how much it costs, etc.); templates for entertainment, in order to attract and keep customers in the mall, as well as templates for advertising.

The pilot VR mall, based on the VRShop tools and templates, in which the pilot applications VR stores are built. The feedback from the pilot mall will lead to commercialisation of the VRShop results, after the project's end.

Four pilot application spread throughout Europe prove the validity of the system in various areas of commerce.

Start Date: 1997-12-01

End Date: 1999-05-31

Duration: 18 months

Project Status: Completed

Project Cost: 2.75 million ECU

Project Funding: 1.25 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Multimedia Technology - Multimedia for ***electronic*** commerce

Project Reference: 25024

Contract Type: CSC (Cost-sharing contracts)

GREECE — Athens

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Project:

Virtual Environments for the Training of Visually Impaired

Objective:

The ENORASI project aims at developing a highly interactive and extensible virtual reality system that will allow visually impaired people, especially those blind from birth, to study and interact with various virtual objects. ENORASI will not only introduce techniques for the training of blind people based on their haptic interaction with virtual objects, but will also provide case studies for their training through interaction, manipulation and modification of objects of complex shapes.

An immersive haptic virtual environment (VE) will be created, simulating the real world guiding them through all the phrases of the training procedure. The ENORASI project introduces completely innovative non-visual virtual reality techniques that will help training blind people into feeling, understanding and interacting with complex virtual objects (airplanes, buildings, 3D maps, famous archaeological findings, etc.)

Objectives:

The project's technological objectives include development, testing, and evaluation of new approaches that will serve the project purposes.

These include:

- Development of a high sensitivity virtual reality haptic system for training.

- Development of novel virtual intelligent agents guiding blind humans and consulting them when interacting with the virtual objects, in the way that real guides would.

- Development of a metadata schema for efficient representation of texture.

- Development of realistic 3D rendering systems.

The business oriented objectives for ENORASI include the promotion of powerful solutions for the training of functionally impaired humans and the definition of the commercialisation and exploitation potential of ENORASI.

Work description:

The project will produce five main outcomes:

1. A usability study of innovative virtual reality systems for the training of visually impaired.

2. The ENORASI virtual reality training case studies where complete pilot training scenarios will be implemented and tested for injury-less and strain-less training.

These include:

a) recognising every day objects,

b) recognising complex virtual objects not easily accessible in their real life,

c) interacting with virtual objects and understanding their physical characteristics,

d) facilitating the participation of the visually impaired users in an educational or entertainment environment and

e) navigating into complex VEs based on haptic information and guidance from virtual guides.

3. The ENORASI virtual reality blind training system consisting of a high sensitivity virtual reality haptic system or training (supporting object interaction, manipulation, modification and query) along with novel virtual intelligent agents (implementing the specific training case studies) guiding visually impaired humans and consulting them hen interacting with the virtual objects, in the way that real guides would.

4. An international conference into Virtual Reality Applications in Training of Visually Impaired Humans planned in the 19th month.

5. A white paper providing technology standards and infrastructure guidelines for the setting up of VR based training systems for the visually impaired persons.

Work in the project is organised in the following phases:

a. System specification and user requirements phase,

b. Development of the haptic VR system and integration of internal system prototype,

c. Development of second prototype with improved functions phase,

d. Evaluation and dissemination phase.

Milestones:

M1: System definition

M2: Internal prototype release

M3: International Conference on Haptics in Virtual Environments

M4: Final system release

M5: Final report

The project will result in the ENORASI Training System, and Training Cases together with a White Paper providing technology and infrastructure guidelines.

Start Date: 2001-01-01

End Date: 2003-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 2.54 million euro

Project Funding: 1.51 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Persons with special needs, including **the** disabled and **the** elderly - Intelligent assistive systems/interfaces to Compensate .. impairment

Project Reference: IST-2000-25231

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://enorasi.systema.gr/

GREECE — Iraklio, Crete

Foundation for Research and Technology – Hellas

Organisation: Foundation for Research and Technology – Hellas

Organisation Type: Research

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Project:

Innovative revival of LIFE in ancient frescoS and creation of immerse narrative sPaces, featuring reaL scenes with behavioUr fauna and flora

Objective:

Since antiquity, images were used as records of both events-lifestyles, as well as decorations. The possibility of reviving them would add a new dimension in understanding our past. Therefore, LIFEPLUS proposes new developments for the innovative revival of life in ancient frescos and creation of narrative spaces. The revival is based on real scenes captured on live video sequences augmented with real-time behaviour groups of 3D virtual fauna and flora. The metaphor, which will inspire the project approach, is oriented to make the "transportation in fictional and historical spaces", as uniquely depicted by frescos, as realistic, immerse and interactive as possible. The whole experience will be presented to the user on-site during his/her visit, through an immerse, mobile Augmented Reality-based Guide featuring wearable computing and multi-modal interaction.

Objectives:

LIFEPLUS proposes the innovative 3D reconstruction of ancient frescos through the real-time revival of their fauna and flora, featuring virtual animated characters with artificial life dramaturgical behaviours, in an immerse AR environment. In greater detail LIFEPLUS objectives are:

1) Real-time hyper realistic virtual life in AR environments;

2) Automatic Real-time Camera Tracking in unknown environments;

3) Perceptual issues in Augmented Reality (Occlusions, Shadow cues);

4) Design of successful character based installations;

5) Expressive autonomous cinematography for interactive Virtual Environments.

Although initially targeted at cultural heritage centres, the paradigm is not limited to those, but encompasses future location-based entertainments, e-visitor attractions and on-set visualisations for the TV/movie industry.

Work description:

The goal of LIFEPLUS is to push the limits of current Augmented Reality (AR) technologies, exploring the processes of narrative design of fictional spaces (e.g. frescos) where users can experience a high degree of realistic interactive immersion. Based on a captured/real-time video of a real scene, the project is oriented in enhancing these scenes by allowing the possibility to render realistic 3D simulations of virtual flora and fauna (humans, animals and plants) in real-time. According to its key technology, visitors are provided with a see-through Head-Mounted-Display (HMD), earphone and mobile computing equipment. A tracking system determines their location within the site and audio-visual information is presented to them in context with their exploration, superimposed on their current view of the site. LIFEPLUS will extend that system and provide key new technologies to render lively, real-time animations and simulations of ancient virtual life (3D human crowds, animals and plants). By its very nature, LIFEPLUS is a

highly interdisciplinary project involving computer vision, computer graphics, user interfaces, human factors, wearable computing, mobile computing, computer networks, distributed computing, information access and information visualization. Two case study applications on virtual heritage will be developed and demonstrated. Historical world-class frescos will be "brought to life", through lively 3D animated revival of their content, superimposed on their real environment. Thus the ancient characters of the frescoes (including humans, animals and plants) will be revived and simulated in real-time in 3D, exhibiting in a new innovative manner their unique aesthetic, dramaturgical and emotional elements.

Milestones:

M1 End of Project;

M2 Completion of the functional specifications;

M3 Completion of Preliminary Camera Tracking SDK;

M4 Finalised prototypes of Virtual Flora and Fauna simulation SDKs;

M5 Final Authoring Tools suite;

M6 Final Mobile On-Site AR Guide;

M7 Final Middleware prototype;

M8 Final Demonstrator.

Start Date: 2002-03-01

End Date: 2004-08-31

Duration: 30 months

Project Status: Execution

Project Cost: 3.25 million euro

Project Funding: 1.45 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities and new imaging frontiers

Project Reference: IST-2001-34545

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.miralab.unige.ch/subpages/lifeplus

GREECE — Iraklio, Crete

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Project:

Interactive Museum Tele-presence Through Robotic Avatars

Objective:

The current project aims at the development of an interactive tour-guide robot (TOURBOT) able to provide individual access to museums' exhibits and cultural heritage over the Internet. TOURBOT operates as the user's avatar in the museum by accepting commands over the web that directs it to move in its workspace and visit specific exhibits. The imaged scene is communicated over the Internet to the user. As a result the user enjoys personalized telepresence in the museum, being able to choose the exhibits to visit, as well as the preferred viewing conditions. At the same time TOURBOT will be able to guide on-site museum visitors. TOURBOT has several advantages for both the museum visitor and the museum itself.

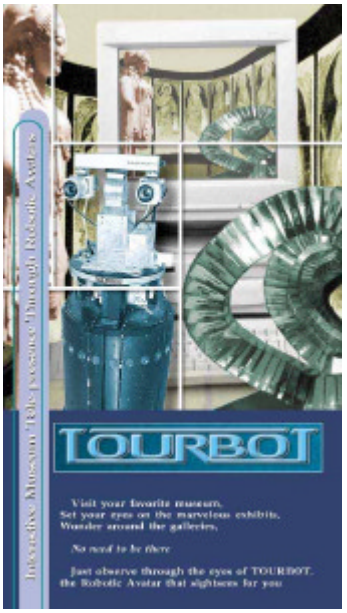
More specifically, the objectives of the project are the following:

(1) develop a robotic avatar with advanced navigation capabilities that will be able to move (semi)autonomously in the museum's premises,

(2) develop appropriate web interfaces to the robotic avatar that will realize distant-user's telepresence, i.e. facilitate scene observation through the avatar's eyes,

(3) facilitate personalized and realistic observation of the museum exhibits, and

(4) enable on-site, interactive museum tour-guides.



Work description:

The execution of the TOURBOT project will proceed in nine concrete steps:

(1) Management; technical and administrative project management that will ensure the smooth cooperation of project partners towards the achievement of the goals of the project.

(2) Dissemination and Implementation; compilation of early dissemination and exploitation plans and end-of project provision of actual achievements in dissemination and realistic exploitation possibilities.

(3) Application specification; definition of application requirements from a technological and user's point of view.

(4) Site information; investigation of technological issues regarding the internal robot representation of its workspace and construction of the maps and information repositories of the two museums.

(5) Hardware configuration; development of the mobile robotic platform, the base workstation for off-board processing and the communication modules for their interconnection.

(6) Avatar navigation; development of the navigational capabilities required by the robotic avatar.

(7) Interfaces; development of web and on-board interfaces that will enable distant and on-site users to be guided by the robot in the museum premises.

(8) Integration; hardware and software integration of the developed modules that will result in a fully operational system (TOURBOT); extensive laboratory experimentation.

(9) Assessment and Evaluation; Validation of the TOURBOT system in real-world conditions (i.e. museum premises) and assessment of its performance.

Milestones:

The expected result of this project is the development of an interactive tour-guide robot (TOURBOT), able to provide individual access to the exhibits of a museum over the internet.

The project milestones are:

M1 (month 6): Release of Dissemination and Use Plan; Application specification completed.

M2 (month 15): Hardware and software modules developed, multimedia site information acquired.

M3 (month 20): System integration completed.

M4 (month 24): System validated and assessed, end of project.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 1.72 million euro

Project Funding: 1.09 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: ***Interactive*** publishing, digital content and cultural heritage - Access to scientific and cultural heritage

Project Reference: IST-1999-12643

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.ics.forth.gr/tourbot

GREECE — Iraklio

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Project:

JUST-in-time health emergency interventions - Training of non-professionals by Virtual Reality and advanced IT tools

Objective:

In health emergency care, effective and just-in-time interventions of on-the-field operators can reduce damages to injured citizens. Such damages can be severe and sometimes turn into permanent disabilities, causing high social costs. In most European countries, proper training of operators is still a critical issue. In traditional training, psychological impact of accident scenarios on operators is afforded in real-case situations without being tested in advance. JUST, therefore, addresses training of non-professional health emergency operators, by using advanced IT tools. The project R&D work aims to produce a Web/CD training course, with innovative, certified, multimedia content, as well as a VR-based verification tool.

The project's main goals are:

(1) to complement traditional courses

(2) to check operator capabilities in adopting correct decision-making procedures

(3) making optimal use of advanced IT, and

(4) in overcoming psychological barriers. Project results will be assessed in four pilot sites, set up in Italy, Greece, Spain, and France through clinical trials. Multi-linguality will, as a result, greatly enhance the European dimension of JUST's R&D work.

Objectives:

The JUST project addresses the domain of training of non-professional health emergency operators. It aims, through the use of advanced information technologies, certified content, and innovative VR based tools, to provide advanced support for continuous education and training, and to overcome the present weaknesses.

The specific objectives of JUST are:

(1) development of a Web/CD training course to support the traditional learning phase, based on the collection and/or creation of multimedia content of European relevance,

(2) development of a Virtual Reality Verification Tool to check operators capabilities to:

- adopt correct decision-making procedures,

- make optimal use of new technological equipment,

- overcome psychological barriers,

(3) the design and development of advanced, adaptive user interfaces for both the interactive course and the verification tool.

There is urgent need to develop new methodological frameworks to help professionals and the citizen to access information in multiple and functionally adaptive ways.

Work description:

The Project activities will be planned to take place within 7 WPs plus Project co-ordination and management. These are:

(1) Analysis of content and technology,
(2) Functional specifications and HCI design,
(3) Development of Web/CD course,
(4) Development of VR-based Verification Tool,
(5) Pilot implementation,
(6) Assessment & Evaluation, and
(7) Dissemination & Implementation.

The main target group consists of non-professional health emergency operators (i.e. mainly volunteers). Ultimately the target group for the JUST product is the European citizen. As a result, the project will pay due attention to the multi-lingual aspects and requirements. A User Group will be set up, consisting of recognised experts from traditional training course providers. Collection of European recommendations / guidelines on health emergency protocols of intervention will provide the basis for fully analysing education and training needs of the selected user groups. The target user groups will be studied in order to identify the preferred interaction patterns with different platforms. User profiles will be elicited to obtain an understanding of their requirements, skills and preferences, and interests. Context analysis will be performed seeking to obtain a global understanding f how the envisioned environment and provisioned respective systems are going to be used. Usability Context Analysis and Design space analysis will be employed to identify prime user groups, contexts of use, candidate platforms, likely scenarios of use, alternative interaction artefacts and dialogue style. An interactive multimedia medical courseware product will be developed with emphasis on interface effectiveness and adopted training and communication strategies; training objectives will not only be limited to the transfer of basic facts and rules, but with emphasis on advanced animation audiovisuals. Emphasis will be on tight integration of the Web and CD platforms, since user-friendliness.

Milestones:

The Project will last 3 years. The major milestones (results) will be:

- Description of state-of-the-art in health emergency training, VR-based training and Web/CD based training

- Specifications of products and scenarios (incl. HCI & localisation issues)

- Prototypes and final releases of products

- Design & results of validation at pilot sites (clinical trials)

- Assessment and evaluation reports

-A product exploitation plan.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.63 million euro

Project Funding: 1.53 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Health - Clinical, biological, managerial and imaging systems for health professionals

Project Reference: IST-1999-12581

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.justweb.org

GREECE **Peania**

Intracom S.A. Hellenic Telecommunications and Electronics Industry

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Project:

Personalised, Immersive Sports TV Experience

Objective:

The PISTE project based on the advent of Digital TV broadcast, the advances in 3D-visualisation, image processing, and the MPEG-4 emerging standard for the efficient communication of rich interactive multimedia material, will develop a system that will transform TV watching into an immersive interactive experience. The project that will address the needs of broadcasters and home viewers will focus on the coverage of sports events. Viewers equipped with a receiver prototype, to be developed in the project, will be presented with augmented views of the events, will able to interact with visual objects to obtain information and customize the way in which they watch the events. In addition, the use of a Head Mount Display will provide immersion and a feeling of "being there".

Objectives:

The PISTE project will build a system, addressing the needs of broadcasters and home viewers, which will transform TV watching into an immersive interactive experience during the coverage of sports events.

The main objectives of PISTE are:

a) The provision of tools based on digital video processing, 3D-visualisation and animation techniques, and a novel XML/VRML to broadcasters, for creating augmented reality views of the events.

b) The development of tools for the encoding and playback of rich interactive multimedia content in MPEG-4. The assessment of MPEG-4 for broadcasting such content over a DVB infrastructure and its presentation on set-top equipment.

c) The specification of requirements for the implementation of MPEG-4 playback on consumer electronics equipment.

d) The assessment of the DVB infrastructure in supporting large scale Virtual Environments through the use of MPEG-4.

e) The assessment of the system through experiments with the involvement of real actors.

Work description:

The rationale of the proposed work structure is based on the incremental development methodology that assumes that the problem definition is not fully covered in the start of the project but that problem understanding grows through prototypes and demonstrations that provide input from the users. In this framework, first, a survey of related application will be carried out in order to make users aware of the possibilities and limitations of the technology

and to help positioning PISTE in the market with respect to other related systems. Based on the survey of related applications, user requirements and application scenarios will be specified. Then will follow the functional specification and design, and the implementation of the first PISTE prototype. In parallel to the implementation, the material (3D models, images, videos, etc) that will be needed for the trials of the initial prototype in both sites will be prepared. The PISTE system components that will be developed in parallel by the technology partner will be integrated into a complete implementation of the initial prototype of the system that will be used for trials in both sites. Based on the evaluation of the initial system prototype during the trials, the system design will undergo eventual design revisions based on which a final prototype will be implemented. In parallel to the implementation of final prototype, more material will be created for the trials of the final prototype that will fully demonstrate the capabilities of the system. The final prototype will be used as a reference installation for demonstrations, especially in relation to the Athens 2004 Olympic games, and the evaluation of the system that will lead to the definition of the plan for the commercialisation of PISTE.

Milestones:

Milestone 1 [month 9]: Functional specification and design of initial PISTE prototype and market analysis

Milestone 2 [month 15]: Delivery of initial PISTE prototype & first draft of Exploitation plan

Milestone 3 [month 27]: Delivery of final PISTE prototype & second draft of Exploitation plan

Milestone 4 [month 30]: PISTE Technology Implementation Plan

Start Date: 2000-04-02

End Date: 2002-10-01

Duration: 30 months

Project Status: Completed

Project Cost: 5.30 million euro

Project Funding: 2.60 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Large scale shared virtual and augmented environments

Project Reference: IST-1999-11172

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://piste.intranet.gr/index.asp

IRELAND — Dublin

An Chomhairle Leabharlanna - The Library Council

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Project:

New Access and Services for Cultural Content

Objective:

The ACTIVATE project will trial the use new technology to open new modes of access to cultural content. Existing content resources will be digitised, and a thematic network will be built. Virtual, non-destructive access will be opened to conservation sites of cultural and historical importance. The project will build and publish templates for thematic network portals and content sites, using recent advances in Internet technologies to improve access to cultural content. It will also build a virtual reality model of a historic landscape, to provide a new way of accessing existing rich stores of cultural content concerning the landscape. Each step of the process will be documented, and the appropriate templates and tools provided, to produce an out-of-the-box solution for cultural providers across Europe who wish to replicate the project's work. The project results, and product, will be disseminated in a focussed, planned manner to cultural providers.

Objectives:

Overall Objectives:

1. To demonstrate the added value that thematic networking provides for small cultural collections.

2. To prove the value of virtual reality as an access tool to large bodies of complex data, as well as for conservation.

3. To provide a published methodology for replicating the project results.

4. To disseminate the methods and the results of the trial specific technical targets: (i) to build templates and samples of sites for thematic networks; (ii) to build a virtual tour of a historical landscape, and integrate the landscape with related cultural material.

Specific Business Targets:

1. a generic product for building thematic networks, with related revenue streams;

2. a flagship product using a VR landscape as a handle to underlying content;

3. to increase the use of cultural services, and to improve the services themselves;

4. to underpin further business based on the cultural content.

Work description:

Overall, the project users and suppliers will cooperate to build a thematic network and also a VRML interface to existing content resources. Having achieved this, the project will publish and disseminate the procedure and tools used as a standalone product.

Work division:

WP1: The suppliers and the users will agree which technologies are the most appropriate, following cooperative evaluation of the various technologies available. The criteria and procedure used to choose the best technology will be documented.

WP2: The major technical work will take place here. Thematic network portal and content site templates will be built and populated. A VRML representation of a fragile historical landscape will be built. This will provide a revolutionary new

access mode to underlying cultural content. The results and the approach taken will be included in the final packaged product.

WP3: The technical output will be formally validated by the users. The criteria and procedures for validation will be published, both to increase the value of the validation exercise, and to allow it to be replicated.

WP4: The effectiveness of the project will be quantified on an ongoing basis. Web tools, HTTP statistics and comparisons of user visits and trends will be used.

WP5: The project output (tools, templates, procedures) will be packaged as a commodity product. This will be distributed online. A wide dissemination exercise, using meetings, articles, conferences and the EU co-operation mechanisms will spread the word about the product.

WP6: The users will refine their plans for further use of the project output. The suppliers will use the results of WP3 and WP4 in a business planning exercise. The market for products based on the (open source) project output will be analysed.

WP7: A lightweight project management WP underpins the rest, and manages liaison with the Commission services.

Milestones:

The most important milestones will be:

- Completion of the technical work.
- Completion and publication of the product.
- End of the dissemination phase.

The key project result will be a product, consisting of software tools, HTML templates, and the procedures for using them to open new access modes. This will allow easy replication of the project experience and results.

Start Date: 2001-07-10

End Date: 2002-07-09

Duration: 12 months

Project Status: Completed

Project Cost: 174001.00 euro

Project Funding: 150840.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Trials on new access modes to cultural and scientific content

Project Reference: IST-2000-29333

Contract Type: ACM (Preparatory, accompanying and support measures)

Project URL: http://www.activate.ie

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Project:

Photorealistic Image Rendering for Manufactured objects

Objective:

The proposed research is directed at developing a software tool for producing photorealistic, synthetic images of manufactured objects and providing a simulation technology which substitutes, either partially or totally, some production phases.

Work description:

The motivating observation for the initiation of the PHIRMA project is that the available commercial systems do not adequately solve the technical and economical problems of computer assisted prototyping in the industrial sectors of interior furnishings, architecture in stone and manufactured objects. Particular emphasis will be given to the objects in-stone.

The major research tasks involved are :

- Development of specific features for the realistic representation of objects, such as the material generation, which includes ad-hoc techniques for stone texturing,

- Development of a kernel system whci integrates pre-existing software applications such as geometric modelers, nesting/cutting optimisers, cost estimators,

- Development of a user interface and interaction paradigms which are oriented to designers with no programming skills,

- Open-system and shared-service architectural approaches which will characterise the PHIRMA system.

Successful completion of the project will result in a high-end product whose cost is half that of commercial packages. The economic benefit for the users of the PHIRMA system is proportional to the reduction in the time-to-market of a given product. Use of this system in the furnishing industry, for example, is expected to reduce the pre-prototyping costs up to 60 %. In architectural applications involving the prototyping of marble/granite surfaces, the use of PHIRMA is expected to reduce the pre-prototyping costs up to 45 %. In general, benefits should be obtained whenever virtual products will replace real products.

Milestones:

The Phirma Core

The PHIRMA prototype is based on a client/server distributed model. The designer can import a 3D model from external CAD/Modelers. Once the model is imported, materials, camera, anchors, lights can be defined within the Phirma server and the scene can be rendered; all the information about the objects in the scene can be stored into a database.

The Multimedia Catalogue

The final user can create his own scenario, for example a kitchen, by interacting with the PHIRMA client. The user can select the components (for example the oven, the sink etc.) from the database. He can position the selected item onto a 2D board. Once the scenario has been assembled, the PHIRMA client can generate the corresponding 3D scene, which can be explored using the PHIRMA browser.

The PHIRMA 3D browser

PHIRMA 3D is a VRML 1.0 compatible browser for SGI/UNIX and PC systems. It provides a scene viewer that allows full movement within and between scenes, high quality rendering

facilities and multiple rendering modes for optimising performance and responsiveness in complex scenes.

The browser is responsible for performing 3D transformations and fast rendering locally on the client machine. Furthermore, some powerful rendering servers may be asked for a more realistic rendering of a given view.

The Material Generation

The material Generation was approached on a theoretical basis. What was analysed within the context of the PHIRMA project were two main ideas:
evaluating aesthetic characteristics of stone slab materials
realistic synthetic image generation of stone slab materials.

Techniques based on Fast Fourier Transform (FFT) were analysed in order to generate realistic images of large stone slices from a smaller sample (a 2 square metre slice). Henceforth, once an image of the material has been established, and its spatial properties are known, the problem remains to find the Fourier Transform which generates the same material with scaled dimensions while still maintaining its spatial properties.

Start Date: 1994-08-01

End Date: 1996-07-31

Duration: 24 months

Project Status: Completed

Programme Type: 3rd FWP (Third Framework Programme)

Programme Acronym : CRAFT

Subprogramme Area: Innovative design tools and techniques
Design Integrating Strategies
Design of Products and Processes
Engineering and Management Strategies ***for*** the Whole Product Life Cycle

Project Reference: CR111591/BRE21321

Contract Type: CSC (Cost-sharing contracts)

ITALY — Casalecchio di Reno (Bologna)

Consorzio Interuniversitario per la Gestione del Centro di Calcolo Elettronico dell'Italia Nord-Orientale

Organisation: Consorzio Interuniversitario per la Gestione del Centro di Calcolo Elettronico dell'Italia Nord-Orientale

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Project:

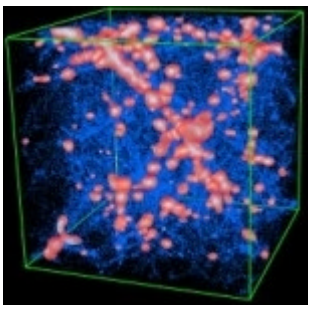
A tOoL for stereographiC visuAlization and analysis Of astrophySical data

Objective:

We will develop a visualization tool for astrophysical problems using the most innovative techniques of virtual reality and advanced 3D visualization. A prototype (AstroMD) is available (developed at Cineca and the Astrophysical Observatory of Catania). Our project extends the AstroMD capabilities to respond to the requirements proposed by several research fields for the management and the analysis of data coming from: cosmological simulations, galaxy catalogues, radio sources. In addition, new methodologies for education and diffusion of astrophysical culture will be developed. The tool will be portable on several platforms: virtual theatres, immersive desks, workstation or personal computers with the software for a 3D stereo-graphic visualization.

Objectives:

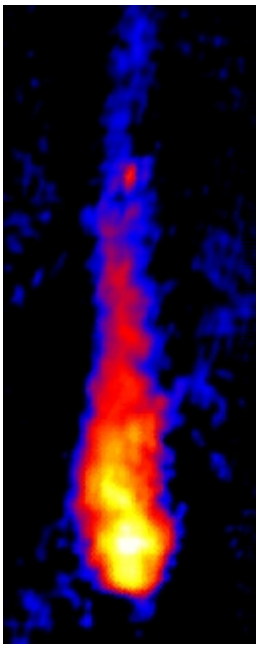
Our objectives are the development of the most modern visualisation techniques for astrophysics, education and the improvement of our knowledge of the Universe through the application of these technologies to three specific fields in astrophysics. We also want to promote new, easier and more intuitive methodologies of learning both for specialists and for students at several degrees. The virtual reality and the techniques of advanced 3D visualisation are particularly suitable for astrophysics; a field in which the objects we observe are projected onto the celestial sphere and generally have an asymmetric morphology. The possibility of visualise the three-dimensional structure of the astronomical objects permits the recognising of their peculiarities and characteristics. Moreover the more intuitive approach to complex concepts of astrophysics, offered by the techniques that we want develop, will extend the astrophysical knowledge on a larger community both of specialists and non.



Work description:

The capabilities of AstroMD will be extended in order to respond to the requirement of the astrophysical problems we want to face and to that of education as summarised below: Cosmological simulations: The available prototype of AstroMD will be implemented with functionalities for the calculation of quantities of cosmological interest as the correlation function, the gravitational field, the power spectrum. The most common data format used in cosmological simulation (e.g. TIPSY format) will be implemented. Volume rendering techniques will be integrated to visualise volumes with different levels of transparency. Visualisation of galaxy catalogues: we intend to refer to the catalogues compiled in the ambit of the Virmos, a consortium of six astronomical Institutes in Italy and France. Specific tool for the individuation of the objects and the description of their characteristics will be implemented together with the possibility of extracting and visualising sub-samples of data according to their nature and

physical characteristics. Powerful radio-sources: According to the dynamical and emission models of radio sources developed by the Institutes of radio astronomy of Bologna and Oxford, new functionalities will be implemented in AstroMD with the aim of represent the directional emission from the radio sources and integrate it along the line of sight to compare the model with the available observations. Education: A tool specifically oriented to didactics will be developed. It will be characterised by a particularly user-friendly interface and by a set of functionalities explaining the characteristic of the visualised data and an accurate description of the physical processes related. The tool will implement also functionalities with the aim of testing the correct understanding of the concepts explained. A route of learning will be projected in collaboration with the schools, taking advantage of the past experience of the Institute of radio astronomy of Bologna.



Milestones:

We intend to achieve an exhaustive and clear project presentation within the end of the month 2. We also intend to produce a public progress report each six months. The beginning of application workpackages is at the beginning of month 2 and the specifications definitions and the software pilot 1 are expected at the end of month 12.The final results and the final tool of visualisation will be published at month 24.

Start Date: 2001-09-01

End Date: 2003-08-31

Duration: 24 months

Project Status: Execution

Project Cost: 687809.00 euro

Project Funding: 378218.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Information access, filtering, analysis and handling - Trials & best practice: information access, filtering, analysis,..

Project Reference: IST-2000-28481

Contract Type: ACM (Preparatory, accompanying and support measures)

Project URL: http://cosmolab.cineca.it

ITALY — Genova

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Project:

Video Assisted with Audio Coding and Representation

Objective:

The main objective of the project is to approach the problem of videophone coding from an audio - video combined point of view, both for analysis and synthesis. The motivating idea is that interpersonal audio-video communication represents an information source that can easily be modulated and characterised in audio by a human speaker's voice and in video by his/her face.

Two demonstrators will be implemented: i) a hardware platform with H324 coder/decoder integrated with a board for speech analysis and articulation estimation, lip extraction and tracking, audio assisted frame interpolation for increasing the frame frequency; ii) a software demonstrator of a hybrid coding scheme compliant with MPEG-4 where audio/video analysis/synthesis are used for composing the natural background together with the speaker's face represented by means of a synthetic 3D model.

Work description:

From the technical point of view, two goals are reached. Firstly, integrating the standard H.324 coding scheme, by means of speech assisted frame interpolation; secondly, implementing a software prototype of a hybrid scheme based on the segmentation of the scene into a component that can be modulated (the speaker's face) and another that cannot be modulated (the background). The region of the speaker's face is encoded through model-based algorithms assisted by speech analysis, while the background is encoded through region-based algorithms. Activities focus on the development and experimentation of suitable algorithms for estimating lip movements from speech, segmenting the speaker's face region form input images, extracting and tracking the speaker's facial parameters and for their suitable and realistic synthesis, either based on simple 2D meshes, or on complex deformable 3D models. A suitable English multi-speaker audio-video database has been acquired for allowing the maximum level of system independence compatible with the scientific and technological state of the art. The H.324 software demonstrator with integrated analysis/synthesis algorithms has been already achieved, while its integration into the hardware H.324 prototype is currently going to be completed.

The implementation of the software demonstrator of the SNHC hybrid scheme is also in progress. The 3D parameterised structure used to model and animate the speaker's head has been supplied to the MPEG-4 SNHC verification model, and has been made compliant to the Facial Animation Parameters (FAP) standardised in SNHC. Current work concerns the upgrading of the model to Facial Description Parameters (FDP) ruling the shape and texture calibration of the face polygon mesh to any specific face.

Processing real images and extraction of facial features used to reproduce the motion and the facial expression on a synthetic 3D head model. Images produced at Miralab at the University of Geneve and at LIG laboratory at EPFL, Lausanne.

Through constant interaction with end user associations (NAD: Irish National Association for the Deaf), a set of suitable subjective experiments has been defined to formalise the visual relevance of speech articulation and co-articulation. This activity has led to the definition of a suitable evaluation protocol used to access the quality of the achieved results.

By taking into account the bimodal nature of the mechanisms of speech production and perception, experiments have been carried out to investigate the sensitivity of a human perceiver to variations of the many system parameters. The outcomes of these experiments represent a basis of knowledge which has been used for purposes of speech analysis and image synthesis. The quality assessment will be done in co-operation with the end user associations by exploiting the expertise coming from the end users, test experiments will be applied to a group of hearing impaired observers who will express their subjective opinion. The various opinions will be collected through a suitable questionnaire defined by the end users as well.

General Information: Key Issues

- Audio/video synchronisation
- Model-based video coding
- 3D modelling and animation
- Synthetic/Natural Hybrid Coding

Milestones:

- A synchronised audio-video corpus of 10 speakers, composed of single utterances of 700 English words, has been acquired and processed to allow bimodal multi-speaker speech processing.

- A set of tools has been developed for extracting the region of the speaker's mouth from QCIF H.324 images and for generating extrapolated frames in which the mouth movements are synthesised based on parameters extracted from speech analysis.

- A real-time H.324 board, based on Trimedia component, with extrapolation of synthesised video frames

- A set of tools for face region segmentation and 3D facial feature extraction & tracking

- A 3D model of a synthetic human face, compliant with MPEG-4, driven by Facial Definition Parameters (FDP) and Facial Animation Parameters (FAP)

The VIDAS project intends to show that major improvements can be brought to model based coding schemes. The model based coding techniques will be standardised at the end of the project activity (MPEG-4). This means that products integrating these techniques will be largely diffused at the end of the century. Therefore, for industrial companies, it is a major issue to control and to introduce them in their devices. The VIDAS software demonstrator is the way to point out improvements to model based codecs allowed by joint video-speech analysis. Therefore, for industrial partners, it is the way to acquire know-how on these advanced techniques which are very promising for them in terms of compression efficiency and new functionality.

Expected Impact

The number of users who could benefit from the project's outcomes is definitely large, ranging from the normal consumer to the pathological hearing impaired. The goals of the project are in fact oriented to the general improvement of the visual subjective quality of the images in a narrow-band videophone. Everyone will benefit from this improvement since the images will look more natural.

Moreover, in case of hearing impairments, this benefit will be dramatic. In this case the videophone will not be a "useless" advanced telephone, but will become the privileged communication means. In some cases, rehabilitation to lip-reading could even be done through remote teaching via videophone. In-between these two extremes, being the normal hearing user and the deaf, a large variety of intermediate possible consumers can be mentioned and, first of all, elderly people who could benefit so much from the improvements on video-phone achieved by the project activity.

Start Date: 1995-09-01

End Date: 1999-02-28

Duration: 42 months

Project Status: Completed

Project Cost: 4.18 million ECU

Project Funding: 2.19 million ECU

Programme Type: 4th FWP

Programme Acronym : ACTS

Subprogramme Area: Multimedia services

Project Reference: AC057

Contract Type: CSC (Cost-sharing contracts)

ITALY — Genova

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Organisation Type: Education

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Project:

MultimodAl analysis/synthesis systEm for human INTERaction to virtual and augmented environments

Objective:

The project will define new models and will implement advanced tools for audio-video analysis, synthesis and representation in order to provide essential technologies for the implementation of large-scale virtual and augmented environments. The metaphor, which will inspire the project approach, is oriented to make man-machine interaction as natural as possible, based on everyday human communication means like speech, facial expressions and body gestures from both sides. A case study application on Internet will be developed and demonstrated.

Objectives:

The objective of the project is to define new models and implement advanced tools for audio-video analysis, synthesis and representation in order to provide essential technologies for the implementation of large-scale virtual and augmented environments. The work is oriented to make man-machine interaction as natural as possible, based on everyday human communication by speech, facial expressions and body gestures. Man to machine action will be based on coherent analysis of audio-video channels to perform low-level tasks, or high level interpretation and data fusion, speech emotion understanding or facial expression classification. Machine-to-man action, on the other hand, will be based on human-like audio-video feedback simulating a "person in the machine". A common sw platform will be developed by the project for the creation of Internet-based applications. A case study application will be developed, demonstrated and evaluated.

Work description:

The project activity will last three years, the first part devoted to specifications definition and tools development, the last part dedicated to the implementation of demo applications. Project coordination, within WP1, will be carried out in synergy and concentration with other projects working in similar research areas within and outside the IST program. Most of the WPs will be activated at the beginning of the project. In particular, WP2 will take responsibility of defining systems specification with particular reference to the common software platform, which will be developed later on in WP5, that will integrate all the tools into an environment with authoring capability for the creation of applications of shared virtual and augmented reality. Technical work packages WP3 and WP4 will develop a library of tools for managing man-machine interaction with reference to man-to-machine and machine-to-man communication, respectively. WP3 will be oriented to the implementation of audio-video analysis tools, WP4 o the implementation of audio-video synthesis tools. Both WP3 and WP4 will guarantee full compliance to specifications defined in WP2. Activities in WP5 will be focused on the integration of the developed tools into a common software platform and on the

implementation of an example of application based on shared virtual and augmented environments.

The integrated sw platform, will be developed progressively through upgraded releases, the first of which at the end of the first year of project activity. Compliance with MPEG-4 and MPEG-7 will be guaranteed by deep project commitment in the standardisation process (WP2). At project conclusion, the Interface consortium will organise an International Workshop for public demonstration and dissemination of the achieved results.

Milestones:

During the 3 year project, major deliverables will be produced that will represent the actual project milestones. In particular, after the first year, the common sw platform with integrated tools, after the second year, the updated sw platform with added authoring functionality and, at the third year, the implementation of a case study application, based on the common sw platform. This last milestone will also include the organisation of a public event with live demonstration of results.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.51 million euro

Project Funding: 1.60 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Large scale shared ***virtual*** and ***augmented environments***

Project Reference: IST-1999-10036

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.ist-interface.org

ITALY	Milano

Artificial Intelligence Software Spa

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Project:

Virtual plane

Objective:

The aim of the project is to develop industrial rear-projection horizontal screens (planes), used to display 3D interactive images. The planes are to be perceived (both sight and sound) using active liquid-crystal spectacles and a stereo headset. The application domain areas are virtual reality and to some extent augmented reality.

Objectives:

The main objectives are:

1. To engineer the display sub-system, including the geometry of the plane, the projector and the optical properties of the material used for the plane.

2. To develop the software environment for Virtual Plane applications; modified versions of existing 3-D modellers for interactive virtual reality will automatically implement the perception and the perspective typical of a Virtual Plane.

3. To develop cooperative interaction tools for applications sharing the same 3-D views among two or more users, locally or at different locations.

4. To select existing devices and hand-held peripherals for interacting with 3-D environments, and integrate them into the overall system for pointing and manipulation.

Work description:

The VIP technology will be tested and validated in three applications, corresponding to three major application domains with relevant final users:

- Architecture: Presentations of architectural projects, especially for large areas, as in city planning projects.

- Medicine: Pre-operation design and testing of implant placements.

- Entertainment: Development of innovative arcade games based on the Virtual Plane platform for the European and Japanese markets.

The project tasks naturally map onto the members of the consortium. The initial focus will be on the display (including analysis, design and implementation) and on the development of the libraries for adding to existing 3-D interactive software environments (including the special features required for the geometry of specific displays). The technology will be used by the three user partners in pilot applications.

The project objectives described above represent major business opportunities for all the partners involved and coordinated exploitation activities will take place throughout the project. The technology partners will be able to deliver the Virtual Plane, an innovative display system, and the corresponding software environment, in an area where there is still no competition and for which there is a very broad range of possible applications. The users will benefit from the in-house availability of the VIP technology, benefiting from more opportunities to sell their services and complementary products (including existing proprietary products) and benefiting directly from the in-house pilot applications.

Start Date: 1995-12-01

End Date: 1998-05-31

Duration: 30 months

Project Status: Completed

Project Cost: 3.38 million ECU

Project Funding: 1.80 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Multimedia Technology

Project Reference: 20642

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.iunet.it/ais/vipindex.htm

ITALY	Milano

Politecnico di Milano

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Project:

A new paradigm for high-quality mixing of real and virtual

Objective:

To bridge the gap between virtual and real worlds including interactive broadcast services and high-end linear production (movie production) through digital analysis of reality and advanced, real-time, motion / position / [e-motion] feedback.

The project intends to define, develop, implement and integrate advanced tools and techniques for a synergetic, interactive, symmetric and seamless mixing of reality and virtuality in linear (script-based) and non-linear (impromptu) production.

This will open the way to a novel WYSIWYG approach to production, which will give back the director the full control over the filming of live (real and virtual) action.

Objectives:

ORIGAMI intends to define, develop, implement and integrate advanced tools and techniques for a synergetic, interactive, symmetric and seamless high quality mixing of reality and virtuality in linear and non-linear production. The Project proposes a synergetic integration of technologies for the virtualisation and the authoring of 3D environments, which will be suitable for a wide range of extreme modelling situations and set extensions. It also proposes solutions for the mixing of real and synthetic live action in a virtual studio with off-line real and synthetic content, while offering a real-time preview of the final result. ORIGAMI will produce an integrated software package that will enable the user to perform a variety of tasks, such as set planning; set extension; and real-time direction in a simple, intuitive and cost-effective fashion.

Work description:

The project activity will last 30 months and will be organised in 7 workpackages.

Project ordination, within WP0, will be carried out in synergy and concertation with other projects working in similar research areas within and outside the IST program.

WP1 will be devoted to the definition of systems specification; for the integration of all software modules within a common flexible environment; and to provide the user with a friendly and intuitive graphical interface.

Technical workpackages WP2 to WP5 will develop software modules for the off-line creation of a virtualised extended set, and for the managing of the interactions between real, virtual, off-line content and live action.

WP2 will be oriented to the implementation of advanced and robust camera motion tracking techniques.

WP3 will deal with object and scene reconstruction based on geometric surface estimation.

Activities in WP4 will be focused on light-field estimation for the plenoptic modelling of scenes; and on the estimation of the radiometric model associated to viewed surfaces. It also includes methods for light-field calibration and illumination correction, to be employed in virtual studio applications.

WP5 will be devoted to the managing of the interactions between real and virtual actors in an extended (virtual) set.

All activities related to the setting up of the extended virtual studio will be included in this WP, as well as the managing of positional, symbolic and emotional feedback between real and virtual and vice-versa.

Finally, WP6 will include all the activities related to the organisation of intermediate and final demonstrations in the three application scenarios of interest.

As part of this activity, at the end of the project, the ORIGAMI consortium will organize a Workshop for public demonstration and dissemination of the achieved results. A short film will be submitted for public exhibition to international events such as the SIGGRAPH Electronic Theater.

Milestones:

1) Research and develop a set of tools to analyse digitise and edit real environments and actors.

2) Research and develop software and hardware solutions for real-time actor feedback.

3) Provide an application environment with a consistent user interface across all the tools, allowing the final user to make a profitable production use of the developed tools.

4) Field-test the results, producing both a real on-line TV production simulation and a set of short demo movie productions.

Start Date: 2001-09-01

End Date: 2004-02-29

Duration: 30 months

Project Status: Execution

Project Cost: 3.69 million euro

Project Funding: 2.04 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: ***Real***-time and large-scale simulation and visualisation technologies - Mixed realities & ***new*** imaging frontiers ***for*** innovative applications

Project Reference: IST-2000-28436

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www-dsp.elet.polimi.it/origami

ITALY Milano

Telecom Italia Spa

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Project:

I-Learning: immersion/imagery enhanced learning

Objective:

Sports trainers have shown that mental rehearsal ('motor imagery') can facilitate motor task acquisition. The goal of this project is to build on the results of this work to develop a completely new technique for the teaching of complex motor skills. In the new I-Learning approach the trainer will be replaced by a virtual reality system, designed to create a sense of presence, which evokes motor imagery in the mind of the trainee and therefore facilitates the acquisition of the task. The project includes laboratory research into the relationship between motor imagery and learning; investigation of the use of virtual reality to evoke motor imagery, as well as practical laboratory evaluation of learning effectiveness. This will be based on Virtual Environments developed by the project. The new approach will be tested in two areas with high societal impact: the rehabilitation of neurological patients and the teaching of safe driving.

Objectives:

The acquisition of sophisticated motor behaviours requires long training under professional guidance. The I-Learning project aims to develop and test a new, cost-effective approach to this problem, based on the hypothesis that virtual environments created with Virtual Reality technology, can induce a compelling sense of presence which helps learners to generate an 'internal model' of desirable motor behaviour, and thus to create new motor schema or, if necessary, to activate and modify pre-existing ones. This we call I-learning. A VR-induced sense of presence can facilitate acquisition of motor skills, and I-LEARNING will use the results to design and implement cost- effective tools and methodologies. These will be subjected to rigorous laboratory evaluation in both a clinical setting (rehabilitation of neurological patients) and with healthy learners (drivers wishing to acquire advanced driving skills).

Work description:

The I-Learning Project will include basic research, the design of tools and methodologies based on these research findings, the development and integration of the necessary hardware and software and rigorous evaluation of the new tools and methodologies in a laboratory setting. The basic research will investigate mechanisms of motor learning, the role of motor imagery in the acquisition of motor skills, ways in which motor imagery can be evoked using Virtual Reality technology, the effect of a sense of presence on the learning effectiveness of virtual environments and the relative effectiveness of different stimulation strategies.

The results will contribute to the design of tools and methodologies for the application of I-Learning. Unlike current practice in sports training, where learners 'imagine' a particular behaviour, or the rich simulation techniques used in training pilots, the I-Learning project aims to use relatively simple Virtual Reality Technology which nonetheless has the potential to produce a compelling sense of presence, helping learners to create new motor schema or, if necessary, to activate and modify pre-existing ones. The Virtual Environments required will be designed and implemented in specific Work Packages dedicated to this task. The tools and methodologies developed within the project will be evaluated under laboratory conditions both with neurological patients and with healthy

individuals. In this latter case the teaching of advanced driving skills will be used as a test case. Here the performance of a treatment group trained via I-Learning will be compared with that of a control groups receiving conventional driving instruction. Evaluation techniques will include behavioural measurements, Electromyographic (EMG) recording, Functional magnetic resonance imagining (fMRI) and user self-report.

Start Date: 2002-10-01

End Date: 2005-03-31

Duration: 30 months

Project Status: Execution

Project Cost: 2.58 million euro

Project Funding: 1.53 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Generic activities: Future and emerging technologies - Presence Research: Cognitive sciences and future media

Project Reference: IST-2001-38861

Contract Type: CSC (Cost-sharing contracts)

ITALY — Pisa

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Project:

Motorcycles rider simulator

Objective:

The aim of the project is to develop a two-wheeled vehicle simulator system. In the final system, the human operator will be seated on a mock-up of a two-wheeled vehicle. A screen in front of the operator and a special helmet will provide respectively graphical and acoustical representation of various simulated scenarios. The mock-up will be moved by an actuation system which will provide consistent inertial feedback. The operator will have the ability to exercise several control actions, i.e. steering, braking, throttling, and weight shifting, as on a real motorcycle. A model computational unit will perform the integration in the time domain of a complete set of non-linear dynamic equations of motion, providing the input values to a real-time system governing the control of the various subsystems of the simulator.

Work description: The mathematical model of the system dynamics will be completely parametric, so that it will be possible to use the simulator as a design tool. It will make it possible to acquire data on motorcycle manoeuvrability at the design stage, before making any running prototype. This will take into account not only the vehicle characteristics but also the rider's interaction and control, which very often play a crucial role.

Other forms of exploitation can be envisaged, including marketing and publicity, ride training, and human factors research, while some subsets could also be marketed as arcade games. The dissemination of the results should have various spin-offs, since the hardware and software tools that will be created could be used in various other industrial and research activities.

Start Date: 1995-12-01

End Date: 1999-11-30

Duration: 48 months

Project Status: Completed

Project Cost: 2.12 million ECU

Project Funding: 1.60 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Multimedia Systems Pilots

Project Reference: 20521

Contract Type: CSC (Cost-sharing contracts)

Subprogramme Area: Multimedia Systems Pilots

LATVIA — Riga

R&I Demo

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Project:

Virtual Open Air Museum

Objective:

The mission of the VIRMUS project is to narrow the gap between Internet users and the on-line virtual museum displaying 3D cultural heritage content. VIRMUS aims at introducing a novel way of 3D web page development for open-air museums and other institutions displaying architectural objects. The innovative aspect of VIRMUS is the use of commercially available 3DML that enables effective supplier-content-user interaction in cultural heritage applications. 3DML emulates HTML syntax. Therefore, first-time users can create 3D pages alongside their HTML pages using the same authoring techniques, images and sounds they already know and understand. The work of the VIRMUS project will be based on data gathering and processing leading to the 3D presentation of a virtual reality museum, as well as creation of an Internet portal www.eurohistory.net disseminating the experience gained to web users.

Objectives:

The objective of the proposal is to provide a way for ordinary museum web masters and Internet users with limited or no knowledge of 3D generating tools to create interactive virtual environments in three dimensions.

There are two basic tasks to be achieved during the VIRMUS project:

1. Create a virtual museum web page interface based on 3 DML modelled spots. Each spot will represent a fraction (courtyard) of museum buildings. Hyperlinks will lead users to other pages containing 2D and 3D information.

2. Establish an Internet portal (www.eurohistory.net) displaying a 3DML assembled virtual open-air museum as well as providing users with tools to create their own virtual environments of historic architecture characteristic to particular culture. VRML generated 3D objects, thematic textures.

Work description:

The work will be divided into three phases:

1. Data gathering. The majority of the data for the structure will be acquired during the on-site phase in the museum. Pencil sketches will be made of the entire exterior, which will be copied and number-coded to serve as a reference and checklist. Measurements will be made via blueprints and official sources. Digital cameras will be used to capture textures for the walls, roofs and other architectural elements of the buildings. Virtual panorama recordings will be carried out, as well as photo recording of the ethnographic objects later to be displayed in 2D and 3D.

2. Data processing and Interface development. The gathered raw data will be processed using Photoshop and Corel Draw software for image editing and texture creating. VRML and other 3D modelling software will be used to generate and process three-dimensional objects. Virtual panoramas displaying the inside of selected buildings, as well as exterior scenes will be created and edited by VR Panoworks. Web site interface will be created using 3DML as well as HTML applications. The consortium will be taking a solid and concise approach towards presenting the subject in a well-designed and user-friendly manner.

3. Evaluation and dissemination of the results. At the closing phase of the project the consortium will assess its outcome and publish the complete results of the work on the Internet at www.eurohistory.net. The results will be disseminated through thematic networks and directly to potential users of the trial experience - museums through professional associations, such as ICOM and AEOM.

Milestones:

- Gained experience about 3DML application for 3D interface modelling for cultural heritage purposes

- European Internet community building with emphasis on involvement of young people in cultural heritage field through a game-like interface.

- Wide dissemination of results across thematic and professional networks stimulating other pertinent institutions to take up the VIRMUS experience.

Start Date: 2001-08-08

End Date: 2002-08-07

Duration: 12 months

Project Status: Completed

Project Cost: 147562.00 euro

Project Funding: 114148.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Trials on new access modes to cultural and scientific content

Project Reference: IST-2000-28507

Contract Type: ACM (Preparatory, accompanying and support measures)

PORTUGAL — Lisboa

Instituto de Engenharia de Sistemas e Computadores

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Project:

Supporting Affective Interactions for Real-time Applications

Objective:

Although emotions were, for a long time, considered undesirable for rational behaviour, there are now evidences in neuroscience and psychology that place emotions as an important factor in problem solving capabilities and intelligence in general (Damasio, "Descartes' Error" 1994). As a result, a strong new field is emerging in computer science: affective computing, i.e. "computing that relates to, arises from or deliberately influences emotions" (Picard "Affective Computing", 1997). As humans interact directly with computers, it is critical for this interaction to be empowered with affective components that enrich it and make it more adequate for each individual user, but also provide "machine intelligence" with otherwise impossible capabilities.

SAFIRA will provide a framework to enrich interactions and applications with an affective dimension, bringing to the software community an enabling technology to support affective behaviour and control in real-time multi-agent systems interacting with users.

We intend to create a set of basic demonstrators of the potential of such systems: 2D and 3D virtual environments shared by synthetic characters and users, and "anthropomorphised" personality-rich personal service assistant based applications. Those demonstrators will explore the concept of a virtual environment improved by an emotional channel seamlessly integrated with the audio-visual representation of the environment. Multi-sensory interaction between participants projected cyber-selves, other participant avatars and the autonomous agents inhabiting the environment will be the means to evaluate the models developed during the project.

Objectives:

Main objective: to bring to the software community an enabling technology to support affective interactions.

1. To create a framework to enrich interactions and applications with an affective dimension.

2. To implement a toolkit for affective computing combining a set of components addressing affective knowledge acquisition, representation, reasoning, planning, communication and expression.

3. To verify under which conditions the hypothesis that emotion, as well as other affective phenomena, contributes to improve rationality and general intelligent behaviour of the synthetic characters, thus leading to more believable interactions between humans and computers.

Work description:

To achieve the main goal of SAFIRA we will research and develop along the three fundamental phases of affective computing:

1. The Affective Sensory for Autonomous Agents, where we will develop some affective sensing techniques mainly through the use of external objects (such as toys) and interpret the input from the user thought the development of techniques for affective user modelling.

2. Affective Reasoning, Planning and Learning, where the problem of embedding emotion and cognition in a machine (being it a synthetic character, an agent or even a robot) will be handled. This entails the development of techniques for affective planning, affective reasoning and decision making, personality and emotions development, learning and emergence.

3. Affective Communication and Expression, where new techniques for conveying emotions in a believable way will be developed. These three parts form the core research and also the components that will become part of an emotion-based architecture. We will integrate these components in a general toolkit that can be used in any application to achieve affective interactions with the users. To illustrate this use we will develop a set of concept demonstrators. Such demonstrators will be test cases for the verification of which conditions the hypothesis that emotion, as well as other affective phenomena, contributes to improve rationality and general intelligent behaviour of the synthetic characters thus leading to more believable interactions between humans and computers.

Milestones:

(M) Components for Affective Toys, (M) Affective User Modelling, (M) Affective Decision Making, (M) Affective Planning, (M) Affective Learning and Development, (M) Emotional Enriched Body and Facial Expression, (M) Affective Graphics.

(M) Toolkit and Framework for affective computing.

Concept demonstrators prototypes:

(M) Drawing Companion, (M) Fantasy World, and (M) Affective Personal Assistant.

(M) Evaluation of affective interactions.

Start Date: 2000-05-02

End Date: 2002-05-01

Duration: 24 months

Project Status: Completed

Project Cost: 1.56 million euro

Project Funding: 996292.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: ***Real-time*** and large-scale simulation and visualisation technologies - Large scale shared virtual and augmented environments

Project Reference: IST-1999-11683

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://gaiva.inesc.pt/safira

SPAIN	A Coruña

VideaLAB – Universidade da Coruña

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Project:

Museo Vacío / Empty Museum. Wireless Multiuser Immersive Virtual Reality System

Objectives:

The Empty Museum provides a distributed multiuser walkable VR space. Users wear an HMD and a light computer with high graphics performance in a backpack. It is combined with motion capture wireless systems and a wireless network.

This allows the user to experience a virtual space walking through it. This space can be shared with other users in the same physical space as well as in another equivalent space in a distant location. Other users are perceived in the virtual world by each user as avatars.

The virtual worlds are not only static 3D spaces, but can include 3D animated elements, video, 3D spatialized audio, etc. The user can interact with the worlds through his or her position or the direction looked at or by more complicated schemes, like gesture languages through hand movements.

The objective is to develop the complete system, including hardware integration, software development, contents design and its final installation in an exhibition to be tested with the general public.

Work description:

The project is being developed by a multidisciplinary team specialized mainly on architecture, computer engineering and arts.

The architecture of the system regarding hardware as well as software is divided in two parts: base and satellites. The base is the central computer with the control and synchronization tasks. It also captures the position of the users' heads and broadcasts it through the wireless network. The satellites are the mobile systems carried by the users, including the HMD, a computer and a tracker.

The project went through four different prototypes of the satellite. Several tracking systems, HMDs and laptops were tried. The 3D, multimedia and interaction engine was also

rewritten based on the conclusions from the first experiences.

Milestones:

1. Evaluation and selection of hardware components of the system. Survey of the state of the art and available devices. Building and integration of the first prototype of the hardware and software systems. User tracking and visualization of a test world.

2. Addition of dynamic elements, spatialized sound, multimedia information, and a first level of interaction. Formalization of these elements through VRML2.

3. Development of the first virtual worlds with contents specifically designed for this platform using VRML2.

4. Development of the multiuser system. Management of avatars and distributed information and synchronization of the users through the wireless network.

5. Development of multiuser worlds.

6. Redesign of the 3D and interaction engine. New engine is based on a high performance scenegraph library. Support for advanced features like shaders, particle systems, etc.

7. Development of new virtual worlds using the new available features.

8. Hand tracking integration. Development of interaction systems based on hands movements. Gesture languages. 3D content creation.

9. Development of new worlds with new levels of interaction. Applications to collaborative virtual art creation.

10 Development of Telepresence features for distant shared exploration of virtual worlds and collaborative virtual art.

Start Date: 2001-5-7

End Date: 2003-12-31

Duration: 31 months

Project Status: phase 8

Project Cost: 230.000 €

Project Funding: 230.000 €

Programme Type: R+D project promoted by regional government. Xunta de Galicia

Programme Acronym : N/A

Subprogramme Area: N/A

Project Reference: N/A

Contract Type: R+D Agreement Xunta de Galicia - Universidade da Coruña

Project URL: http://videalab.udc.es

SPAIN Barcelona

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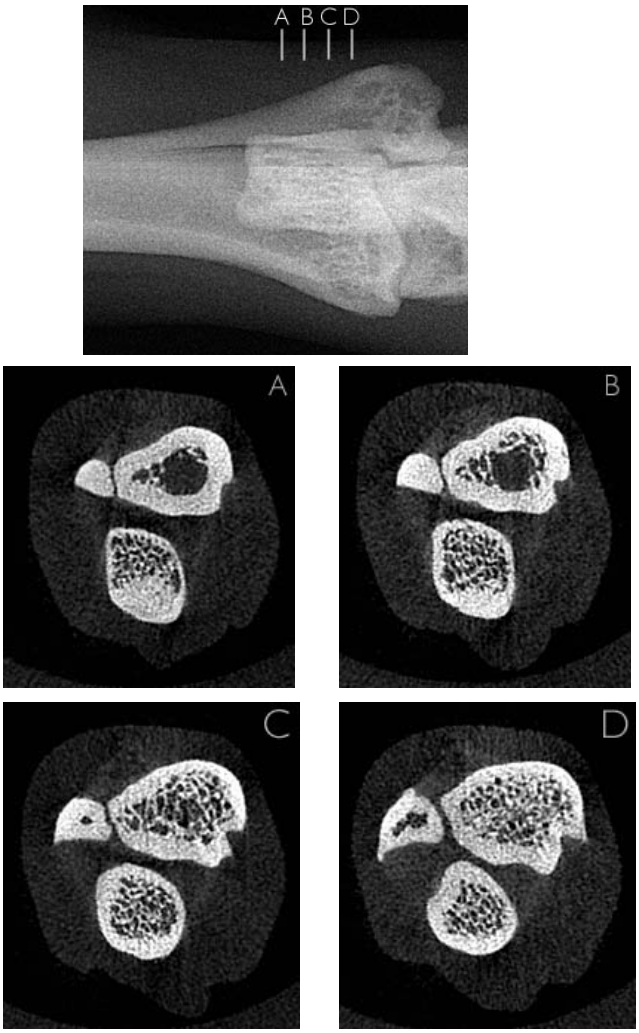


Project:

New materials and new technologies for bone regeneration and repair: 3D simulation of biomaterial implants into bone tissue.

Groups involved:

CREB: Biomaterials and Biomechanics division

CREB: Computer Graphics division

USC: Veterinary School

Objective:

The whole project objective is to obtain materials capable of simulating the regeneration and repair of injured tissues in order to restore their function. In this project rabbit femurs are used for experimentation.

The computer graphics subproject objective is to devise a 4D model of the evolution of a biomaterial implant in a rabbit femur. In addition we wish to prove that the analysis of this model can provide as much information or even more as conventional histological cuts do and then, to reduce the number of animals to be sacrificed in these kind of experiments

Work description:

The biomaterials group will develop adequate materials. For the regeneration, resorbable materials will be produced to stimulate bone tissue formation as they degrade over time. These kind of materials are porous glasses and calcium phosphate cements. For the repair, materials with specific mechanical requisites and velocity of degradation adjusted to the velocity of bone regeneration are needed.

Then, the veterinary group will implant these biomaterials into the femur of several rabbits which will be sacrificed at several time periods. The obtained samples will be analyzed by the biomaterials group by the microscopic observation of histological cuts. In parallel, images will be obtained via CT, RM or μCT of these samples. These images will be conveniently segmented and filtered in order to obtain a voxel model which will be tested in our software platform. Plannar sections of the model will be computed and compared with histological cuts using quantitative and qualitative parameters.

Then, we will devise a 4D or temporal model. Based on our previous developed models that

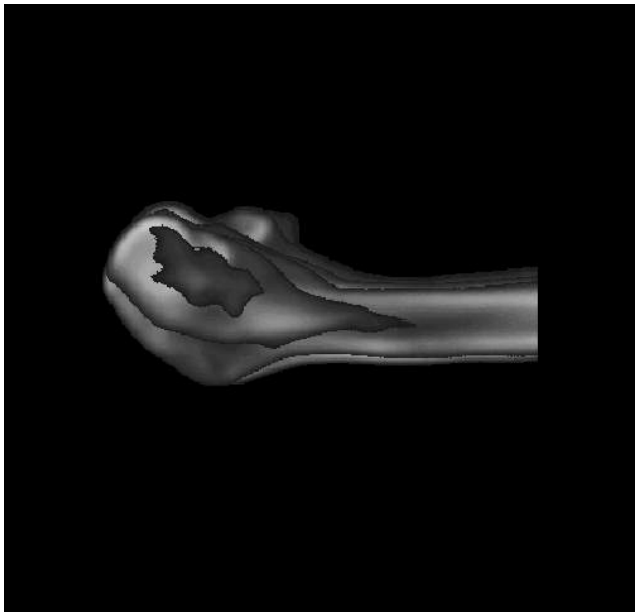
adequately represent and interrogate 3D volume medical objects and multimodal data, we will define and implement a temporal model representing the data. We will study and include compression strategies using temporal coherence and input/output optimizations.

Finally the results obtained with this model will be analyzed together with the Materials group in order to extract conclusions that will be used to improve the model and to define more interrogations.

Milestones:

The success of the results obtained from images compared to those obtained from histological cuts will allow to improve this kind of experiments. As we won't need to sacrifice animals, few animals will be used and we will be able to compute more cuts and more periods of time. Moreover the evolution of the material will be studied for the same animal.

The developed 4D model will allow to interrogate property values for each point at each time period as well as to extract isosurfaces and to visualize them ahd the whole model. It also will allow to perform interrogations related to this kind of experiments as the computation and visualization of different sections of the model, the separation and analysis of zones with different properties and the computation of several measurements directly from the model as the evaluation of the degradation of the implanted material and formation of new bone tissue.



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Start Date: 2003-01-01

End Date: 2005-12-31

Duration: 36 months

Project Status: in process

Project Funding: 100,880 €

Programme Type: National R + D

Subprogramme Area: Materials

Project Reference: MA2002-04297-C03-02

SPAIN — Barcelona

Polytechnical University of Catalonia (UPC)

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Project:

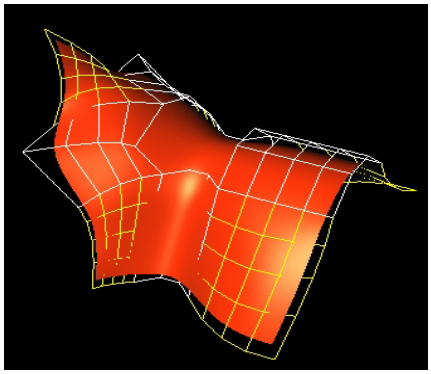
Multimodal modeling and rendering of the human brain

Objective:

The project addresses the problem of the integration, modeling and rendering of multimodal volumes, i.e. 3D images from different medical input systems. Specifically, its objective is to provide a geometrical model from Magnetic Resonance (MR) and Single Positron Emission Computed Tomography (SPECT), able to represent the anatomy of the human brain as well as its activity.

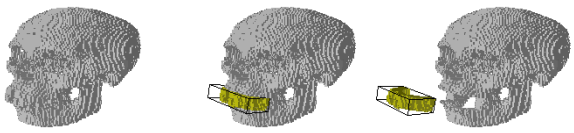
Work description:

The project is structured into five different tasks. The first problem addressed is the alignment of the images. A new intrinsic registration method has been developed based onto three steps: (i) surface extraction of anatomical and functional features from SPECT and MR images, (ii) alignment of the surfaces, and (iii) resampling of a unique multimodal model according to the different geometrical transformations computed. Related to this strategy, the second task of the project is the investigation of efficient surface extraction methods. Surface models computed applying the Marching Cubes algorithm and contouring plus tiling have been compared. In addition, a new tiling methodology has been proposed able to create triangle meshes between contours structured into adjacent labeled regions.

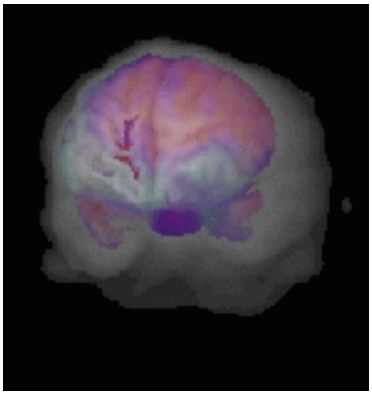


Triangle meshes extracted from volume data present two main drawbacks: their high memory requirement and their inadequacy to model free form shapes. The investigation of these two problems is the aim of the third task. In order to address the former problem, a new algorithm that produces Delaunay triangulations from dynamic sets of points has been proposed, which is applicable to internal points of cerebral regions. This algorithm has been extended to approximate a surface by triangulation, a strategy applicable to the brain surface. In addition, the application of the Extended Vertices Model (EVM) to represent discrete “cuberille” surfaces has been studied. Moreover, algorithms for the generation of a free-form surface from arbitrary topology have been proposed.

The fourth task concerns modeling multimodal data. The extension of the EVM to represent non-homogeneous multimodal data has been addressed. A hierarchical representation of the multimodal data based on fusion decision tree and run-length encoded voxel arrays has been proposed.



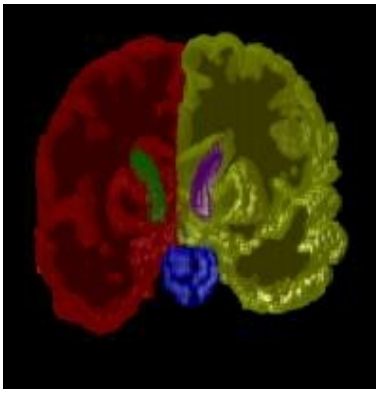
Finally, the fifth task consists of the proposal a framework for multimodal rendering that allows fusion to be done at five different steps of the rendering pipeline. The visual clues provided by these different modalities have been studied. In addition, the extension of current unimodal strategies to multimodal data has been analyzed.



Results

The main results of the project have been published as journal papers (8) and conference proceedings (13 international and 5 national).

In addition, the rendering techniques have been implemented in a software platform, HIPO, designed specifically to support multimodal data.



Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Completed

Project Funding: 46.000 euros

Programme Type: National R&D

Programme Acronym : Multimodality

Subprogramme Area: Communication technology

Project Reference: TIC99-1230-C02-02

SPAIN	Barcelona

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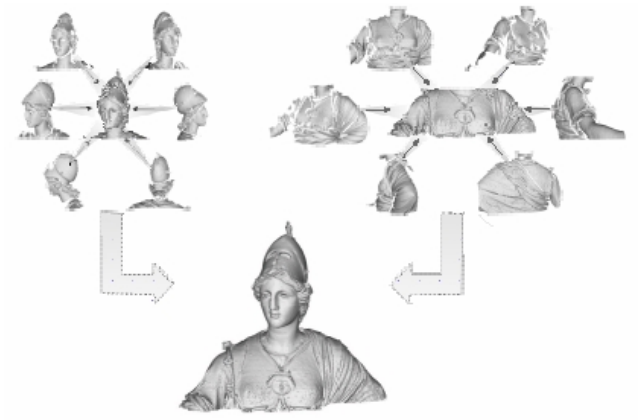
Project: ViHAP 3D

Virtual Heritage : High Quality Acquisition and Presentation.

Objective: To build and inspect virtual museums containing arrangements of digital works of art (3D sculptures) in a virtual space.



Work description: Different software tools will be produced within the project: advanced tools for data acquisition (geometry and precise data on surface appearance), mesh registration and merging, 3D model post-processing (including topology repairing and multiresolution of the produced models), a Virtual Museum builder for on-the-fly setup of virtual museums (including the arrangement of the virtual sculptures and the definition of virtual guides), a Virtual Museum Browser for interactive navigation and exploration (available for standard PC architectures and for low-cost affordable VR systems), and a Virtual Inspector for the visualization and inspection of single artifacts with maximum realism to be used as a scientific instrument for technicians

Results: First release of the software tools is expected during September, 2003.

.**Start Date:** March 1st, 2002

End Date: February 28th, 2005

Duration: 36 months

Project Status: Active

Partners: Max Plank Institute, CNR-Italy, UPC, Minolta, Gedas, SBAAAS - Pisa

Project Reference: IST 2001 - 032641

SPAIN Girona-Castelló-Barcelona

UdG-UJI-UPF

Organisations:
- Universitat de Girona (UdG)
- Universitat Jaume I (UJI)
- Universitat Pompeu Fabra (UPF)

Organisation Type: Universities

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Project:

Photorealistic Image Synthesis and development of interfaces for computer games

Keywords : Realistic Rendering, Computer Graphics, Computer Games, Man-Computer Interface, Virtual Reality

Description:

In this project the know-how of participant groups in areas of realistic rendering and multiresolution will be applied to the development of new techniques or to the adaptation of existing ones for their use in computer games. Given the closeness between the techniques used in computer games and the ones in virtual reality, the developed algorithms are likely to be also useful to the virtual reality field. Also, more realism demands the development of more sophisticated man-game interfaces.

The project is organized in three subprojects, Photorealistic image synthesis, Multiresolution modelling and Advanced interface design for computer games, being respectively responsible for each subproject University of Girona (UdG), University Jaume I from Castelló (UJI) and University Pompeu Fabra from Barcelona (UPF).

***Figure 1**. Image with obscurances*

Objectives:

The objective of each subproject is the following:

Photorealistic image synthesis

Objective: To obtain new methods and adapt existing ones of photorealistic image synthesis for their application to computer games and virtual reality.

Multiresolution modelling

Objective: To introduce new multiresolution models for real-time visualization of triangle meshes with continuous levels of detail to increase the visualization speed of complex scenes.

Advanced interfaces design for computer games

Objective: To determine requirements and development criteria to define new interfaces for computer games taking into account application and usability parameters.

Work description:

The work is organized around the completion of specific sub-objectives.

UdG is responsible for:

- non-physical or simplified simulation of the global illumination.
- automatic computation of the best trajectories for the exploration of virtual environments and reconstruction in Image Based Rendering.
- Use of simplified environments for the acceleration of the illumination calculation, and in its case, obtaining the illumination in real time.
- Use of coherence for the acceleration of the illumination calculation.
- To parallelize different algorithms of global illumination.
- Use of hardware in techniques of global illumination.

UJI is responsible for:

- Evaluation and comparison of existing multiresolution models.
- Full development of *Multiresolution Ordered Meshes* (MOM), a multiresolution model for triangle meshes (already developed in our research group).
- Testing MOM in a computer game engine.
- Development of new multiresolution models that improve the benefits of the existing ones using connectivity information. The base element of these models will be the triangle strip primitive, so that it will allow to have more compact and faster models in visualization and transmission.
- Development of specific multiresolution models for the representation of trees and plants.

UPF is responsible for:

- Study of the motion capture system as a input interface.
- Study of interfaces based on augmented reality for games.
- Study of the specific video capture as an input/output interface.
- Study of interactive narratives and their relation with Artificial Intelligence as a paradigm for the interaction between agents and characters in the game.
- Study of Artificial Intelligence topics and their relationship with computer games.

***Figure 2**. Multiresolution modelling for trees*

Start Date: 2001-12-01

End Date: 2004-11-30

Duration: 36 months

Project Status: In progress

Project Funding: ca. 150.000 euro

Programme Type: TIC (Information Technologies Programme)

Programme Acronym : TIC

Project Reference: TIC2001-2416-C03

Project URL:
http://ima.udg.es/iiia/GGG/TIC2001-2416-C03-01/

SPAIN	Girona, Zaragoza,Granada

Universities of Girona, Zaragoza and Granada

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Project:

CAD for Vial Security Elements Based on Illumination Simulation Systems

Objective:

The purpose of this project is to apply the methods and tools developed in previous projects to the design of CAD system for road-safety applications. This platform will use several different lighting simulation modules to take account of the different phenomena and circumstances to be simulated. The platform will allow the design of the different light sources present in typical applications such as street lighting design and headlight design as well as modelling and managing other elements involved (reflectors, traffic signs, bedrock). Besides, it will be capable of designing the different environments that may contain the previous elements as well as simulating them in both normal and adverse circumstances. Thus, the system will allow the simulation of media such as fog, rain, dust and snow.

Work description:

In this project we start from several software systems already developed for global illumination computation, realistic rendering and distributed CAD. These software platforms will be tailored and extended to meet the specific needs associated to road safety planning. The project work is structured in these tasks

1. System scientific and technical specification
2. Light sources design
3. Materials design and manipulation
4. Environment design
5. Visibility computation
6. Illumination simulation
7. Physical and psychological effects simulation
8. Virtual Reality/Simulation

Task 1 includes a detailed analysis of project objectives and platform precise specification. In tasks 2 to 4, we plan to define physical and computational models for road related objects, materials and lights. Tasks 5 to 7 are devoted to the production of software for simulation and computation of global illumination, and finally in task 8 we plan to produced an usable and integrated hardware and software system for driving simulation based on VR techniques, and enhanced with global illumination computation results.

Results

At the end of the project, we plan to have a working car simulator system which will run software capable of displaying realistic images of virtual road environments. The simulator will be usable for testing different road configurations, weather conditions, road element visibility, etc...

Thus the system will be useful for planning road elements and configurations in order to optimize safety long before the road is built.

Start Date: Dec-28,2001

End Date: Dec-27,2004

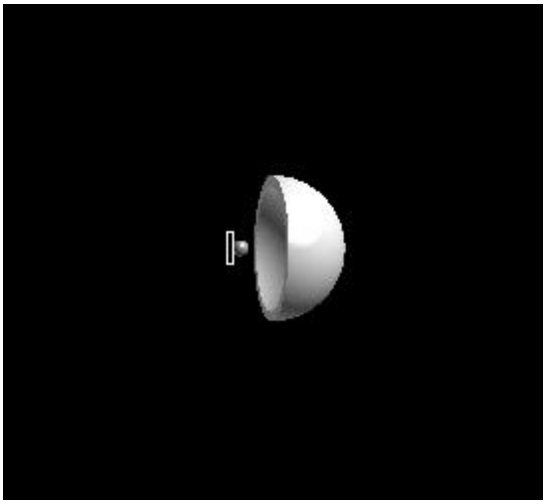
Duration: 3 years

Project Status:

At this moment, we are planning the adaptation and extension of existing software for global illumination to the specific needs introduced by our concrete objectives. We work on the definition of the interface between global illumination software and simulator software. We focus on various goals: the enrichment of 3d vr models with precomputed view-independent diffuse illumination information to be used in

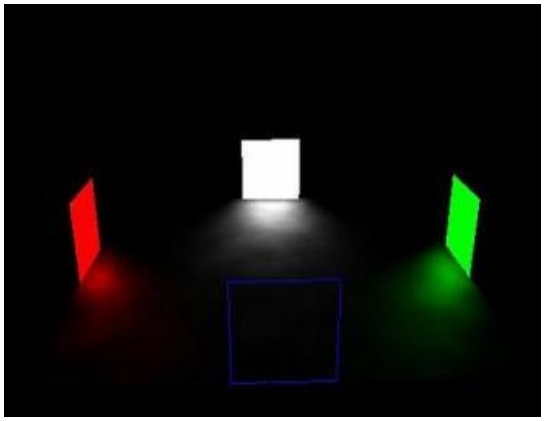
real-time displaying of environments and the precomputation of view dependent effects for realistic static images, such as non diffuse reflecting surfaces or scattering media. We also consider to include visual adaptation effects in hard lighting conditions, and evaluate the possibility to include real-time computation of view dependent effects.

This project includes implementation of software for simulation of car headlights in order to test the influence of headlight design onto road safety.



It also necessary to implement software for real time visualization of complex geometrical models including results from global illumination computation

We are also experimenting with techniques for real time visualization of view dependent global illumination solutions for non diffuse environments



Project Funding:

142.000 € (aprox.)

Programme Type:

Ministerio de Ciencia y Tecnología. Ayudas a Proyectos de I+D (Spanish Ministry for Science and Technology. Funding for R+D Projects)

Subprogramme Area:

TIC: Tecnologías de la Información y las Comunicaciones (Information and Communication Technologies)

Project Reference:

TIC-2001-2392-C03

SPAIN — Granada

University of Granada

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Project:

Progressive transmission of solid and volume models.

Objective:

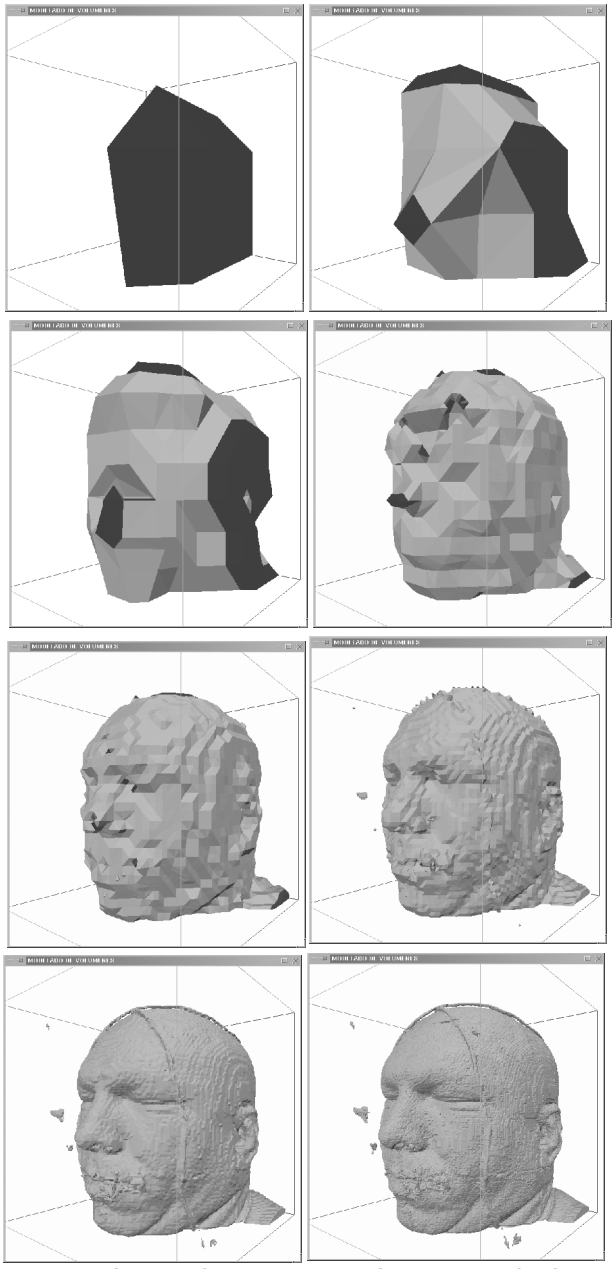
The project addresses the design of new solid and volume modeling methods for progressive transmission.

Work description:

Generally the teams of engineer involved in cooperative design are located at different geographic sites, so their cooperation is based on distributed information systems, that must transfer geometric models between sites. The use of large geometric models, and the access to geometric data throw the internet requires the use of multiresolution representation.

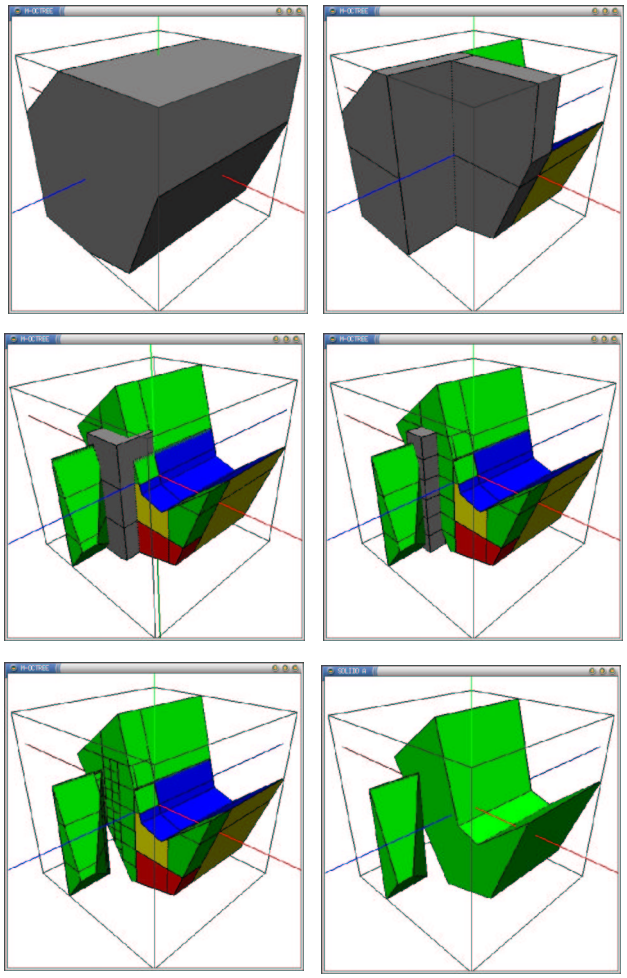
The project address approaches for the representation of different kind of geometric models: volume, polyhedral solid and free form solid. All the representation have a hierarchical structure that allows its use at different detail level, and facilitates its progressive transmission.

Cell octrees are used for the representation of volumes, that use bono as start point and, by a bottom-up process, prunes are done where some uniform gradient conditions are observed. On every prune, eight **brother** leaf nodes are forever pruned and their old **father** internal node is converted into a new leaf node. On every prune, the eight cells represented by the pruned leaf nodes are no longer accessible and a new bigger cell that is represented by the new leaf node is accessible now.



In order to do a progressive transmission of a cell octree, both the grid and the tree need to be transmitted by the server and received by the client. Moreover they need to be synchronized. With our proposal no extra information is needed to do the progressive transmission.

For the representation of polyhedral solid, a new representation, SP-Octrees (Space Partition Octrees) has been proposed. The model is based on the inclusion of boundary information in internal nodes that partially defines the object represented in each node of that level. Thus, the information of the boundary faces appears in the upper levels of the tree and



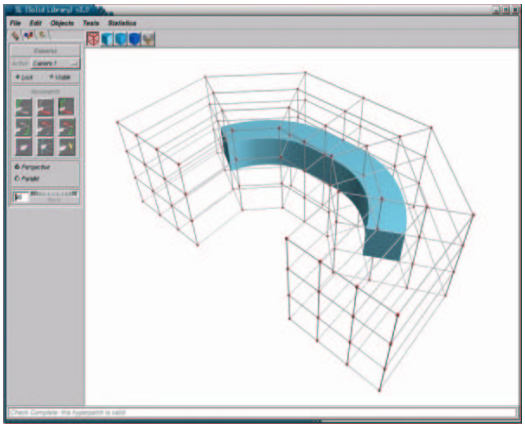
it is not necessary to repeat the information in neighbouring nodes that share a face.

We can use this structure to make a progressive transmission of the tree, level by level, so that the receiver of the model can visualize it and operate with it from the beginning of the transmission, without having to receive the complete model. For each level, we transmit the nodes of the Octree that represent the model and the information of the boundary planes that appear in each node of that level (the equation of the planes).

For the representation of free form solid we use volumetric dataset. A volumetric dataset is a special kind of non-homogeneous solid in which each point of its interior has a different property value varying continuously. Volumetric datasets can be used to model volumetric solids with smooth shapes. Hyperpatches can be used as a modeling tool with the advantage of being able to model the interior as well as the boundary surfaces. Also, hyperpatches can be edited easily by moving control points that make them suitable for inter-active design.

Results

Software tools that implement the solid and volume models representations have been implemented.



Some results of the project have been published as journal papers and conference proceedings.

Start Date: 2001-12-28

End Date: 2004-12-28

Duration: 36 months

Project Status: On going.

Project Funding: 78.700 euros

Programme Type: National R&D

Programme Acronym: PAMPECAD

Subprogramme Area: Communication technology

Project Reference: TIC2001-2099-C02-02

SPAIN — Jaén

University of Jaén

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Project:

Free-Form Solid Modeling. Multiresolution models

Objective:

There are problems using current CAD products when it is necessary to model free-form solids or polyhedral objects of complex faces. These deficiencies make those systems unable for manufacturing free-form solids or complex planar pieces, nor representing them in CAD-oriented virtual reality environments.

As it is not necessary to work always with a high level of detail in both virtual reality environments and real applications, multiresolution schemes are one of the research fields in which big efforts are inverted. These schemes allow to use not all but only the amount of information necessary for each problem to be solved.

In addition to the previous aim, it is necessary to develop tools that take advantage of current distributed systems, implementing efficient distributed algorithms for free-form solid modeling. This will make work in collaborative virtual environments, which is essential in complex organizations, easier.

The objective of this project is to develop advanced software tools to allow free-form solid modeling in CAD. Therefore it is necessary to appropriately solve all the geometric problems that appear in two dimensions and in triangle-based models, and then extend the developed solutions to make them able to deal with free-form solids.

Objectives:

Development of software tools based in parametric modeling and multiresolution for advanced CAD in distributed environments that allow collaborative design and manipulation of solids.

This general aim is detailed in the following specific objectives:

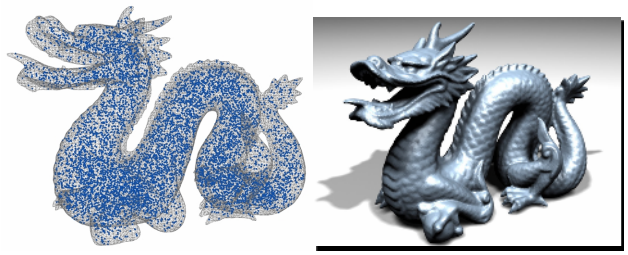
- Design of a software component for free-form solid modeling in distributed systems.
- Construction of a subsystem for CAD/CAM able to handle solids defined by geometric restrictions in multiview and multiresolution environments.
- Specification, design and implementation of methods for multiresolution representation of solids and volumes.
- Specification, design and implementation of conversion routines among the representation schemes used for the previous objectives and to virtual reality and prototyping languages.

Work description:

Geometric modeling based on triangular meshes has become a standard for developing multiresolution algorithms, specially since the appearance of low cost graphics hardware with support for efficient handling of this kind of data. One usual way of working with polyhedral solids is to decompose their faces in triangles; if the faces of the solids are modeled with parametric surfaces (like NURBS), they can also be approximated with triangle meshes.

Moreover, it is essential to have formal fundamentals as the basis of the whole modeling system, so that the necessary properties of validity, non-ambiguity and wide domain of the system can be assured, as well as the support for modeling techniques like B-Rep, CSG, octree or sweeping.

Solid modeling based on simplicial chains can properly solve usual modeling problems. In particular, it is possible to develop algorithms based on the point inclusion test for realistic and interactive visualization, conversion to other representations, operations with complex solids, etc. This must be one of the first steps towards the development of a free-form solid modeling system.



In addition, the extended simplicial chains scheme allows to model free-form solids and to construct complex models based on CSG using free-form solids as primitives. The algorithms for handling complex and free-form models will enable us to develop fast prototyping techniques, and to obtain essential conversion routines to migrate these models to virtual reality environments.

Start Date: 2001-12-28

End Date: 2004-12-27

Duration: 36 months

Project Status: In development

Project Funding: 84,658.56 €

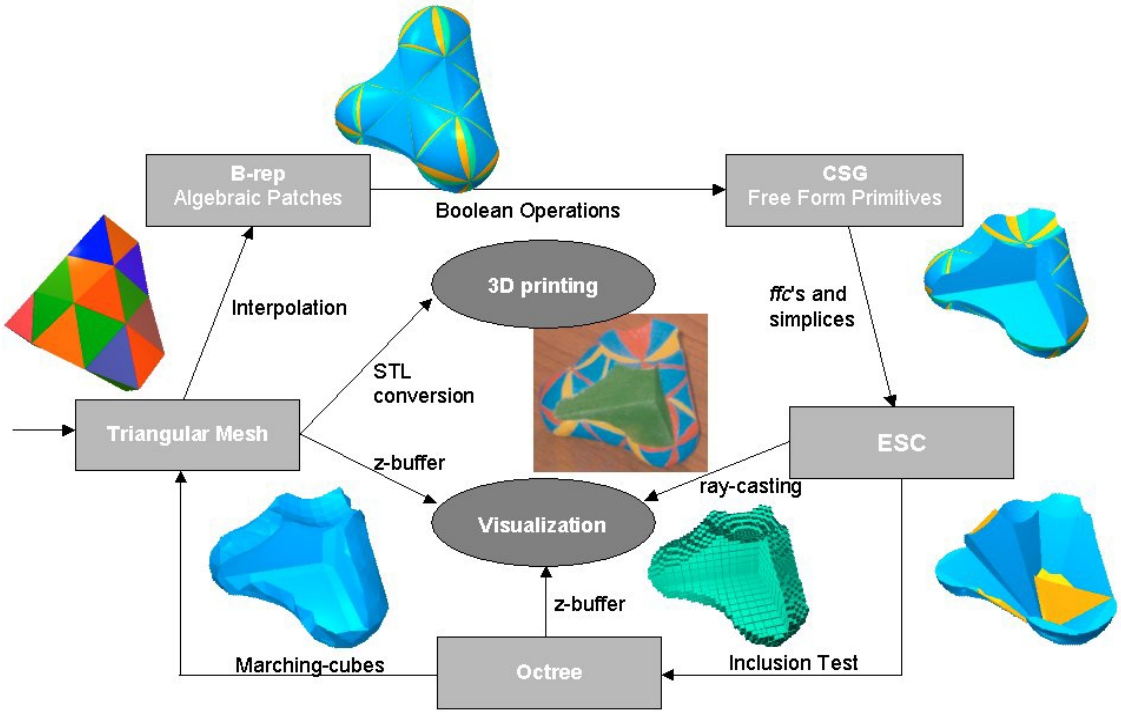
Programme Type: Ministry of Science and Technology of Spain and the European Union by means of the ERDF funds

Programme Acronym : PAMPECAD-JAEN

Subprogramme Area: Programa Nacional de Tecnologías de la Información y las Comunicaciones

Project Reference: TIC-2001-2099-C03-03

Project URL: http://wwwdi.ujaen.es/gigjaen



SPAIN Madrid

Algoritmos Procesos y Diseños

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Project:

Animation package for real-time simulation

Objective:

The aim of the project is to develop an animation package for the development of real-time graphic applications including games, simulation and virtual reality. It will be a fully integrated package which can be used to generate graphics which are optimally designed for speed and to define the context-sensitive behaviour of objects used in applications.

Work description:

The package will solve several problems that are encountered with current systems:

- Costs: Current systems run on expensive and dedicated platforms (workstations with high-cost/high-performance graphics cards). In contrast, the ARTIST package will run on a low-cost standard platform (a PC equipped with a relatively inexpensive rendering board). An interface will be provided to run on different graphics boards.

- Development time: Animation tools do not incorporate mechanisms for defining context-sensitive behaviour of objects. Virtual reality applications do, but they lack the modelling and animation features. Neither incorporates mechanisms for efficiently linking behaviour and animation. ARTIST will provide a means for defining both the graphics and the context-sensitive behaviour of objects used in a game, simulation or virtual reality application. It will also enable these two aspects of the application to be easily linked, saving development time and improving the product's functionality and consistency.

- Speed: Animation and modelling tools do not incorporate automatic optimisation algorithms for defining graphics databases. The ARTIST package will generate graphics database structures that are optimised for speed and which take maximum advantage of the graphics hardware.

- Risks: The current risk of being obsolete before reaching the market aimed for (e.g. games, virtual reality or simulation) is high because such markets (especially the games and virtual reality markets) are very dynamic. With current tools, development time is high and therefore time-to-market is as well. The bigger the gap, the bigger the possibility for the competition to introduce new products, gaining market share. ARTIST will reduce the risk involved in the development of new real-time graphics applications, enabling a shorter time-to-market and thus providing an advantage over competitor using traditional tool.

The tools developed in the project will be tested in the development of a 3-D real-time application incorporating a high degree of animation.

Start Date: 1995-11-01

End Date: 1997-10-31

Duration: 24 months

Project Status: Completed

Project Cost: 3.00 million ECU

Project Funding: 1.50 million ECU

Programme Type: 4th FWP

Programme Acronym : ESPRIT 4

Subprogramme Area: Multimedia Systems - Multimedia Technology

Project Reference: 20102

Contract Type: CSC (Cost-sharing contracts)

SPAIN Madrid

Eptron, S.A.

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Project:

Virtual Image-processing System for Intelligent Reconstruction of 3D Environments

Objective:

The objective of the project is to develop innovative computer vision technologies to be applied for the reconstruction of 3D environments with great accuracy and realistic appearance. Rather than spend hours of expert modelling jobs trying to build synthetic worlds, the aim of the project is to develop techniques that allow to extract 3D geometry and textures directly from a video stream. Due to automatic mapping of textures obtained from the video stream; the result would be a trustworthy 3D reconstruction of the scenario with the most realistic appearance current technology allows. The pilot application proposed to demonstrate the technology will consist of the simulation of a Virtual Museum in 3D. The reconstruction process of the museum will be based on a video capture session using conventional camcorders, just in the same way a home user would take a domestic video shot. No expensive devices or complex calibration are required.

Objectives:

The goal of current proposal is to push the limits of current computer vision technologies enabling the possibility to obtain realistic 3D reconstruction of scenarios from video streams using conventional camcorders.

Based on captured images, the computer vision algorithms will generate a simulation of the environment in 3D. The geometry and textures of the scenario will be directly extracted from the video stream through stereovision and applied to the 3D synthetic world for improved realism. The final result will be a real-like 3D environment with interactive capabilities. The user will be able to navigate, observe the scene from different positions, zoom-in in details and interact with the objects in the scene by means of hot spots. The 3D simulation of a famous museum has been selected as the pilot application to demonstrate the possibilities of the technology. The pilot application itself will become a marketable outcome.

Work description:

The project involves research and development activities in three areas: Computer vision, 3D visualisation and interactive user interfaces. All these contribute to build a novel data reduction tool where 3D geometry and texture information present in the real world is transferred to digital format by means of 3D computer scenarios with realistic appearance.

It is important to mention that the 3D models created by the system are not complex man-made 3D models generated by graphics Cad tools. The models obtained by the system are the result of a sophisticated Computer Vision process on real video streams that reflects with reliability the real aspect of the environment to be reconstructed.

The models will not show computer-like appearance or machine-like lighting. They will not have the appearance of brand new objects usually found in traditional computer graphic simulations but will demonstrate the real texture obtained from the video images. This means the 3D-reconstruction process will show most trustworthy state of the objects being reconstructed including possible time degradation or broken parts.

Computer vision activities play a crucial role in the project. They will be based on current expertise on related subjects, but an important research effort is required in areas such as: stereo vision, 3D view registration, feature

extraction, tracking, auto-calibration, fusion of range and intensity data and structure from motion. Maybe one of the most innovative aspects of the project lies in the research effort required to extract, analyse and compute 3D geometry from moving video data. Being a demanding task, motion analysis is a basic component for a successful implementation of project objectives.

But the success of the project will relay not only on the computer vision algorithms but also on the 3D reconstruction procedure itself. The basic idea is to avoid the time consuming effort required to model by hand each element of a 3D scenario. The objective is rather to devise a semiautomatic method that will directly translate the 3D information contained in a 2D video stream acquired using conventional camcorders into useful digital data.

The VISIRE project will comprise the following activities: Image acquisition, feature extraction, feature tracking, calibration, image registration, geometry correction, Euclidean 3D reconstruction, texture mapping, image based rendering, user interface and production of the contents of the museum pilot application.

The foreseen sequence of activities to be performed for a 3D reconstruction session is as follows:

The user takes one or several free hand video shots around the scenario he desires to reconstruct.

The acquired images are taken to the laboratory where the 3D reconstruction tools builds the real-like synthetic 3D environment. Images from the video stream are analysed, the 3D geometry information of the objects appearing in the scenario is recovered and textures are mapped after appropriate geometry correction.

As a result of processing the video data, the 3D modelisation of the site is obtained. The target application for the project will consist of the simulation of a famous museum, but the techniques to be developed within the project can also be applied with little extra effort to a great variety of applications like 3D simulations of buildings, archaeological sites, public works (bridges, motorways), topographic 3D reconstruction of terrain, tele-shopping services. The final result will consist of a synthetic real-like 3D world where any computer manipulation will be possible. The 3D model of the museum will be digital and will support all the possibilities of digitally built environments but it will also support real-like textures taken from the original images. The user will be able to navigate through the different parts of the museum, watch the exhibition cabinets, focus his attention on special details, choose his poin.

Milestones:

The 3D reconstruction tools. A complete software environment that allows Multimedia professionals to build realistic 3D models of the interior of buildings. The tools use as input a set of video sequences and produces the finished 3D models in VRML format.

The simulation of a famous museum in Florence. As part of the work foreseen in the project the 3D reconstruction tools will be tested by building the 3D simulation of a famous museum in Florence. The resulting multimedia production will be used for promotion and dissemination. It could be considered also the possibility to commercialize the finished model. Current alternatives for the museum include Museum of Science in Florence, Museum of Technology in Milan, Uffizi Gallery and Palazzo Vechio.

Start Date: 2000-05-01

End Date: 2003-04-30

Duration: 36 months

Project Status: Execution

Project Cost: 2.49 million euro

Project Funding: 1.40 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interfaces making use ***of*** the various senses - Adaptable multi-sensory interfaces

Project Reference: IST-1999-10756

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.eptron.es/projects/visire/

SPAIN	Madrid

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Project:

Trade Fair Web - based Information Services

Objective:

The main objective of the project will be to develop a web-based "virtual winery" which will be used to promote and commercialise selected European wines. A pilot application will be built for a wine maker in Rioja.

The system will provide a 3D paradigm to access the information, using technologies like VRML and MPEG-4, so that the visitors can access a 3D representation of a winery, which will integrate digital information of several kinds.

The consortium is composed of 5 highly complementary partners from 4 different European Countries: a wine producer, a multimedia content developer, a 3D graphics expert, a legal expert, and application developer.

Objectives:

This project FAIRWIS (Trade Fair Web-based Information Services) aims at offering on-line innovative services to support activities of trade fairs and a possibly unlimited number of exhibitors, organized in Web-based virtual fairs, in order to improve the efficiency of European SMEs and facilitate job creation.

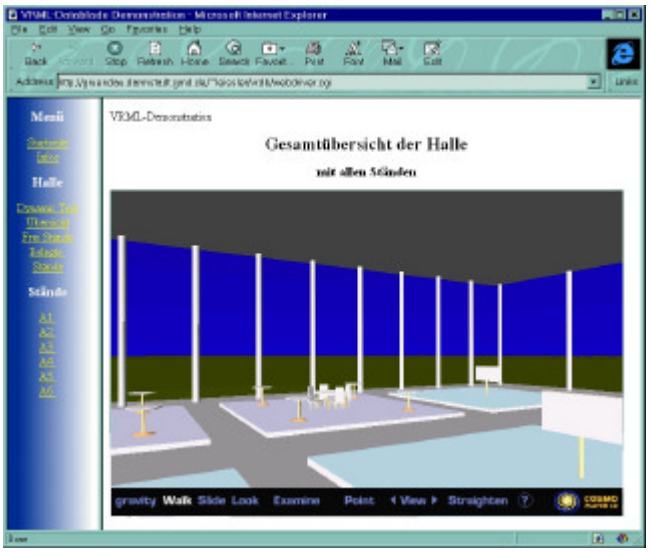
Two closely related software systems will be created and validated:

1) a supporting system of trade fair events, called Real Exhibition System (RES), which is accessible in-loco by exhibitors, operators, visitors, etc. of a trade fair

2) Virtual Exhibition System (VES), supports and manages a permanent on-line virtual trade fair, which is a permanent on-line system, accessible via Internet.

By enhancing Trade Fair information systems, and providing several innovative services on-line, the project will allow comprehensive and focused visibility of SMEs within markets, without the need to make large investments into advertising, thus improving the economical European development

Work description:



FAIRWIS (Trade Fair Web-based Information Services) is a prototype system that aims at offering on-line innovative services to support the activities of trade fairs as well as the activities of a possibly unlimited number of exhibitors, organized in Web-based virtual fairs, in order to improve the efficiency of establishing business contacts. The way in which business contacts are obtained in the proposed approach is a new one, because the whole concept of trade fairs is extended to an electronic form. Visualization techniques exploiting different paradigms, including virtual reality, will be used in order to improve the user interaction with trade fair information systems. Moreover, the

interaction environment is capable to adapt to the many types of user that will have access to the system. FAIRWIS is a research and technological development project. The proposed tasks will conclude with validation and evaluation of the emerged technical solution. After defining the FAIRWIS final prototype and its potentialities, a new set of actions as accompanying measures and own efforts should be done with end and intermediate users in order to extend the use of suitable tools and project outputs in general.

Milestones:

Validation and evaluation of the emerged technical solution will be provided. Prototypes for both RES and VES will be produced and evaluated with users. Modules implementing innovative services, such as on-line customer analysis; on-line customer satisfaction; direct marketing; user profile management, will be produced. Such modules will be also integrated in the FAIRWIS prototype; European conference, seminar and workshops for concentration actions with Trade Fairs and SMEs about IS.

Start Date: 2000-01-01

End Date: 2001-12-31

Duration: 24 months

Project Status: Completed

Project Cost: 2.42 million euro

Project Funding: 1.40 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Management systems for suppliers and consumers - New market mediation systems

Project Reference: IST-1999-12641

Contract Type: CSC (Cost-sharing contracts)

Project URL:
http://www.darmstadt.gmd.de/delite/Projects/FAIRWIS/

SPAIN — Palma de Mallorca, San Sebastián

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Project:

HUMODAN IST-2001-32202 (An automatic human model animation environment for Augmented Reality interaction)

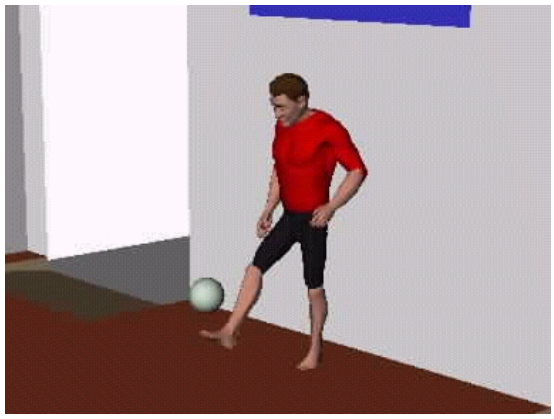
Objective: The objective of the project is to design, develop and set up an innovative system for automatic recognition and animation of human motion in controlled environments. The most relevant and distinctive feature of this system with respect to existing technologies is that the individual being recorded will not wear any type of marker or special suit and neither will other type of sensors.

By this way this system will be highly useful in a wide range of technological areas, like for example TV production, tele-presence, immersive and collaborative interactivity storytelling, medicine diagnose support, tele-operation, education and training.

The innovation and challenges of the project rely both in the recognition system to be developed and in both real-time and non real-time applications that such a system will allow.

Principal goal of HUMODAN project is to produce efficiently, realistically and with low cost the virtual animation of an individual by means of processing only a sequence of images recorded from different cameras and avoiding the use of sensors, markers or special suits. The project addresses following objectives:

- To obtain automatically and rapidly (real-time in some applications) a realistic animation of an individual using a sequence of images from recorded from different cameras.
- To use robust biomechanical analysis.
- To develop specific networking applications, interfaces and plug-ins
- To produce an easy-to-use, user-friendly tool
- System will be easier and cheaper to use. Also, and possibly more important, with respect to future new application areas in which the slowness of the process and the necessity of markers are actual main limitations that prevents from using motion capture technology.



In the basis, it will be developed an innovative system for recognition of human motion based on the most modern techniques of image processing, analysis and synthesis. Besides, the system will be enhanced to recognize and analyze other biped and no-biped beings, like for example pet animals, robots, etc. In addition, system will be able to focus only in a part of the body but with high detail, like for example the hands or the face.
To ensure the widest range of applications, the individual recorded will not wear any type of marker or special suit. To this end, biomechanical models will be constructed using a hierarchical and articulated structure in order to establish a correlation between each structural element of the biomechanical model with the analytical characteristics of the images obtained using different views. Innovative shape or part recognition techniques will be applied. The biomechanical model will include a knowledge database to retain high-level information of the motions.
The biomechanical model will also require developing specific kinematics and dynamic models, and analysis and synthesis tools to support firstly the

recognition phase and later the reconstruction and animation phase.
To make the system usable it will be also necessary to develop specific applications and plug-ins to integrate the animation into end users tools such as digital TV production software, animation software and virtual environments like a CAVE.

Objectives:

The objective of the project is to design, develop and set up an innovative system for automatic recognition and animation of human motion in controlled environments. By this way this system will be highly useful in a wide range of technological areas, like for example TV production, tele-presence, immersive and collaborative interactivity storytelling, medicine diagnose support, tele-operation, etc.Within this context, the project aims to acquire the **knowledge** and to enhance the **technology** to advance current state-of-the-art in recognition and reconstruction of human motion, biomechanics models, and visualisation of human motion in virtual environments.

The main objective, exposed above, will be attained by means of the following concrete objectives:

- To develop a new system of human motion recognition. The system will be based in **computer graphics shape recognition techniques** as opposite to current techniques based on tracking markers or using sensors. In this way, the performer being recorded can wear normally and a special suit with either markers or sensors will be **no longer necessary**. Moreover, the system will be enhanced to recognise other biped and no-biped beings
- The fundamental aim is to obtain a 3D model of the person or persons by means of a sequence of grey and/or colour images taken from different viewpoints. With this information we aim to carry out different tasks such as: realistic animation of a person, biomechanical study of sports or dance movements, recognition of a person (face and movements), integration of a virtual humanoid with real characters, interaction in a person and humanoid immersed environment, robot tracking of a person, etc.
- To obtain **automatically** and **rapidly** a realistic animation of a person using a sequence of images from recorded from different cameras.
- To unify robust biomechanical analysis technology with this new automatic motion recognition system to be developed. This will require developing a biomechanical model of the player or performer. The biomechanical model will include a knowledge database to retain high-level information of the motions. The biomechanical model will require developing specific kinematics and dynamic models and analysis and synthesis tools to support firstly the recognition phase and later the animation phase.
- To make the system usable it will be also necessary to develop **specific applications, interfaces and plug-ins** to integrate the animation into end users tools such as digital TV production software, animation software and virtual environments like a CAVE. To this end, all developed software from the different system's components will be integrated using adequate interfaces in order to be able to comply with networking applications and real time requirements.
- This research will produce an easy-to-use, user-friendly tool, which will in fact **enable it to be used in areas, which were restricted up to now, such as TV post-production**.
- In addition to the above considerations, authors want to point out the **economics benefits** expected from this system, which in facts constitutes a main objective of the project as well. The system will simplify the use of human motion reconstruction technology, basically by avoiding markers and sensors and by doing it rapidly, even in real-time, and automatically.

Work description:

The workplan of the project extends in duration of 30 months and is structured in six workpackages in charge of the technical work of the project and one workpackage in charge of the project management activities. The structure has been decided to impose a gradual increase of the complexity of the technical work carried out.

Start Date: 2002-09-01

End Date: 2005-5-31

Duration: 30 months

Project Status: In progress

Project Cost: 3.67 million euro

Project Funding: 1.83 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Project Reference: IST-2001-32202

Project URL:
http://dmi.uib.es/research/GV/HUMODAN

SPAIN — San Sebastián

CEIT

Organisation: CEIT
Organisation Type: R&TD
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Project:

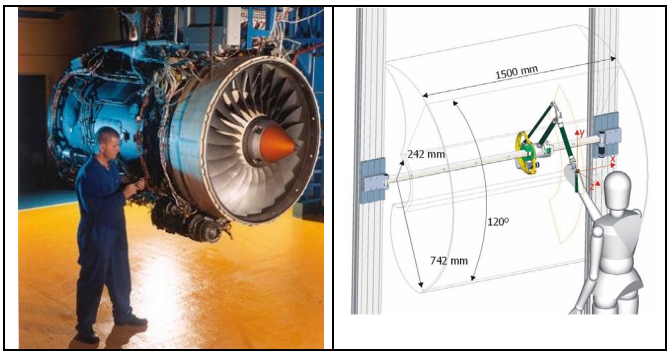
Revima (Development of a virtual reality tool for the simulation of assembly and maintainability processes)

Objective:

REVIMA (Virtual Reality for Maintainability) is a virtual reality system for maintainability simulation in Aeronautics. Within this project we have developed and integrated a new haptic device with a virtual reality system. Through this device we track hand movements and provide force feedback within the large geometric models that describe aircraft engines. Using our device the user movements are the same ones that are done when testing physical mock-ups. This fact provides an enhanced sense of real manipulation and can lead to important reduction in costs in the development of new aircraft engines.

Objectives:

The REVIMA Haptic is designed to have 6 DOFs of data input so that it can serve as a position controller to a virtual model of a tool in a 3D scene. However, only 3 of these DOFs are driven, so only a directional force can be sense by the end user.
The REVIMA Haptic device is designed with the size of an aircraft engine in mind. These engines are usually quite big (3-4 meter long, a 1-2 meter radius), and the haptic decice's working volume size must be quite big, specially along the axis of the engine. The design of the haptic deals with this problem by having a long horizontal guide.

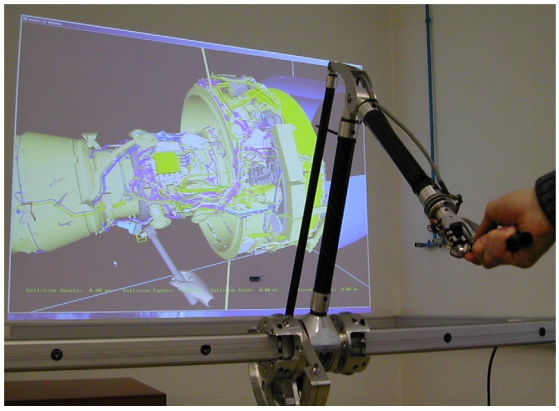


Complex mathematical calculus help avoiding troubles with the inertia of the arm, so that the end user is not required to exert a big force in order to move the haptic, in a true operation a worker would not end exhausted by moving a screwdriver.
The main goal of REVIMA is the simulation of a maintainance operation as realistic as possible. To achieve this goal a number of subgoals must be satisfied:

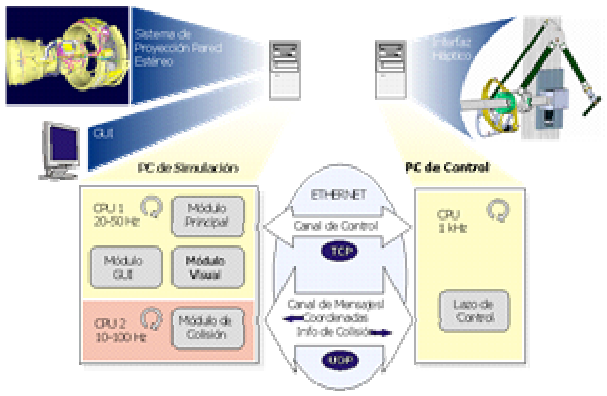
- REVIMA must be able of rendering a complex 3D environment, formed by thousands of parts wich are build from thousands of triangles themselves (An average scene can have over 2000 parts and 2 million triangles).
- It must be able to import the geometric data for every part from a CAD system using standard file formats such as VRML 2.0.
- It must be able to read the structure of the aircraft system being analyzed from a standard product structure database from a CAD system.
- The system must be able to load tools (to simulate maintainance operations) from a database during operation and move it freely around the scene.
- REVIMA must be able to calculate interactions (collisions i.e.) between the parts and tools used during a virtual maintainance operation and the scene.
- REVIMA must be able to give visual and force feedback of the interactions.
- The force feedback and 3D input device must have a large working volume, as close as possible to that of an aircraft engine in shape.
- The user must be able of saving a maintainance simulation, and repeting it.

Work description:

REVIMA is a haptic system developed to check the maintainability of aircraft engines. The system has been created from scratch by CEIT Applied Mechanical Department. This is a multidisciplinary development that includes, amongst others, the following disciplines: mechanical design, control theory, computer graphics, computational geometry and human-machine interaction.
The research involved in the project concerns two main areas: mechanical design and software development. Both of them deal with important challenges since system maintenance simulation needs to be very close to reality.



One of the main targets of the mechanical design was that the workspace of the device should match that of an aircraft engine. At the same time, any haptic device had to have low inertia. Both requirements have been achieved by combining mechanical design with significant sensible use of a force sensor. The need of large workspace was established by ITP to perform ergonomic studies.
In turn, software development has involved the integration of a fast control loop that reflects force to the operator, the evaluation of collisions, and the visualization of the scene. The two last tasks are especially difficult because of the enormous size of the model.



Milestones:

- REVIMA attempt to avoid the problem of the construction of a physical wooden mock-up. This mock-ups are extremely expensive and when a fault is found, a new mock-up can be required.
- REVIMA is a tool designed to work just between the design and the physical mock-up construction, aiding to discover maintainability issues earlier and thus saving money by reducing the amount of physical mock-ups required.

But due to the first design goal, a two others can be easily achieved:

- REVIMA can serve as a training tool aiding workers to have a better knowlege of what operations must be accomplished to performe a certain maintance operation
- REVIMA cas serve to design to design this maintainance operations by providing hints of what steps must be followed to get a certain system well maintained.

REVIMA is built by two tools, a hardware tool, namely a haptic device, and a software tool wich work together to achieve the goal of helping to discover possible maintainability issues.

Start Date: 1999-07-01

End Date: 2002-04-30

Duration: 36 months

Project Status: Completed

Project Cost: 1.46 million euro

Programme Type: Cooperative Project of the Basque Country Government

Project Reference: CI01TP03

SPAIN — San Sebastián

CEIT

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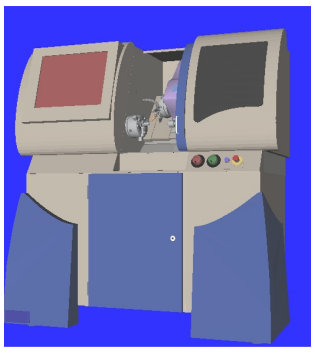
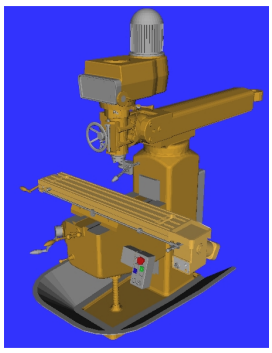
Project:

VIRTOOL – Virtual Manipulation to Simulate Machine Tool's Processes.

Objective:

The objective of the VIRTOOL project is to design and develop a computer-supported learning environment for machine-tool (conventional and CNC) processes by using interactive 3D graphics and virtual reality techniques. This tool specially focuses on the training aspects relating to machine-tool. However, the software integrates an easy to use pre-processing part that helps defining and generating new models of machine-tool and digital libraries of accessories. New learning material can be prepared in order to build a complete database of learning stages.

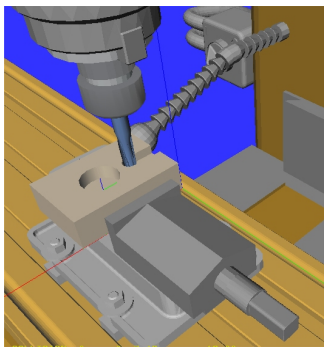


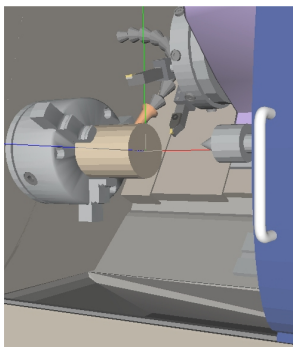


The cost of the real machines, their availability and las but not least the safety conditions make the use of VIRTOOL relevant.

VIRTOOL-machines offer the learner different possibilities to define the machining process, mount the workpiece, select parameters, orientate the cutting tool, select the security elements, set-up the tool, operate the machine, and finish the process.

Errors will occur as naturally as they occur in real live machinery and will be simulated as dramatically as it is technically possible to show the learner the possible results of misconceptions or wrong operations.





Objectives:

In order to achieve the main objective of developing this learning environment, it is necessary to prepare different machine tools, elements and the pedagogical material.

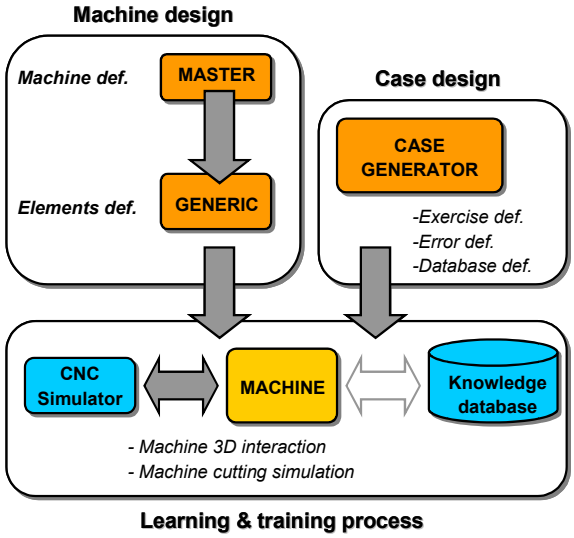
The first task is to define the geometry and kinematics of the machines as well as properties of some elements like levers, wheels or buttons.

Secondly, both parameters and geometry of accessories like cutting tools, holders or mounting elements should be specified. Once the technical data has been prepared, the next step will be to define the learning case material that contains a set of conditions, errors, help material and the optimum process.

Finally, it is necessary to integrate all this both technical and pedagogical data in an application that offers learners the interaction with the machines and its elements and produces the correspondent response.

Work description:

VIRTOOL is a software tool formed by four applications: Master, Generic, Case Generator and Machine. The first three applications constitute the preprocessing step.



Firstly, VIRTOOL Master generates machine-tool models, both conventional and CNC, that is, it builds the kinematic definition for each machine and assigns this definition to the different assemblies or parts of the whole machine. The geometric parts are imported from CAD applications. On the other hand, VIRTOOL Generic allows machine-tools manufacturers and professors to generate specific elements or accessories libraries for different machines. Cutting tools, holders and fixtures, mounting tools or measurement tools are some examples of these accessories. The last application of the pre-processing step is VIRTOOL Case Generator, where teachers produce cases or exercises according to the learners' knowledge and generate the knowledge database that later will provide feedback in VIRTOOL Machine.

VIRTOOL Machine, which is based on virtual reality techniques, is the final application to be used in the training process. This application offers the learners a wide range of different interactions by using two and three-dimensional computer interfaces. It imports the machine and elements definition from Master and Generic, and the case information from VIRTOOL Case Generator.

Milestones:

Even though the project has not finished yet, the next achievements have been carried out:

- Virtool Master can build different machine tools like conventional and cnc lathes and milling machines or planar grinding machines.
- Virtool Generic produces a broad catalog of elements that can be found in a real workshop. These elements can be stored in a general catalog and thus, the user can reuse elements for other machines.
- Virtool Case Generator provides instructors the possibility to define a complete learning case with help material, the objectives and requirements of the case. It is possible to define an open case or either an optimum process with the conditions and errors.
- Learners can use Virtool Machine to perform set-up and machining operations. It is possible to produce operations for example like drilling, slots or longitudinal turning.

Start Date: 2001-04-01

End Date: 2003-09-30

Duration: 30 months

Project Status: Unfinished

Project Cost: 1.35 million euro

Project Funding: 675000 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Cooperative Research Contract

Project Reference: IST-1999-55018

Contract Type: CRAFT

Project URL: http://www.virtool.com

SPAIN	Sevilla

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Project:

On Line Interactive Mechanical Parts 3D-data base

Objective:

Using VRML modelling techniques, HTML, XML and Java languages, the aim of this project will be the development of data bases for small manufacturing companies that have assembling processes distributed in several locations, and in general, using parts from distant providers. The databases would contain the 3D parts representation and the ways they interact to get the final assemble. The software developed will let designers and engineers have a tool for distributed design via Internet, being possible to interact with different parts in the same way as having the parts themselves, in a user-friendly environment, low computer resources consuming. As a core part of the project, the different possibilities and uses of virtual reality interactivity and 3D webs applied to mechanical parts representation and assembling will be introduced in this kind of small companies through a wide plan of information and dissemination, first in Spain.

Objectives:

Using these VRML modelling language and Java, the aim of the project will be development of data bases for small manufacturing companies that have assembling processes that could be distributed in several locations or using parts from distant providers. Final objective will be to demonstrate the benefits to small manufacturing firms of the adoption of 3D interactive representation technologies through a controlled and well-focused experiment. We will make best use of several currently existing and available technologies, but in the context of a well-defined project a real business case of a small steel works company that will improve its representation techniques, precision and accuracy.

Work description:

WP1 - Management of the project, including Administration and co-ordination of project resources; keeping a good level of communication within the Consortium; Interface with the European Commission; General Monitoring and control of the work plan;

WP2 - In depth analysis of needs and requirements of the industry: design, manufacturing and commercialisation processes in the factory and integration of the new representation techniques. A detailed project scheduling the programming and modelling tasks to the completion of the data base will be developed;

WP3 - Mechanical parts modelling and programming of assemble sequences. Data base programming and implementation as a 3D-web with different access possibilities;

WP4 - Installation, test and validation. The database is implemented and offered to the professional users (designers, engineers) and general users (customers). It will be validated in a real industrial environment;

WP5 - Dissemination and diffusion. This is one of the main parts of the project. The objective

will be to enlarge the field of application of the initial results, which will allow a transfer and adaptation of the methods to other sectors, other geographical areas and other public addressees. The software tools developed during the project are expected to be exploited after its end. New versions will be released and a detailed plan of commercial exploitation will be developed.

Milestones:

Milestone 1. Month 4. Analysis and definition of industrial requirements completed;

Milestone 2. Month 10. First draft of the line interactive database finished;

Milestone 3. Month 13. Database installed and working, integrated in the manufacturing process of the end user, training of staff performed and test cases started;

Milestone 4. Month 18. Diffusion activities and exploitation plan performed; End of the project; Final Report.

Start Date: 2001-12-01

End Date: 2003-05-31

Duration: 18 months

Project Status: Execution

Project Cost: 402317.00 euro

Project Funding: 396312.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interfaces making use of the various senses - Advanced interfaces - take-up measures

Project Reference: IST-2000-31121

Contract Type: ACM (Preparatory, accompanying and support measures)

SPAIN — Valencia

Universidad Politecnica de Valencia

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Project:

Virtual Reality Surgery Training System

Objective:

Training is a key issue in any task. Surgery training is even more critical since inexperience could lead to fatal consequences. Cadavers lets trainees to get experience in general tasks, but they are an expensive resource and lack of reproducibility. Moreover, dead tissue is usually harder, and arteries or nerves do not react. Virtual Reality (VR) can solve these problems. VR has succeeded in areas such as flight simulation, architecture or chemistry. Complexity of human interaction has prevented surgical simulation to grow up. New VR devices simulate touch sense and high-performance computing (HPC) enable to use on a real-time basis accurate Finite Element models from real pathologies. This project proposes a VR simulator, mainly focused to maxillo-facial surgery. It will enable the user to hold real surgical tools attached to force-feedback devices which will simulate the haptic sense.

Objectives:

At technical level, the objectives are:

- To implement numerical parallel algorithms for the FEM model processing.

- To integrate the haptic devices to simulate the force feedback of the surgery intervention.

- To design a surgery training scenario.

At business level, the objectives are the following:

- To reduce the costs that imply the use of cadavers.

- To improve the quality of the training by means of automatic evaluation and repeatability.

- To be able to train on specific interventions in which cadavers are not useful.

- To be provided with a flexible tool that can be dynamically updated to many surgical subjects.

Work description:

Virtual Reality (VR) environments can help surgery training overcoming these constraints. The real feeling can be fairly simulated, and the possibility of working with models from real pathology images and the ability to redo actions can complement the skills of the trainees. This project proposes to create a VR visualisation system to simulate the interaction of tissues and surgical tools, mainly in specific areas such as maxillo-facial surgery. The proposed simulator will enable the user to hold real surgical tools to touch, probe, grasp, cut and suture anatomical structures. The surgical tools will be attached to force-feedback devices, so the user can feel the tissues during interaction. Soft tissues deformation and bone interaction can help extremely surgeons to improve their techniques to reduce the esthetical impact on the patient's face. To increase the reliability of the models, very large real medical images will be used. To provide real-time interaction, which is crucial for surgery training, a parallel computing visualisation kernel will be used in the project. Soft and hard tissues will be modelled using Finite Elements-like (FEM) techniques. These numerical techniques are very computing

intensive, but an extensive work has been done to reduce the processing latency by means of parallel computing. Surgery tools will be provided of spatial positioning devices to provide with the 3D interaction. Moreover, the system can be extended with stereoscopic images, combined with the proper glasses will provide the immersive feeling required for a complete training. To implement the VR medical surgery training system. The hardware required is composed of a large-screen monitor, a High-Performance PC-based Cluster for medical image rendering and one or two haptic devices. The system will use a surface rendering visualisation algorithm. The experience of the consortium in efficient medical image processing has been proven in previous projects.%

Expected Result:

A VR Surgical Simulator for maxillo-facial surgery with high-quality realistic graphics and haptic feedback with a cost under 45KEuro.

Milestones:

MR1. (PM8): The surgical case to be used for testing must be completed.

MR2. (PM12): A first prototype of the parallel system for the simulation of tissue deformation and the prototype for the haptic feedback must be ready

MR3. (PM14): The MR2 prototype should be completed.

Achievements: The project has leaded to the implementation of a general purpose VR surgery simulator that is customisable for any patient's anatomy, provided of the appropriate medical images. The system runs on real-time on high-performance standard PCs and do not have very expensive requirements.

The system provides haptic feedback for training motor skills and uses advanced methods, such as Boundary Element Methods for a realistic simulation of the deformation of the organs. Camera position can be controlled by 3D localisers.

The project ended-up with 3 modules for obtaining models of the organs from medical images, building-up scenarios and simulating the intervention.

The dissemination of the project has been performed in 5 events and 6 publications. The end user has tested the system on several cases and has positively reacted to its future adoption. Navimetric is planning both renting the simulation facilities for laparoscopy surgery courses and setting-up complete installations.

Start Date: 2000-11-01

End Date: 2002-04-30

Duration: 18 months

Project Status: Completed

Project Cost: 206273.00 euro

Project Funding: 182086.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Large scale shared virtual and augmented environments

Project Reference: IST-1999-20783

Contract Type: ACM (Preparatory, accompanying and support measures)

SPAIN — Vizcaya

Fundacion Labein

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Project:

Authoring Mixed Reality

Objective:

AMIRE is about the efficient creation and modification of mixed reality (MR) applications. Generic design recommendations and procedures, best practice examples, interface specifications, MR gems, MR components, MR frameworks, dedicated MR authoring metaphors together with authoring tools (that are MR applications themselves) will be developed in order to efficiently use MR in applications, to conceive new MR methodologies and exploit synergies when combining MR technologies in the AMIRE framework, and to establish authoring as a new application domain for MR. Two demonstrators (a training application for an oil refinery and a museum application together with MR authoring tools) will be implemented. The first by a group of experts in order to derive an initial version of AMIRE, the second by a consulting company as a kind of experiment in a business scenario setting that will seamlessly lead to an exploitation of AMIRE.

Objectives:

The objective of AMIRE is to enable people, not only expert researchers, to use Mixed Reality (MR) for their applications as well as to create and modify these MR applications with the support of dedicated tools that foster an efficient authoring process for MR. This is the key for a more widespread use of MR, for a transfer of MR into different application domains, for exploiting synergies between different MR methodologies and for establishing authoring itself as a new application domain for MR. With authoring tools that employ MR, users are given means to efficiently communicate their ideas. An objective of AMIRE is also to set up and exploit a business scenario where a MR provider (MRP) produces MR content for a customer. Using AMIRE it is aimed that the MRP has key advantages over his competitors (e.g. faster content production, delivery of dedicated MR authoring tools). Besides, an objective of AMIRE is to trigger and to contribute to standardisation efforts in the field of MR.

Work description:

In order to reach the objectives, three main work tasks need to be accomplished. Firstly, a best practice example has to be elaborated that shows how MR content can be produced efficiently and how a dedicated authoring application for the user of the MR content can be produced. The approach taken is to identify characteristics of MR methodologies and describe a common infrastructure, employing state-of-the-art software engineering techniques. Besides, the usage of MR technology for authoring tools is examined.

Thus, the best practice example consists of the software of two actual demonstrators as well as generic design recommendations and procedures, interface specifications, dedicated MR authoring metaphors, MR gems and MR components. Secondly, demonstrators need to be built that show the benefits of having an authoring tool beside the MR application itself. In AMIRE there will be demonstrators for an oil refinery training application and an application for the Guggenheim museum. Thirdly, evaluation results need to be derived that show how consultants and content developers can use the AMIRE project results and what economical implications there are if they choose to offer services in the production of content that makes use of Mixed Reality technologies. The project is organized in four phases. First, a

group of experts will build the first demonstrator and according authoring tools, incorporating the ideas of the AMIRE approach. Second, learning from the process of building the first demonstrator, a first version of design recommendations, interface specifications, and authoring process descriptions will be derived. They are handed over to a consultant who is experienced in building multimedia applications, but not MR applications. Third, the consultant will build the second demonstrator. This process will be reviewed and evaluated. The results will be fed back to AMIRE. Fourth, the overall project results of AMIRE will be compiled.

Milestones:

The expected milestones and results are the following ones:

- A production process for developing and modifying MR content with design recommendations;

Specifications of MR gems, MR components, MR frameworks and dedicated MR authoring tools along with best practice examples how to employ them;

The specifications are aimed to be partly used as a basis for MR standardisation;

Two demonstrators with MR authoring tools; Evaluation reports based on experiences with companies using AMIRE, business models and commercialisation strategies.

Start Date: 2002-04-01

End Date: 2004-06-30

Duration: 27 months

Project Status: Execution

Project Cost: 3.60 million euro

Project Funding: 2.16 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities and new imaging frontiers

Project Reference: IST-2001-34024

Contract Type: CSC (Cost-sharing contracts)

SPAIN Zaragoza

Grupo de Informática Gráfica Avanzada (GIGA)

Organisation:

- Grupo de Informática Gráfica Avanzada de la Universidad de Zaragoza.
- MEDTEC S. A.
- Unidad de Hemodinámica y Cardiología Intervencionista. Grupo del Hospital Clínico de San Carlos de Madrid.
- Unidad de Hemodinámica y Cardiología Intervencionista del Hospital de Badalona.
- Grupo de Biomecánica de la División de Mecánica Estructural de la Universidad de Zaragoza.
- Grupo de Mecánica de Medios Continuos de la Universidad Politécnica de Madrid.
- Grupo de Mecánica de Fluidos de la Universidad Politécnica de Madrid.
- Centro de Visión por Computador de la Universidad Autónoma de Barcelona.

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Project:

MOTRICO project. Three-dimensional modeling and simulation of the coronary arteries.

Objective:

Presently, cardiovascular diseases are the first cause of death in Spain among people from 75 and the second one among people between 15 and 74.The MOTRICO project plans the creation of an advanced environment that will offer computer assistance to cardiac therapy and diagnosis. It will be useful in the hemodynamics units of those hospitals that have the possibility of working with the instrumental techniques of Angiography and Intravascular Ultrasound (IVUS).

Objectives:

The MOTRICO project plans the development of an advanced environment that will offer computer assistance:

- For constructing an anatomically realistic model of segments of the human vascular system. This three-dimensional geometric model is generated on the basis of the information obtained by means of the fusion of angiograms and intravascular ultrasound images (IVUS).

- For simulating blood flow through arteries in order to calculate the wall shear stress distribution in these arteries.

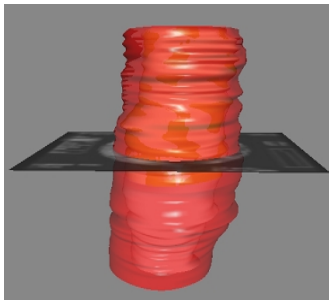
- For allowing the user to interact with the system as friendly, quickly and intuitively as possible using virtual and augmented reality techniques.

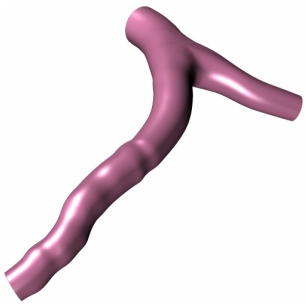
Work description:

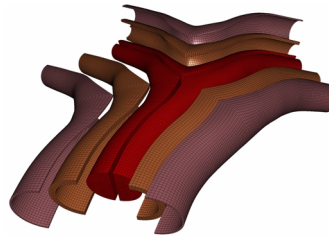
From the medical images (obtained using Angiography and Intravascular UltraSound techniques -IVUS-) of segments selected from the coronary tree, the three dimensional geometry of the area will be reconstructed and the distribution of forces and deformations will be calculated both at blood-wall interaction (shear stress) and at the walls of the arteries. Moreover, the project seeks the validation of the hypothesis that relates these stresses -fundamentally the shear ones- with the development of the atherosclerosis and postangioplasty restenosis and the application of the developed model to humans and animals. In humans, a model of patients with accelerated atheroesclerosis (situation after cardiac post-transplant) and a model of restenosis after stent implantation will be studied. In both cases the relation between biophysical factors and the development of atheroma and/or restenosis will be analysed. The procedure to obtain the biophysical factors that is proposed in this project is based on the application of simulation techniques to blood circulation inside the arteries, using Computational Fluid Dynamics methods.

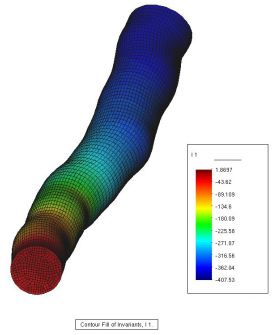
The simulation of the proposed phenomenon is extremely complex, because it comprises not

only fluid dynamics but also disciplines such as the ones related to the behaviour of the biological soft tissues and to the contact between the fluid and the solid. To make all the previous aims possible, it is necessary the construction of a geometric three-dimensional model of the anatomic zone under study. The proposed environment will allow the generation of the model from the sequence of IVUS images and angiographies and the possibility of obtaining quantitative volumetric measurements. To fulfil these goals, several problems related to Computer Vision and Computer Graphics have to be solved.









Milestones:

The MOTRICO project has developed a comprehensive framework to enable the conduct of computational vascular hemodynamics research. The prototype system in development will provide a set of tools to solve clinically relevant blood flow problems and test hypotheses regarding hemodynamic factors in vascular adaptation and disease. The laboratory orchestrates the interactions between an object modeler, finite element mesh generator, multiphysics finite element parallel solver, and scientific visualizer. The result is a four step process for solving vascular blood flow problems:

- Model Construction. Geometric models of the human left coronary artery bifurcation have been produced. These computational geometric model has been developed on the basis of real anatomical information. In this idealized bifurcation model, a LAD vessel segment has been replaced with a real 3D reconstruction of the same segment. This reconstruction has been developed on the basis of the information obtained by the fusion of angiograms and intravascular ultrasound images.

- Mesh Generation. Five finite element meshes have been generated for the adventitia, media and intima layers of the vessel wall and for the arterial lumen of the geometric models.

- Finite Element Solution. The solution to blood flow problems is computed with appropriate behaviour of the difference artery material models.

- Visualization and Information Extraction. A qualitative view of the flow field is obtained through contour and vector slices, streamlines, isosurfaces and particle release methods.

Start Date: 2000-12-28

End Date: 2003-12-27

Duration: 36 months

Project Status: Execution

Project Cost: 0.25 million euro

Project Funding: 0.25 million euro

Programme Acronym : TIC

Project Reference: TIC2000-1635-C04

Project URL: http://amelia.cps.unizar.es:90/

SWEDEN — Stockholm

Kungl Teckniska Hoegskolan

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Project:

Electronic arenas for culture, performance, arts and entertainment

Objective:

Characteristics and goals of the eRENA project include the following.

- A focus on developing inhabited information spaces in which all participants can be mobile and socially active. Thus, audience members as well as performers and artists will be able to explore, interact, communicate with one another and participate in staged events.

- Directly addressed issues of scale. Through concepts such as dynamic crowd aggregations, the electronic arenas will eventually support hundreds or thousands of simultaneous participants, bridging the gap between current small scale, real-time communication technologies such as video conferencing and current massive-scale non-participative broadcast technologies such as television.

- Integration of artistic, technical and social perspectives. This represents a fresh and important approach to the development of information technologies and will result in highly engaging and interactive interfaces and underlying systems.

- A potential use by every citizen, representing a potentially large future market for IT

- The project is structured around underlying research challenges, which involve three topics:

- Production - addressing the spatial and temporal structuring of electronic arenas

- Participation - addressing the representation and behaviour of different participants in electronic arenas, including humans, agents and crowds

- Interaction - addressing navigation, unencumbered interaction and new forms of "mixed reality" boundaries between real and virtual space

Work description:

The Erena project is focused on inhabited information spaces to support new forms of cultural experience spanning arts, performance and entertainment. We refer to these kinds of spaces as electronic arenas. In eRENA long term research is involved into a range of "spatial technologies", especially multi-user virtual environments, coupled to new forms of artistic content and an understanding of social interaction.

Milestones:

The eRENA project will publicly demonstrate and evaluate the results of these research challenges through thematic spaces which provide specific examples of electronic arenas. Initially, these thematic spaces will be based on the extension of the traditional cultural forms of galleries, performances and television. In the longer term, however, we will explore entirely new cultural forms appropriate to this new medium of expression. The research challenges and thematic spaces are brought together in a detailed three year workplan.

The outcomes of eRENA will include: new techniques for individual and mass participation in producing and shaping the content of virtual arenas; new ways of structuring electronic arenas so as to afford different modes of interaction, navigation and communication in different virtual spaces or at different stages of an event; powerful new techniques for embodying humans and agents in electronic arenas; mechanisms to support dynamic crowd aggregations, including crowd representations and mechanisms for managing crowd membership; new ways for groups and individuals to interact with shared and projected displays; technical support for building structured mixed realities out of boundaries between real and virtual space; and finally, the demonstration of these techniques through a series of public exhibitions and performances which are complemented by networked experiments.

The eRENA consortium brings together internationally known digital artists from ZKM and GMD; experts in multi-user virtual reality and computer animation from EPFL, Geneva, Nottingham, KTH and GMD; social scientists from Nottingham and KTH; broadcasters from Illuminations and KTH; expertise in CAVEs and other projected interfaces from GMD and BT; and networking expertise from BT.

Start Date: 1997-09-01

End Date: 2000-08-31

Duration: 36 months

Project Status: Completed

Project Cost: 2.99 million ECU

Project Funding: 1.70 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Proactiveness

Project Reference: 25379

Contract Type: ACM (Preparatory, accompanying and support measures)

Project URL: http://www.nada.kth.se/erena/

SWEDEN — Stockholm

Kungliga Tekniska Hogskolan

Organisation: Kungliga Tekniska Hogskolan
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Project:

SHAPE - Situating Hybrid Assemblies in Public Environments

Objective:

SHAPE is devoted to developing and evaluating assemblies of hybrid, mixed reality artefacts in public places. Hybrid artefacts exhibit physical and digital features and can exist in both physical and digital worlds. They combine interactive visual and sonic material with physically present manipulable devices. Hybrid artefacts can combine to form room-sized assemblies that provide groups of people with a rich sensory experience of a large-scale mixed reality. These assemblies can be deployed in public spaces such as museums and exploratoriums as new kinds of engaging and educational social experience. The consortium combines social and computer science expertise and is concerned to motivate innovation through studies of people's activity in public places and techniques of participatory design. 'Living exhibitions', where results are shown direct to the public, are planned at selected European museums which have agreed to participate.

Objectives:

The objectives of SHAPE are:

1. to explore hybrid artefacts and the various relationships that are possible between physical and digital manifestations, and create prototype demonstrators;

2. to examine and construct organised assemblies of hybrid artefacts within room-sized environments as a means for delivering a thematically integrated, yet rich, social experience;

3. using social scientific methods, to study and develop a detailed understanding of the activities of members of the public as they engage with exhibited artefacts in public places such as mus

Work description:

SHAPE is proposed as a three year project with 225 person-months of total effort distributed across five workpackages and four partners with complementary skills and roles. The project will map out different ways of linking physical objects with digital representations so as to develop a typology of hybrid, mixed reality artefacts. We shall construct assemblies of hybrid artefacts at different levels of scale and explore means for managing inter-artefact communication in ways, which link low-level protocols with applications. The project will establish an archive of empirical materials collected at a variety of public places such as museums and exploratoriums. We will analyse the methods employed by visitors as they interact with exhibited artefacts and each other.

On the basis of empirical analysis, a design framework for informing the development of hybrid digital-physical artefacts will be produced. We intend to create, through participatory design with personnel from collaborating museums, two public exhibitions demonstrating technologies developed in the project as a means of integrating project results across partners and evaluating emerging technologies in practical, public settings. A series of workshops is proposed to reflect on the progress and methods of the project and to consolidate its results for dissemination. The project involves a number of innovative management strategies, designed to increase the involvement of 'grass roots' researchers in project planning, while promoting the internal mobility of researchers within the consortium, thereby instantiating some of the wider features of the Disappearing Computer program within the project (e.g. 'research troubadours').

Start Date: 2001-01-01

End Date: 2003-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 1.92 million euro

Project Funding: 1.92 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: P1: The disappearing computer

Project Reference: IST-2000-26069

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.disappearing-computer.net/projects/SHAPE.html

SWEDEN — Stockholm

Kungliga Tekniska Hogskolan

Organisation: Kungliga Tekniska Hogskolan

Organisation Type: Education

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Project:

Video Browsing Exploration and Structuring

Objective:

Video is a rich source of information. It provides temporal and spatial information about scenes. However, this information is implicitly buried inside the raw video data, and is very inefficiently organized. While the standard sequential frame-based representation of video data is adequate for viewing in a "movie mode", it fails to support rapid access to information of interest that is required in many emerging applications. VIBES proposes new content-based representations of video data, which explicitly emphasize the geometric, photometric, and dynamic components of information. In particular, VIBES will develop methods for rapid video search, hyper-linking, re-animation and view synthesis, which will enhance the content and enrich the experience of video sequences.

Objectives:

Video provides continuous coverage of scenes over an extended region both in time and in space. That is what makes it more than a plain collection of images. In VIBES, our objective is to make video a first class data type, which can be searched on content, annotated, hyper-linked, and edited much as text can be now. Furthermore, video has many more modes of information than simple text. For example, it contains scene geometry and extended actions over multiple frames.

Our objectives are also to extract and use these "modes". With these aims, VIBES proposes new ways of exploring and using video that have the potential of leading to significant breakthroughs in video consumption and new industrial, commercial, and home entertainment applications. The tools we develop will enable cut detection, indexing, synthesis, and classification of non-static and non-rigid scenes.

Work description:

The project contains eight interlinked workpackages investigating two main themes:

1. Rapid browsing and retrieval: A video or a DVD will be automatically augmented with hyperlinks connecting shots containing a particular actor, type of action, or scene. E.g. all scenes inside the casino in "Casablanca". Such facilities will change the way in which video is addressed, significantly reducing the tedium and inefficiency of current serial video browsing.

2. 3D scene synthesis and human animation models: 3D scene geometry for virtual reality environments will be automatically generated for particular shots. E.g., the yellow brick road in the "Wizard of Oz" could be reconstructed, and a viewer could then walk down it using VR together with virtual actors. 3D dynamical models of actors from classic movies will be learned and used to generate new scenes involving the actors -synthetic thespians- or to replace one actor by another. For example, replace the "hero" in Home Alone or Toy Story by a texture mapped dynamical model of your son or daughter.

Milestones:

YEAR 1: Simple video unit segmentation. Feature based matching between shots. Simple object recognition. 3D scene models of shots. Simple within-shot human tracking.

YEAR 2: General video unit segmentation. Multi-shot matching. 3D scene models from multiple shots. Advanced human modelling and tracking. Initial hyper-linking demonstrator.

YEAR 3: Classification of action and certain object and scene types. Sequence-to-sequence alignment. Merging human models from multiple shots. Final web-based hyper-linking and video synthesis demonstrators.

Start Date: 2000-12-01

End Date: 2003-11-30

Duration: 36 months

Project Status: Execution

Project Cost: 2.31 million euro

Project Funding: 1.68 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Generic activities: Future and emerging technologies - FET O: Open domain

Project Reference: IST-2000-26001

Contract Type: CSC (Cost-sharing contracts)

UNITED KINGDOM — Bristol

University of the West of England - Bristol

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Project:

Virtual Archive and Library for Cathedrals

Objective:

The objective of this project for a Virtual Archive and Library is to develop a prototype for Web based historic collections based on the 3D model as a metaphor of a Cathedral building with an underlying multimedia database. This objective will be achieved in three stages: digital recording of selected data and artefacts (WP1), creation of a database containing an enhanced catalogue of metadata with multimedia records of artefacts (WP2) compiled with and accessible through an interactive portal / 3D VRML model generated from MapInfo (GIS) system and the Pavan VRML authoring system. The prototype will represent an invaluable complement to the viewing of the collection, add to the visitor experience and develop a methodological framework for Web views of site based historic collections, which can be applied to others. Delivery of the prototype via the Web will accommodate local and distributed users groups and allow alternative views of the data and the historic collection.

Objectives:

The primary objective of the project is to develop a prototype for Web based historic collections where an interactive 3D VRML model as a metaphor of the place is integrated with an underlying multimedia database providing a portal for exploration and retrieval of data. The purpose of the prototype is to improve and provide an integrated access to the historic collection through a user-friendly interface in the form of a 3D model, as well as to set up a new framework and methodology for recording and designing a multimedia database for historic collections. Although the project is based on the example of a Cathedral in Wells (Somerset, UK) it will trial novel digitising methods and computer technologies in order to create a methodological framework which once evaluated can be applied as an improved methodology for recording, managing and presenting any historic collections of a similar type and scale in Europe on the Web.

Work description:

To achieve the objectives of this Take-Up Action the project has been organised into six workpackages.

WP1 - Create a digital record of selected data and artefacts from the Cathedral inventory.

WP2 - Design a multimedia database for publishing on the Web

WP3 - Create and publish interactive a 3D Web based model based on Wells Cathedral and its environs

WP4 - Measurement and evaluation of the prototype.

WP5 - Dissemination and exploitation.

WP6 - Project management.

The first three work-packages will involve the design, development and integration of the prototype:

create a digital record of the selected artefacts and records form the Cathedral's Archive and Library;

design a sustainable multimedia database for publishing on the Web;

design and integration of search facilities: linking of the database with digitised records with a 3D VRML model - create an interactive 3D VRML model of the Cathedral and its environs.

Survey data will be entered into a GIS, a 3D model generated and integrated with the underlying multimedia database. The 3D model will provide visual and technological access to the historic collection and allow exploration of the record.

Work-package 4 is the evaluation and measurement of the prototype. In this work-package archivists and librarians from Europe, together with computer specialists and generalist focus groups will be brought together, both physically and virtually to exchange views, to evaluate the prototype and appraise the benefits and difficulties of broader implementation.

Work-package 5 is the publishing/ dissemination and exploitation package. The proceedings, the evaluation and analysis of the project as well as the reports will be published on the prototype's Web site.

Work-package 6 is project management which aim's to ensure the project is well managed. It will ensure that high quality outputs are delivered, the timetable is followed and the limit of the budget is not exceeded. It will be organised around 4 key actors: The project co-ordinator UWE, Bristol, Wells Cathedral, the Steering Committee and the Advisory Board. This work-package will also ensure that all relevant information is passed on the European Commission.

Milestones:

A digital collection of the data and artefacts

-A sustainable database of the record with integrated search facilities for publishing on the Web Improved and enhanced access to the collection which will minimise visitors damage to fragile objects

-A methodology for digital recording and retrieval of information for historic collections

-A prototype Website capable of adjusting and expanding, applicable to historic collections

-Evaluation, appraisal of benefits and difficulties in creating the prototype via seminars to the users ranging from scholars to the general public.

Start Date: 2001-09-01

End Date: 2002-08-31

Duration: 12 months

Project Status: Completed

Project Cost: 208654.00 euro

Project Funding: 109689.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Trials on new access modes to cultural and scientific content

Project Reference: IST-2000-28673

Contract Type: ACM (Preparatory, accompanying and support measures)

UNITED KINGDOM — Cheshire

National Nuclear Corporation Limited

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Organisation Type: Other

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Project:

Virtual Reality Cultural and Heritage Information Portal

Objective:

The VRCHIP Project involves the application of virtual reality (VR) modelling technology to the dissemination of a town's historical and cultural information to the general public. The project involves the construction of models of a town through the ages with links to supporting multimedia information about features in the virtual towns. The models will include animations and sound for increased realism and will provide a user-friendly environment for research. Users will be able to navigate their way around the VR worlds easily and save or print images and information for later use. Public perception will be monitored and reported over a trial period to measure the value of the concept and to establish its future development direction. Proposals for further content development and its access via the internet will be included in the final project report.

Objectives:

The VRCHIP project aims to contribute to the European Commission's community social objectives by providing a pleasurable means of accessing cultural and heritage information. The primary objective is to create and test a facility utilising virtual reality (VR) representations of Knutsford through the ages as the interface to multi media cultural and heritage information about the town. The facility will be designed to operate in a web browser environment in anticipation of its future use across local intranets or the Internet. Evaluation of the facility is a key element of the project, not only in measuring the success of the facility as an information source but also its acceptance by the community as an effective means to deliver the information. As a result of monitoring usage and reactions from a range of interested parties the trial will contribute to an improved understanding of user requirements in accessing cultural and heritage information.

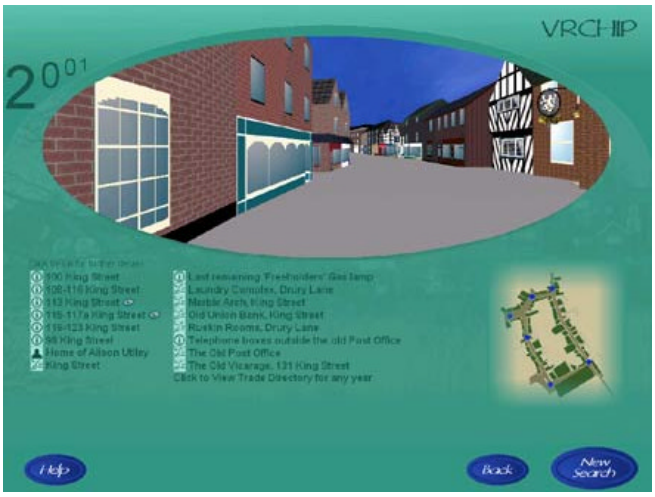
Work description:

The project will commence with the development of a detailed description of the project requirements, their interfaces and responsibilities. This will require some research into the nature and extent of information available and the establishment of the periods represented by each VR world. The extent of each VR environment, its animation and sound content, and the user interface will also be specified. Data requirements will be identified and formats for data capture and transfer documented. In addition, the methodology for measurement of public perception during the trial period will be developed.

The VR models will be built using commercial off the shelf (COTS) modelling software and will be developed from local maps, plans, photographs, drawings and layout information. The virtual towns will then be built using geometrical constructions with a combination of common building textures and digitally captured images to provide the realism. Sound bites will be captured or developed to provide a proximity sensitive background. Animation of humans and vehicles will be incorporated to provide added realism and information. The world will be designed to prevent the user passing through objects or getting lost in the VR environment. It will also be constructed to provide optimum performance on a standard desktop PC and to be viewable subsequently over an intranet or the Internet without undue performance penalties.

Links will be established throughout the models to aid navigation and to provide the additional multimedia information associated with the features in the VR world.

The basis for the historical VR world structure and content will be determined from available documentation and other archives held locally. The additional information will be gathered and compiled into electronic files that will be linked to the VR world features. This will include photographs, text, drawings, video and sound.



The completed facility will be installed in the new Knutsford library building where its use will be monitored. Training of supervisory staff will be provided and user manuals supplied. A scheme for measuring its usage and public perception will be implemented over an evaluation period to determine the success of the concept. The results of this monitoring exercise will be reported with observations on technical implementation issues, the human computer interface, and recommendations for future uptake and development.

Milestones:

M1 Issue of requirements specification

M2 Completion of present day VR world and information links

M3 Completion of all Historical VR worlds and information links

M4 Completion of public evaluation

M5 Issue of final report

Start Date: 2001-09-01

End Date: 2002-08-31

Duration: 12 months

Project Status: Completed

Project Cost: 255277.00 euro

Project Funding: 113036.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and **cultural heritage** - Trials on new access modes to **cultural** and scientific content

Project Reference: IST-2000-29486

Contract Type: ACM (Preparatory, accompanying and support measures)

Project URL: http://www.nnc.co.uk/vrchip

UNITED KINGDOM — Coventry

3D SCANNERS LTD

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Project:

Populating inhabited information spaces

Objective:

The most visible deliverable will be the AvatarBooth which will be used to automatically build Avatars for large numbers of people. The booth will be networked to i3-NET and Avatar datasets sent to the i3-NET server. AvatarBooth users can then download their Avatars from i3-NET at home.

POPULATE is a horizontal proposal within the IIS schema. Collaboration with other IIS consortia and the development of shared vision(s) of population of IISs will be an important first step. 3D Scanners will then lead the AvatarBooth research. REM-Infografica will research into automatically generating the humanoid Avatar models from the captured data in the various formats required by IISs. Both companies will evaluate aspects of the population of IISs by conducting user trials.

Work description:

Most people in Europe will eventually have access to Inhabited Information Spaces (IIS). This proposal addresses the research question of how IISs will be populated with representations of real people. Our thesis is that it is fundamental that people have a representation in an IIS (an Avatar); that a standard Avatar will evolve; that the standard Avatar will be humanoid and that a person's Avatar will be very similar to the actual person.

Passport photos have been a requirement for over 80 years in Europe. We believe that a person's identity in an IIS will be his humanoid Avatar. The premise for POPULATE is that a step is required in which the reality of a person is captured to form that Avatar. In other words an Avatar booth will be required that is similar to a passport photo booth. It is our belief that the specialised equipment of an AvatarBooth is required to capture the reality of a person - a reality that will add an enhanced dimension to an IIS - a reality that cannot be captured in the home.

The POPULATE research will address the questions:

- how should the reality of a person be captured?

- how can the captured data be converted into humanoid Avatars?

- what is the level of quality required from the reality capture process?

Start Date: 1997-07-01

End Date: 1999-09-30

Duration: 27 months

Project Status: Completed

Project Cost: 1.25 million ECU

Project Funding: 625000.00 ECU

Programme Type: 4th FWP

Programme Acronym : ESPRIT 4

Subprogramme Area: Proactiveness

Project Reference: 25474

Contract Type: ACM (Preparatory, accompanying and support measures

UNITED KINGDOM — Hertfordshire

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Project:

Reconstruction using Scanned Laser and Video

Objective:

The purpose of RESOLV is to produce a cost-effective system for creating realistic 3D models of the environment. These will enhance the sense of 'being there' for telepresence and virtual reality applications. The models will also be sufficiently accurate for real estate, construction and other industrial applications.

Objectives:

A portable unit known as an EST (Environmental Sensor for Telepresence) is taken around the environment that is to be captured, The EST includes a scanning laser rangefinder for capturing the 3D structure of the surroundings and a video camera for adding the textures. The environment is scanned from a number of capture positions but the reconstructed model can be viewed from any position.

Surfaces are recognised by processing the range data and are textured from the camera images. By combining what is seen from neighbouring capture positions, surfaces that would be occluded from one position are recorded.

The EST travels from one capture position to another on a trolley or an autonomous vehicle. The environment is reconstructed as the EST progresses and each new position is registered with previous ones using key points in the surroundings. The partial reconstruction is used to determine future capture positions.

The EST is optimised for human scale applications, It is not intended for detailed reconstruction of small objects or for capturing an external landscape. Both the trolley shown in the picture and the autonomous vehicle are designed to support capture at two heights - eye level when sitting and standing. The size of the unit is comparable to that of a person to ensure that it can be taken to all the places where people are likely to pause when looking around a building.

The data is held in a form suitable for CAD systems and for viewing on a WWW browser.

Live video of people can be inserted into the reconstruction for telepresence applications. In this way remote parties can look around the people they are talking to as if they were all in the same location.

RESOLV is related to products such as Quicktime VR from the Apple Corporation in creating a virtual copy of a real location. However the observer will have an enhanced sense of presence through being able to move freely within the reconstructed environment. The pictorial quality will be exceptionally good (equal to existing visual panorama systems) when the observer is near the environment capture point and will gracefully degrade in moving away from capture points.

Work description:

Social Telepresence:

An existing location will be captured in sufficient detail for viewing through a VRML viewer. Peoples bodies will then be identified from live video and inserted into the reconstruction. The video can include people who are actually at the location and others who are only telepresent. In this way it will be possible to support the illusion of all members of a distributed meeting being in the same place.

The social telepresence trial will take place between project partners and between staff in factories addressing similar factory organisation and layout issues.

Interiors Visualisation:

Visualisation is becoming an essential tool for the construction industry. This is easy for new buildings for which a detailed CAD model exists. However reconstructing the dimensions and appearance of existing interiors can be a time-consuming and expensive process. This trial will evaluate the cost-effectiveness of capturing interiors for refurbishment, maintenance and facilities management applications.

Key Issues:

The key technical issue is establishing how accurately the surroundings need to be scanned in order to produce a reconstruction of sufficient realism for telepresence and adequate accuracy for industrial applications. This will indicate the potential cost-effectiveness of the service and hence the size of the potential market.

The credibility of the reconstruction is critically dependent on the performance of the 3D viewer. Dramatic performance increases for PC based 3D and graphics cards indicate that future mass market PCs will be able to view RESOLV reconstructions.

Achievements: Following completion of the Requirements and Specification reports, the prototype EST trolley has been assembled. The spatial reconstruction and texture algorithms have been integrated to produce textured scenes such as those shown here. The software has been transferred from the workstation development environment to the PC in the EST so that reconstruction can take place during the capture process.

The navigation and registration algorithms for the Autonomous EST have been tested and these were demonstrated in early 1997. A high speed laser scanner has been evaluated and will be included in the Autonomous EST.

Milestones:

The output from the project will be a set of algorithms for producing 3D reconstructions of intended environments requiring the fusion of range data and texture information from many capture points.

These algorithms will be implemented in two types of environmental capture device, one portable and the other autonomous. Technical results will include an assessment of which applications suit the RESOLV approach of integrating laser scanning with digital images. An assessment will be made of the nature of the markets for the overall methodology and a suitable exploitation path will be identified in the light of user responses to the interiors and telepresence trials.

Expected Result:

RESOLV is expected to be one of many catalysts in encouraging a universal move to more natural three dimensional user interfaces. The most obvious demand is for truly spatial activities such as building design. However there is increasing interest in providing familiar spatial contexts in which more abstract issues can be discussed.

RESOLV will improve the usability of future multi-way multimedia services by providing the environmental realism needed to feel telepresent in remote locations. As such it will contribute to European competitiveness by lowering the cultural and psychological barriers to communication between people in different countries.

Start Date: 1995-09-01

End Date: 1998-08-31

Duration: 36 months

Project Status: Completed

Project Cost: 2.18 million ECU

Project Funding: 1.23 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ACTS

Subprogramme Area: Multimedia services

Project Reference: AC021

Contract Type: CSC (Cost-sharing contracts)

UNITED KINGDOM — Kingston Upon thames

Kingston University

Organisation: KINGSTON UNIVERSITY

Department: DIGITAL IMAGING RESEARCH CENTRE - FACULTY OF TECHNOLOGY

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City: KINGSTON UPON THAMES

Region: SOUTH EAST (UK)
SURREY, EAST-WEST SUSSEX
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Country: UNITED KINGDOM

Contact Person: Name: REMAGNINO, Paolo (Dr)

Project:

Motion and interaction planning for environment-aware animated **avatars**

Objective:

The objective of the proposed project is to add a significant additional level of automation to the process of animating human avatars. This will greatly enhance the efficiency and flexibility for the production of animated multimedia content for film, games and the web. The autonomous animated characters will be capable of planning their motion, being aware of their environment. This involves detecting/ avoiding collisions with other objects in 3d space - They will also be able to interact with other objects, including animated characters: examples may be touching or holding static objects catching moving objects or, to mention a more complicated case, shaking hands. It will require solving the problem of inverse kinematics.

A user will be enabled to specify the behavior of the animated characters using high - level commands rather then defilling key frames and micromovements as in traditional approach. These high-level commands will be interpreted in a way similar to that in which humans would behave in the real world. Some models of human behaviour will be implemented, both on low, kinematic level (patterns of movement, incl. walking) and on the high level, including elementary goal construction. Application of some techniques related to artificial intelligence will be necessary on this stage. However, advanced, long-term goals and complex purposive behaviour are out of the scope of this proposal, and are planned to be carried by other researchers at the host institution. The expected impact for the applicant involves gaining the experience of the British researchers in issue of applying AI to commercial animation packages, as well as m animation technologies themselves. The host institution - Kingston University (together with WhiteSpace Studio located at two of the campuses) is an important centre for both technologies. It also gives an opportunity for co-operation with leading industry companies.

Start Date: 2003-01-01

End Date: 2004-12-31

Duration: 24 months

Project Status: Execution

Project Cost: 107272.00 euro

Project Funding: 107272.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : HUMAN POTENTIAL

Subprogramme Area: Training and Mobility of Researchers - Marie Curie Fellowships

Project Reference: HPMF-CT-2002-02106

Contract Type: RGI (Research grants (individual fellowships))

UNITED KINGDOM — Lancaster

University of Lancaster

Organisation: University of Lancaster
Organisation Type: Education
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Project:

Electronic landscapes

Objective:

The main objective of this proposal is an investigation of the means by which future large scale shared electronic environments will be realised. This requires fundamental research into the formation of a suitable set of paradigms for these environments and the demonstration of the application of these paradigms in practice. This requires the development of metaphors, paradigms and theories that offer engaging and supportive interfaces. eSCAPE (the project) seeks to explore precisely these issues and lay the theoretical foundation for the future developers of shared virtual environments through the consideration and development of electronic landscapes ,or 'e-scapes' (the concept).

The eSCAPE project will investigate the exploration and development of the concept of an 'electronic landscape' (e-scape) as a virtual environment which provides interconnections to other virtual environments. An e-scape is a place where places meet and where all those places are inhabited information spaces which can contain representations of persons (avatars), objects/information and artificial agents. An e-scape supports the integration and coexistence of multiple shared virtual environments.

Work description:

The last three years have seen a rapid growth in the development of systems that adopt a spatial approach to the presentation of computer based information. This has been fuelled by the increasingly ubiquitous nature of the Internet and the maturing of 3D interaction techniques. However, despite the large number of research and commercial explorations into shared, multi-user virtual environments little or no consideration has been given to the development of heterogeneous large scale landscapes capable of allowing a wide range of different spaces to coexist. Rather, an insular approach has been pursued with each virtual environment being relatively separate from others. This sets the research challenge of developing techniques which will allow a wide variety of different approaches and spaces to coexist successfully in a seamless manner. Recognising and supporting this diversity of space in itself requires a radical departure from existing considerations of electronic environments. Indeed, it is unlikely that we will see the wide-scale adoption of shared virtual environments in use by the general citizen unless attention is paid to their integration and interconnection, without disrupting healthy variation between different environments as a function of their application or of the social group they support or the culture within which they have emerged .

Milestones:

The eSCAPE project will result in the development of a series of specific theoretical and practical results. These will include:

- A set of novel demonstrators that show the applicability of the electronic landscape concept to support social interaction in shared virtual environments.

- Experience of using distributed eSCAPE systems and outlining of the suitability of these techniques for future users and vendors.

- The development of novel mechanisms to support electronic landscapes which can be incorporated in future products.

- The development of techniques and concepts to inform future developers of electronic landscape based systems.

- A set of multimedia works and events that demonstrate electronic landscape concepts.

This research is multidisciplinary in nature and one of the unique aspects of the eSCAPE proposal is that it brings together a set of previously disparate traditions to address these issues in a concerted manner. In particular the following skills and expertise are combined:

- VR Development

- Social Scientific Studies of the use of real and virtual spaces

- Aesthetics and Multimedia Art

eSCAPE results will be communicated through research publications, access to concept demonstrators, multimedia events and workshops.

Start Date: 1997-07-01

End Date: 2000-06-30

Duration: 36 months

Project Status: Completed

Project Cost: 2.39 million ECU

Project Funding: 1.95 million ECU

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ESPRIT 4

Subprogramme Area: Proactiveness

Project Reference: 25377

Contract Type: ACM (Preparatory, accompanying and support measures)

Project URL: http://escape.lancs.ac.uk

UNITED KINGDOM — Leicester

University of Leicester

Organisation: University of Leicester
Organisation Type: Education
Department: Department of Geography
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Project:

Fuzzy Land Infomation From Environmental Remote Sensing

General Information:

In project FLIERS we propose to develop a new approach to mapping land cover from remotely sensed data and for incorporating such land cover information in Geographical Information Systems.

The project is based on the reality that natural landscapes present a continuum of variety at many different spatial scales and that a high proportion of the discretely-sampled pixels within an image contain mixed spectral signatures, and are not easily placed into fixed thematic classes. Since the approach advocated here contains an implicit recognition of the reality of the continuum we believe that it will be considerable improvement over the traditional concept of "thematic classification" of satellite imagery. The approach involves three complementary activities:

1. neuro-fuzzy classifiers - use of classifiers which admit recognition of uncertainty in class allocation, and store that uncertainty for later manipulation. Research will examine fuzzy neural network classifiers, texture-based neural computing, and other alternative classifiers, and all outcomes will be compared with standard classifiers;

2. scientific visualisation - user interaction in the decision making process, via visualisation, at all stages. This will involve projection pursuit to assist data compression and selection for classification, interactive visualisation by hypermap linked views of multiple images and source data to assist combination of the outcomes of classification, and interactive manipulation to produce tailor-made thematic map products for particular purposes, and

3. ground verification - comparison of the outcome of classification with ground information is crucial, and this activity will include detailed vegetation, land cover and land use mapping from aerial photographs and in the field. The approach to field mapping will require development of novel approaches to mapping the continua of vegetation so that it can be used to verify multiple resolution remotely sensed data.

The research partnership established to address these issues includes five organizations which bring to bear a unique combination of skills, including those in advanced computational image processing involving neuro computing and texture analysis (Southampton, VTT and JRC), scientific visualisation of spatial information (JRC and Leicester), and innovative vegetation and land use mapping in remote sensing (Leicester and Thessaloniki). Above all the approach advocated here is a total environment for the recognition that the allocation of pixels to classes is uncertain and that acceptance of that uncertainty and its manipulation could strengthen the use of remote sensing as an input to subsequent activity. Keywords - Fuzzy sets, fuzzy mapping, fuzzy neuro classifiers, texture classifiers, hyperrnap, interactive decision making, projection pursuits, ground verification, multiple sensor resolutions.

Start Date: 1996-10-01

End Date: 1999-09-30

Duration: 36 months

Project Status: Completed

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : ENV 2C

Subprogramme Area: Methodological research and pilot projects - Methodological research

Project Reference: ENV4960305

Contract Type: CSC (Cost-sharing contracts)

UNITED KINGDOM — London

University College London

Organisation: University College London
Organisation Type: Education
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Project:

CREATE: Constructivist Mixed Reality for Design, Education, and Cultural heritage

Objective:

CREATE (Constructivist Mixed Reality for Design, Education, and Cultural Heritage) aims to develop a mixed reality framework enabling highly interactive real-time construction and manipulation of realistic virtual worlds based on real sources. This framework will be tested and applied to two prototypes: a cultural heritage/education application, for students and the general public and an architectural/urban planning design review application, for decision makers and the general public. To develop these applications, the project follows a "constructivist" approach, combining innovative work in VR, simulation, data capture, visualisation graphics, and interface design to provide highly realistic yet interactive experiences where users actively participate in the construction of environments. Development will be driven by actual user requirements, through careful analysis for each case, and evaluated for its effectiveness.

Objectives:

In CREATE we will develop a mixed-reality framework that will enable interactive construction of virtual scenes based on real sources, resulting in highly realistic and interactive experiences. In particular:

i) We will design new methodologies to determine user requirements based on a human-centred, "constructivist" approach to working and learning, with special attention to evaluation;

ii) We provide a complete set of techniques for a realistic capture of real sites, that can subsequently be used in an impressive virtual reality displays;

iii) We will develop, adapt and combine novel, visualisation, display and audio technologies based on the user requirements, to enable realism with interactivity, specifically for VR/AR/MR applications.

Finally, we will build & exploit two prototypes, one for a cultural heritage/learning application, and one for and architecture/urban-planning application, incorporating more natural and usable interface approaches.

Work description:

The CREATE work plan consists of the project management and dissemination & exploitation work packages as well as five technical work packages:

1) Case Study Definition, Design and Methodology, to define and design the specifications and methodology for the two case studies, the first concerning a cultural heritage/education prototype and the other concerning a urban planning/design review prototype, and thus aid in their integration and the development;

2) Data Collection and Overall Scene Construction, to acquire existing site data forming the basis for construction and reconstruction for the case studies;

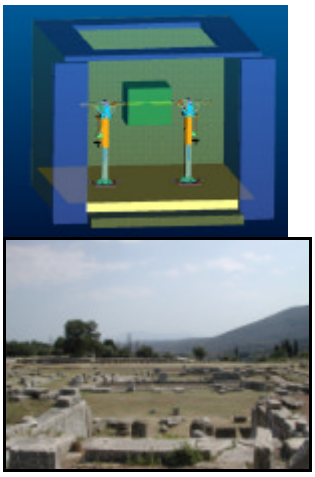
3) VE Enhancement: Re-lighting, Rendering, Population and Sound, to choose, adapt and develop appropriate algorithms and methodologies to enhance virtual environments so that they can provide a highly realistic

experience while supporting interactive use;

4) Prototype Integration and Interface, to bring together the results of the techniques developed in the other work packages, and to design and implement the interface, creating a prototype system which will be used in the two application scenarios, for cultural heritage and urban planning. In this package, integration will be performed to provide a visual, haptic and audio experience to the user;

5) Evaluation, where the goal is to evaluate the effectiveness of the performed work and the technical choices, with respect to the fulfilment of the objectives as set and targeted by each of the case studies/prototypes.

Reconstruction of Place Massena in Nice, and insertion of virtual vegetation, tramway, and pedestrians.



Left: Integration of the haptic interface in one of the immersive display of the project. The green cube refers to the workspace that will be available for interaction. Right: View of the archaeological site, the ancient Messene Temple, for the Cultural Heritage case study, as photographed for the CREATE data capture.

The consortium will ensure timely and widespread dissemination of the results, both in the scientific community and to industry and the general public. The exploitation plan is twofold, first with the direct usage of the full prototypes by end-user partners or other take-up mechanisms and second the technology transfer of the individual technological breakthroughs developed, either for data capture or VE enhancement, in sectors such as VR, computer games, postproduction.

Milestones:

- User requirements on Cultural Heritage/Education and on Urban/Architectural Planning & Design applications;

- On-site data acquisition Techniques and Novel Algorithms with Digitally produced reconstructions of two sites;

- Design & Specifications for VE Enhancement Algorithms;

- Prototype mixing immerse technologies, and integration of the new virtual reality algorithms for realistic experience.

Start Date: 2002-03-01

End Date: 2005-02-28

Duration: 36 months

Project Status: Execution

Project Cost: 2.35 million euro

Project Funding: 1.60 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Real-time and large-scale simulation and visualisation technologies - Mixed realities and new imaging frontiers

Project Reference: IST-2001-34231

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.cs.ucl.ac.uk/create/

UNITED KINGDOM — Oxfordshire

Oxford Computer Consultants Limited

Organisation: Oxford Computer Consultants Limited

Organisation Type: Other

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Project:

Rehabilitation IT Aid for the Parkinsonians

Objective:

The aim of the project is the design and development of a system for:

a) the assessment of motor performance and, b) the subsequent design of Parkinson's - related training programmes.

The project will incorporate virtual reality, visual stimulation, auditory biofeedback and interactive video conferencing technologies with conventional kinematics analysis. Our aim is thereby to improve care provision and provide rehabilitation services to Parkinsonians in all kinds of geographical areas including isolated areas.

Objectives:

Parkinson's disease is a dysfunction at the level of motor planning. Recently scientists have shown that visual stimulation of Parkison's disease patients with "virtual" obstacles and auditory stimulation with rhythmical sounds can significantly improve the efficacy of traditional rehabilitation schemes.

The project is aiming for the design and development of a system for:

a) the assessment of motor performance and b) design of training programmes for patients suffering from Parkinson's Disease by incorporating virtual reality visual stimulation, auditory biofeedback and interactive video conference technologies to conventional kinematics analysis and rehabilitation exercise protocols. The project will strongly contribute to social policies by guaranteeing a high level of social security-related services throughout the community. Such activities strongly motivate human mobility, which of course is endorsed by all European policies.

Work description:

The proposed system can be divided into three main subsystems:

*the motion tracking and analysis systems,
*the virtual reality audio-visual stimulation system, and
*the telematics subsystem.

The work comprises the design, development, integration and verification of:

*Motion tracking and analysis systems that will provide digital information regarding the motion of the patient during a rehabilitation programme.

The information will be compared to the desired motion data to assess the level of conformance to the rehabilitation exercise programme.

*Virtual reality systems which implement the central and remote station operating environment. The work includes the development of virtual reality objects incorporating kinematic models, virtual worlds for patient training, exercise scenarios, motion monitoring and analysis software, virtual reality data (models, objects, scenery etc.) archiving and distribution software.

*Auditory rhythmical feedback stimulator: a biofeedback auditory system that will provide rhythmical auditory information to the patient according to the movement the patient has planned to perform. This will provide the patient with feedback to control rhythmically the pace of the attempted movement.

*Telecommunication systems for the data interchange process between central and remote stations and maintaining data compatibility with emerging standards in order to maximise usability. Tele-pointing software tools will be implemented to allow the interactive bi-directional annotation of the console screen. *Remote real-time graphical reconstruction of legged locomotion: a graphical reconstruction subsystem in order to reconstruct the motion of the legs of a patient exercising in a remote medical centre to a workstation located at a central medical centre. This allows an expert in the central medical facility to monitor the patient's progress on-line and provide immediate feedback.

Milestones:

M1: Parreha system architectural description, M2:Alpha fully functional system prototype, M3: Verification of beta functional prototype, M4: Evaluation and business plan.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 2.86 million euro

Project Funding: 1.68 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Health - New generation tele-medicine services

Project Reference: IST-1999-12552

Contract Type: CSC (Cost-sharing contracts)

UNITED KINGDOM — Somerset

University of Bath

Organisation: University of Bath

Organisation Type: Education

Department: Media Technology Research Centre - School of Mathematical Sciences

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Project: Platform for animation and virtual reality

Objective:

We propose to address the common needs of animation and virtual reality - Young researchers involved with network partners will obtain experience systems, by developing a comprehensive software platform consisting of of the international breadth of their field of research, major facilities drawn from our various partners uniquely broad experience. - We will exchange both post-doctoral and more senior research workers, as The proposed software platform will have as its objectives: appropriate

* to provide to the animator facilities for automatic creation of animation

- For younger research workers the main goal of the placements will be training. We collectively offer a very broad range of topics. Placements * to provide facilities for controlling or guiding virtual moving objects by speaking in a microphone like a choreographer would do for conducting will be made with a view to evening out the skills base across the whole a ballet dancer network. Some sites have identified graduate-level courses which could be included.

* to offer motion synthesis with: biomechanical models, physics- based modelling, state feedback control, optimisation, identification and

- For more senior research workers the goals in placement are more varied. learning

- The network will enable the strengthening and formalisation of existing * to extract 3D objects cleanly from photographs and video sequences contacts between partners, to general benefit.

* to extract motion parameters from magnetic motion capture

- Some sites have close close contact with industry. Here work will * to help animators with the task of managing the large number of images include industry-driven sub-projects which will enable visitors to develop in real production environments contacts with industries in other countries.

* to provide access to these facilities across broadband networks

Start Date: 1996-11-01

End Date: 2001-10-31

Duration: 60 months

Project Status: Completed

Programme Type: 4th FWP (Fourth Framework Programme)

Programme Acronym : TMR

Subprogramme Area: NETWORKS

Project Reference: FMRX960036

UNITED KINGDOM — Wiltshire

Historic Buildings and Monuments Commission for England

Organisation: Historic Buildings and Monuments Commission for England

Organisation Type: Other

Department: National Monuments Record

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Project:

Heritage Illustrated Thesaurus

Objective:

The aim of HITITE is to enable anyone interested in the historic environment to access and explore, remotely, information relating to sites and monuments without having to have specialist knowledge either of the heritage or thesauri. The project will build on existing knowledge and expertise within English Heritage and ADLIB Information Systems to develop a Heritage Illustrated Thesaurus, which will allow users to explore thesaurus terminology through images and Virtual Reality models. It will bring together specialists from different areas of expertise to assess the extent to which the existing technologies can be brought together to create a new and innovative product which can be offered as a practical solution to customers, as well as developing a robust methodology.

Objectives:

The objectives of HITITE are to:

1) Develop an on-line thesaurus of monument terms illustrated with images from the NMR's archive

2) Assess the extent to which existing technologies (text databases, images and Virtual Reality) can be brought together to provide advanced and intuitive searching capabilities for image to text and text to image

3) Develop a new and innovative product by bringing together specialists from different areas of expertise (thesaurus creation, web design, image management and Virtual Reality)

4) Encourage wider access to heritage information by helping to unlock the information resources within the National Monuments Record, ranging from heritage professionals to school children

5) Encourage people to take greater interest in the historic environment, understand it better and protect it.

Work description:

English Heritage's National Monuments Record has been developing text-based thesauri for over 20 years. The NMR has recently also been working with Virtual Reality interfaces to its heritage databases. These are intended to provide intuitive web-based access, less reliant on users keying in text entries. ADLIB is a specialist software company with substantial experience of thesaurus development, including multilingual and multimedia thesauri, e.g. the Australian Pictorial Thesaurus. Whereas traditional thesauri assume users have some prior knowledge of terminology associated with a monument and guide the user in the correct use of the term, the Heritage Illustrated Thesaurus will allow users to explore thesaurus terminology through images associated with monument terms; using photographs, drawings and Virtual Reality models to discover the correct term for the monument type. The proposed system will use textual metadata links to enable the end-user to navigate the system and discover images associated with terms, or terms associated with images using a minimum of key-strokes (wherever possible, navigation will be by mouse). To help the user navigate the hierarchy, the project will develop a series of 18 Virtual reality models as an interface to the top level

broad terms in the thesaurus. Examples of these top-level terms include Defence, Ritual, Religious and Funerary etc. The Virtual Reality models constructed for each of these will allow the user to explore whether they are in the correct classification. Browsing the virtual world of the top-level category will allow the user to explore the scope of monument terms. For example, under Ritual, Religious and Funerary there will be examples of different types of religious structures (churches, stone circles etc), graves, statues and other iconography. These will be supported by text explanations of the Virtual Reality representations.

Milestones:

1. Project start-up with project management mechanisms and structures in place

2. Project methodology developed and evaluated

3. Prototype database developed and images and content loaded

4. Prototype interface developed

5. User evaluation completed and demonstrator developed

6. Launch and final review.

Start Date: 2001-10-01

End Date: 2002-09-30

Duration: 12 months

Project Status: Completed

Project Cost: 272929.00 euro

Project Funding: 160380.00 euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Interactive publishing, digital content and cultural heritage - Trials on new access modes to cultural and scientific content

Project Reference: IST-2000-28484

Contract Type: ACM (Preparatory, accompanying and support measures)

UNITED KINGDOM — Winchester

Independent Television Commission

Organisation: Independent Television Commission
Organisation Type: Other
Department: Standards & Technology
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Project:

Virtual Signing: Capture, Animation, Storage & Transmission

Objective:

ViSiCAST will develop and evaluate Virtual Humans generating European deaf sign languages. ViSiCAST builds on SignAnim, which received two UK Royal Television Society awards for technical innovation in 1998. An English language analysis or speech recognition system drives a virtual human using data captured directly from human signers. SignAnim demonstrated that a virtual human is a valid alternative to video and could run semi-automatically.

ViSiCAST will extend this work in three areas: (1) In television. Sub-titles help hard-of-hearing people who can read easily. The virtual signer will improve access for those who sign as a first language.

(2) For Web and multi-media. Improved control over signed multi-media generation and delivery will increase the independence of deaf people using the Internet for communication and learning.

(3) In face-to-face transactions. It will improve communication between a deaf customer and a service provider.

Objectives:

ViSiCAST will develop, evaluate and apply realistic Virtual Humans (avatars), generating European deaf sign languages. The project will develop systems for the generation, storage and transmission of Virtual Signing Systems. It will develop user-friendly methods to capture signs where appropriate. It will also develop a machine-readable system to describe sign-language gestures (hand, face and body), which can be used to retrieve stored gestures or to build them from low-level motion components. It will use this descriptive language to develop translation tools from speech and text to sign. By building applications for the signing system in television, multi-media, Web and face-to-face transactions, VisiCAST will improve the position of Europe's deaf citizens, their access to public services and entertainment, and enable them to develop and consume their own multi-media content for communication, leisure and learning.

Work description:

A key result in the first year will be a live signing system for television using a virtual human according to a new standard transmission format, trials of face-to-face communication with deaf subjects and initial web-based tools. In the second year the project will deliver an ambitious prototype text-to-signing tool and an avatar driven from HamNoSys. Key third year results include a face-to-face dialogue system, and a semi-automatic translator from text to signing implemented within a web browser.

A key result in year 1 will be live a signing system for TV using a virtual human according to a new standard transmission format, trials of face-to-face communication with deaf subjects and initial web-based tools.

Year 2 will deliver an ambitious prototype text-to-signing tool and an avatar driven from HamNoSys.

Key year 3 results include a face-to-face dialogue system, a semi-automatic translator from text to signing implemented within a web browser.

Start Date: 2000-01-01

End Date: 2002-12-31

Duration: 36 months

Project Status: Execution

Project Cost: 3.77 million euro

Project Funding: 2.88 million euro

Programme Type: 5th FWP (Fifth Framework Programme)

Programme Acronym : IST

Subprogramme Area: Persons with special needs, including the disabled and the elderly - Systems and services for independent living

Project Reference: IST-1999-10500

Contract Type: CSC (Cost-sharing contracts)

Project URL: http://www.visicast.co.uk