Low Cost-Interactivity for 3D-Computeranimation with Computer Game-Engines

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Abstract - **This paper describes a project that examines possibilities to use a 3D game engine as a basis for a building-signpost in the form of a Point of Interest. The user shall virtually experience a real existing location with the help of multimedia content. Thereby the aspect of entertainment as far as the used technical possibilities of a 3D game has an important role. It is shown that the given ways of interactivity facilitate completely new approaches of using a Point of Interest. Furthermore the work shows that the technological basis of a 3D game engine also can be used for a lot of other purposes than just for playing for fun. This work was developed at the University of Applied Sciences Vorarlberg in cooperation with the Virtual Reality Laboratory of the User Centred Technologies Research Centre.**

Keywords – **3D-Computeranimation, Game Engine, POI, Interactivity**

I. INTRODUCTION

The User Centered Technologies Research Center at the University of Applied Sciences Vorarlberg in Austria focuses especially on the topics Usability and Virtual Reality (VR). The in this article introduced project was acquired within a diploma thesis by Mag. (FH) Daniel Peherstorfer und Mag. (FH) Stefan Neururer and coached by the authors of this article. The work deals with a new interaction platform referring to results of previous works (Dontschewa& Schade, 1994; Dontschewa, Stamatov et al. 1995). It should communicate information of specific buildings in a playful way. For the prototype of the Discovery Terminal we decided to take the new building at our University as a basis. Therefore all the interior and exterior regions were created virtually and integrated in a game engine. So it's possible to explore the architecture with the use of a simple gamepad and gain information about specific rooms in a play full way.

II. METHOD

A. *The Challenge*

Within the framework of the work at hand we are examining if a 3D game engine is appropriate to make an existing, real location interactively accessible.

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The resulting product named „Interactive Discovery Terminal" (IDT) consists of a Windows-PC and a TFT screen that are both integrated in a robust case as seen in Figure 1.

Fig. 1: Terminal

The terminal is controlled by a customary gamepad, acoustic information is mediated by earphones. It is positioned at a frequented spot within the visualized building and allows the user to experience the University of Applied Sciences in a playful way.

B. *The Game Engine*

The term Game Engine is composed by the two words game and engine. The game itself consists of levels, textures, models and other game-specific elements, but is also to classify as an information system (Dimitrov&Georgieva, 2001). The engine portrays the working basis for the development of the game; it is the technology for the graphical representation in realtime, the sound environments, physical calculations and other gaming experiences. Modern game engines for titles like Half Life 2 by Valve Software or Max Payne by Remedy Entertainment are programmed in a way that is is possible to make own modifications and levels. Therefore own editors are shipped with the game that allow the user to create own models, texture them and implement them within own levels. Because the game editor for Max Payne 2 is especially powerful and makes it possible to not only model own levels but also program several different interactions and character animations this engine by Remedy Entertainment was chosen as a basis for the application.
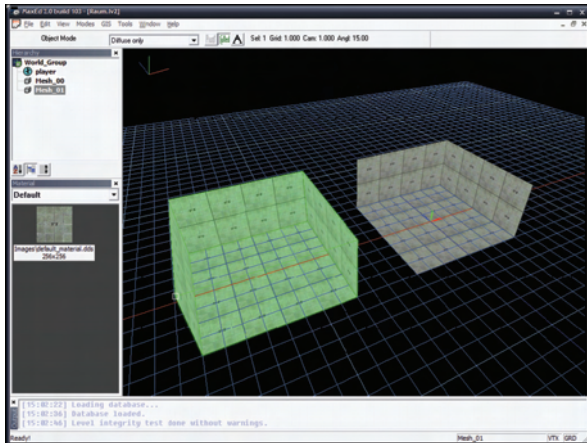
III. WORK STEPS

A. Modeling

Fig. 2: Room modeling

There are several different ways to implement geometry. A special plugin allows importing complex objects from other 3D-animation software, but MaxEd – the game editor of Max Payne 2 – offers the possibility to create own simple objects directly. For an architecture project like in the work at hand only simple geometric shapes are needed. That lends itself to construct rooms, corridors, elevators and similar objects within the editor. Figure 2 shows two rooms modeled in MaxEd that are further connected by a corridor and integrated in the complete building model.
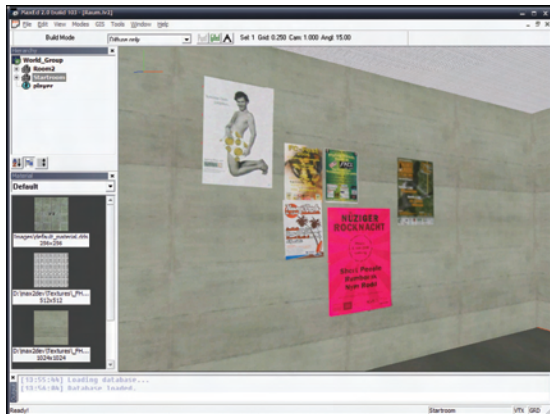
B. Texturing

Fig. 3: Texturing a wall

The creation of textures starts with taking pictures of real existing surfaces in a most possible distortionfree way. These pictures are optimized in a photoediting software as far as color and perspective are concerned. Finally they are exported as DDS-Files including Alpha-Maps and different MipMap-channels. In the editor the prepared textures are applied to the appropriate objects. Figure 3 shows how posters are mapped onto the virtual wall. In this way all rooms and objects are provided with pictures and material properties.
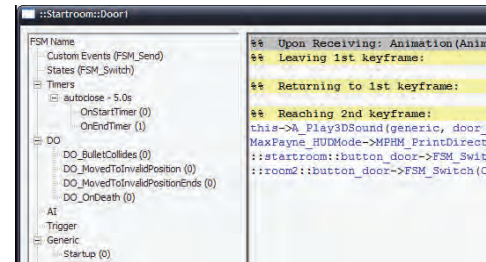
C. Interaction

Fig. 4: Interaction by scripting

Virtual scenes can be equiped with interaction by Scripting, keyframeanimation and dynamic simulations. In that way commands can be applied to switches or objects that communiate with other elements through messages and recall predefined animations on demand (Künz, Dontschewa et al. 2005). The Havoc Physics Engine is used for collision detection and simulation of physical behaviour of the objects in the scene.
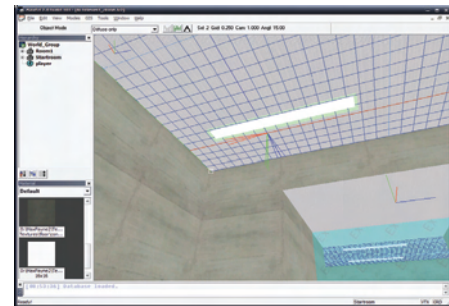
D. Lighting

Fig. 5: Placing lights

The engine used in Max Payne 2 offers a variety of methods to visualize virtual worlds as realistic as possible. Environment Mappings make realistic reflections on surfaces possible – for example mirroring on car paint. To garantuee a good performance (Gerullis, Dontschewa et al. 1997) the lighting situation is already pre-calculated. Radiosity lights are based on the law of conversation of energy: the light that a surface receives but not absorbs is reflected. The result is saved into so called lightmaps that are multiplied by the object textures. That leads to a quite realistic presentation.

E. Characters

Fig. 6: Enrichen places with virtual humans

One of the biggest advantages of the Max Payne 2 editor is the quite simple possibility to implement human characters from an extensive library including animations. The virtual persons can walk on pre-defined paths, talk, react to the user and do specific actions. Therefore so called Artificial Intelligence Nodes are created that are combined to a network to exchange information within a level. Separate character scripts can be started either automatically or by a trigger. They send a row of commands to the characters that accomplish them in a specific order.

IV. APPLICATION

The product developed during this work is predestinated for all kinds of presentations as well as for interactive signposts or applications in museums. In all three areas architecture plays a big role. The terminal can be seen as a multimedia platform that allows visitors to explore bigger complexes of buildings and to gather information about that location without any stress and effort. Additionally to an application in big public buildings the terminal could be used for architecture projects that do not exist yet or even anymore. Especially in museums or historical diggings such a platform would offer visitors a completely new experience. They could directly walk through formerly existing buildings and explore old cities that are already destroyed. Such an interactive visualization in 3D lets the visitors understand and experience old churches, arenas, streets, etc. much better than simple paintings.

V. DISCUSSION

Generally you may ask why the IDT was developed with the specific game engine described in this article and not with probably more appropriate software. In this connection it is necessary to elicit the alternatives for creating such interactive 3D scenarios:

- Open Source Game Engines: Most of the engines like OGRE, openSceneGraph or Blender are completely free and fully adaptable. But also quite often there is a lack of support and usability. Besides it is difficult to find a product that really implements all relevant tasks such as phsyics, shaders, scripting, characters, etc. Additionally a lot of these engine demand solid programming knowledge.
- Commercial Game Engines: software like Torque or 3DgameStudio mostly provide all the features for a high price. They also afford quite a long time to learn using all the features.
- VR-Tools: Software like Quest3D and WTK are explicitly capable of creating interactive virtual worlds. Anyhow they often have constricted graphical qualities and also demand a higher budget.
- Other Game Editors: Of course there are a lot of different games out there that ship complex editors that offer a lot of editing. Max Payne 2 was the final choice because it is cheap, flexible and easy to handle. The most important advantage is the offer of human-like characters that lead to a believable and vivid staging.
- Quicktime VR: This technology is too restricted as it only offers pre-defined views and transitions.

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