Developing Virtual Reality Game

Results of a practical course at the Chair for Computer Graphics and Multimedia
(RWTH Aachen University, Germany)

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Figure 1: *A cave which has to be explored by the player.*

Abstract

Our aspiration was to develop a horror game, where the player finds himself in a cave or dungeon chased by a monster. The goal should be to beware of the monster's attention by hiding or sneaking, as well as survive and accordingly escape the level.
Because of the shortage of contributors we just provided a demo version of our game concept with focus on creating a virtual world affected by a weird atmosphere and scary, dark ambience.

1 Introduction

Within the framework of the software practical we developed a render engine with elements from a game engine. We consciously aware the word game engine since the application misses some important core elements which a so-called has to provide.
This report shall give an overview of the most considerable aspects as well as be roughly responsive to some certain use cases of the application.

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2 Main Structures

The application is entirely coded in C++ and based in Windows and Linux. We used OpenGL 3.3 for the rendering and the physic engine "Bullet" for a realistic physic-simulation.
Beside the application, the external level editor takes up a crucial role. Therefore we used Blender, because additional to model editing it features a great variety of functionalities and concepts. Furthermore we created an own file format, which is oriented towards the structure of .3ds files, and developed an exporter regarding this format for Blender (Python) and Unity (C#). Though the version of Unity is still in condition of development. Beyond the geometry it exports a diversity of other data including light, information about physic, material, transformation, object hierarchy and animation.

The first thing the player is confronted with is the main menu. It gives the possibility to start and pause the game. Starting the game enables the player to explore the level and interact, especially pick up, throw, move around and put in every single objects.

As a main structure we instantiated the *Entity Component System* design pattern. On the one hand it facilitates easy and flexible handling and bundling of the components, which would be otherwise very different, without the critical extending hierarchy.

On the other hand it offers simple and generic interfaces

For the audio we use OpenAL, which allows in addition to simple sound 3D sound as well. Therefore we can insert ambient sound in a scene, too.

3 Rendering and Shading

To determine differences and try different concepts, two render paths are implemented. The first one is simple Forward-Rendering, which applies Phong Shading and the second one is Deffered-Rendering, which uses Deffered Lighting instead, because this is more performant. Both support Multipass Rendering as well.
Moreover it uses various free combinable texturemaps such as Diffusemap, Normalmap, Specularmap and Heightmap (Parallax and Parallax-Occlusion). To be able to performantly display extensive scenes, a Renderqueue, Frustumculling and Instanced Rendering are applied.

4 Graphical and other effects

In addition to the Multipass-Rendering, we use a simply upgradeable *postprocessing pipeline* to add some effects to the renderpass which can affect the ambience very well. By pressing the appropriate key the effects can be turned on and off during the runtime. There are commercial ones like *blur, gray scale and glow effects*, as well as more especial ones, such as Object-outline-drawing and light-scattering.
Within the shaders it is possible as well to enable fog in the scene, so the atmosphere becomes more weird and confusing.

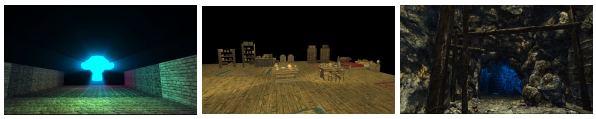

Figure 2: *several scenes, different effects.*

5 conclusion

All in all our render engine allows to create and render very atmospherical and realistic scenes in a simple way. It is independent and compatible to any concept of game.