

Demo application for Virtual Reality Laboratory Software

Autor: Marián Hudák
Supervised by doc. Ing. Štefan Korečko PhD.

Problem

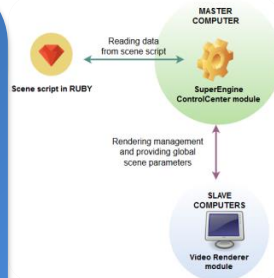
- System delays while rendering complex scenes,
- absence of lighting effects on 3D scenes,
- support for connecting control devices,
- optimizing 3D scenes to achieve full immersion.

Goals

- 3D scenes optimization for faster rendering
- fully immersive virtual scenes with lighting effects,
- extension of the system for input control devices.

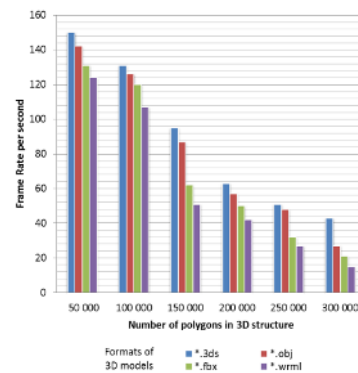
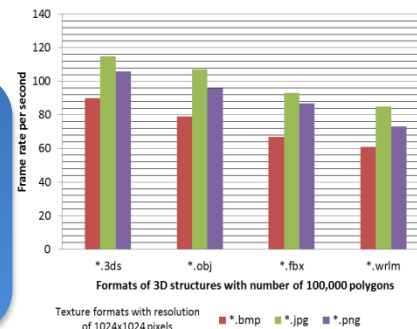
The LIRKIS CAVE

The LIRKIS CAVE at Technical University in Košice is a compact fully immersive VR environment with unique features such as a non-typical configuration of LCD displays and transportability. Cave uses Super Engine software, which consists of Control Center, Video Renderer, and Scene scripts. The main hardware configuration contains of one master computer, six slaves and twenty LCD displays. Motion tracking is provided by eight OptiTrack cameras around the user. The SuperEngine provides realtime rendering by OpenGL visual core.



3D formats scene optimization

Influence of using different formats of 3D structures on frame rate per second in visualization process. Considering 30 frames per second as the lowest acceptable framerate, the models with about 250000 polygons can be used but only in 3ds or obj formats.

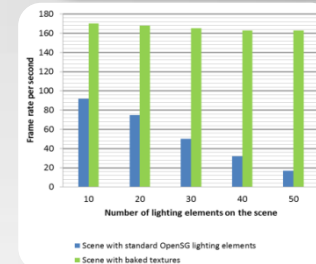


Tested texture formats

Impact of various combinations of texture and 3D model formats in 100,000 polygons scene on frame rate. Three formats were considered: uncompressed bmp format, png format with lossless compression and jpeg with lossy compression. The best scene fluency was achieved with the jpeg textures.

Baked textures

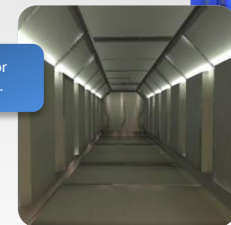
Rendering lighting effects such as shadows and reflections in real time can cause significant drops in framerate. To cope with this performance problem an alternative approach exists, where all lighting effects are generated beforehand, in a 3D modelling tool, and saved as a part of the 3D model texture. Such textures are called baked textures. A typical scene with baked textures uses only diffuse lighting, which values are the same in all parts of the scene. The Scenes using baked textures without OpenGL lighting components has a small latency and better visual impression. The framerate was affected significantly when the OpenGL lighting components were used in real time.



The scene of corridor with OpenGL lighting components.



The scene of corridor with baked textures.



System extension

It was necessary to extend the system to support control devices. The solution was to create external application for reading data from control device and providing data flow to Control Center Module. In addition it is possible to use various types of remote controls to manipulate with scene objects.



Conclusion

- The LIRKIS CAVE system is currently expandable with different types of 3D scenes.
- It is possible to create scenes with lighting effects and full immersion.
- Extended support for control input devices.
- Fluent scene simulation without system latency.

