MODELING AND RENDERING VIRTUAL ARCHITECTURE BY USING FISHEYE-PANORAMA-BASED IMAGES AND LIGHTINGS IN HDR-QUALITY

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Abstract

We use digitally made spherical panoramas as background for vr-visualisation in architectural sceneries instead of stitched photographs (fisheye-based or serical-mirror-based). For this reason we had the idea to develop the first fisheye-based digital-scanning panorama-camera together with the manufacturer Spheron. The ultimate step in reaching optimal quality not only as a background but also as a source of lighting the background-image is taken as a HDR-image. The high-dynamic-range-technology was developed by the Californian scientist Paul Devebec. High dynamic photographs contain a broader range of information between the very bright zones down to the very dark zones - a lot more than “normal” photographs (digital and analogue), which are named LDR (low dynamic range in comparison to HDR). Some software-products in the field of cad-visualisation in virtual and augmented reality already enable the use of HDR-images and open a new field of controlling daylight and artificial light simulations with photographed backgrounds instaed of synthetic ones. The combination of digitally produced (scanned) sperical images together with the use of HDR open a wide range of new implementation in the field of architecture, especially in combining synthetic elements in existing buildings, e.g. new interior elements in an existing historical museum).

Introduction

We present a method, which combines vr-visualisation and pano-rama-image techniques, based on recovering high dynamic range radiance maps (HDRi) from photographs taken with a digital fisheye panorama camera instead of stitched photographs, taken with fisheye lenses or using a mirrored ball.

HDR stands for High Dynamic Range Imaging. Usually 360-degree-images are photographed from a spherical mirror, a series of pictures with different exposure settings that capture the ratio between dark and bright regions as represented in the real world. Mapped as a spherical environment, HDRI illuminates the scenes with different levels and colors of light of generating “global illumination”, and the amount of light can be altered through the exposure settings.

VR background as source of illumination

When doing computer graphics, it is particularly important to get accurate information about the bright lights in a scene, as they will naturally have the greatest effect. The standard technique to acquire high dynamic range images that capture this missing information is to take several photographs at different exposures (making each photo progressively darker, without moving the camera), until the bright lights are no longer white. The sequence of photographs is then analyzed to derive the light intensity of each point in the scene. All the existing image-editing programs, such as Adobe Photoshop, are built around editing standard low dynamic range images. HDR Shop, a special software, developed by Paul Debevec, the HDR-”inventor”, was created to work correctly with HDR images, and provides a framework for converting, analyzing, and modifying HDR images, as well as prototyping HDR image tools.

Camera and software

Our field of research is producing HDR Images with a digital pano-rama-HDR-camera from Spheron (the german manufacturer of the first digital cylindric-panorama-camera, as well as of the first digital spherical-panorama-camera and the first digital hdr-spherical-pa-norama-camera “ICOPIC RX”) and using them as vr-background for vr and ar (Virtual and Augmented Reality). With the ICOPIC RX you can easily capture full spherical HDR images in a single pass. The extension comprises additional software capabilities for the PanoCam Operating Software as well as special hardware capabilities of the camera.

The images are postprocessed like a simple panorama and are then stored in RADIANCE, TIFF float or PFM file format. This omnidirectional high dynamic range image can be used as a background shot and light source for illuminating virtual objects. To use the benefit of Illumination, there is a special kind of new renderer necessary. We are working with 3ds max 4.2 and finalRender. The most important new feature added by finalRender is its true und ultra – fast Global Illumination. Because of its unique implementation in 3ds max materials as well as working with most of the plug-ins availlable for 3ds max.

Global Illumination

Global illumination (“GI”) rendering is not particularly new and has been around for many years, as anyone having attended Siggraph will know, but it was never incorporated into commercial renderers due to the lengthy calculations required to produce these results. Now that computers have become much faster, this type of rendering is becoming somewhat feasible. However, todays glo-bal illumination renderers such as “Brazil”, “Raymax”, “Vray” and

“FinalRender” can still take hours to produce an image. Many of these renderes support multiple global illumination rendering methods for optimized GI rendering as well as now-standard GI tools such as HDRI`s, saving GI solutions, GI baking, and many more.

We will show the different techniques to use HDR images for illuminating virtual objects e.g. cubic HDR images as a lightbox.

Conclusion

In the field of architecture the combination of using photographed spherical background-images instead of artificial graphics opens new ways of combining real-existing surroundings (e.g. existing buildings) with objects in the state of planning, especially in the state of evaluating different alternatives (of threedimensional VR-models). On the other hand the use of the HDR-technology opens a new level of quality in respect of simulating natural lighting and reflections. The result is an optimisation of simulation in planning.

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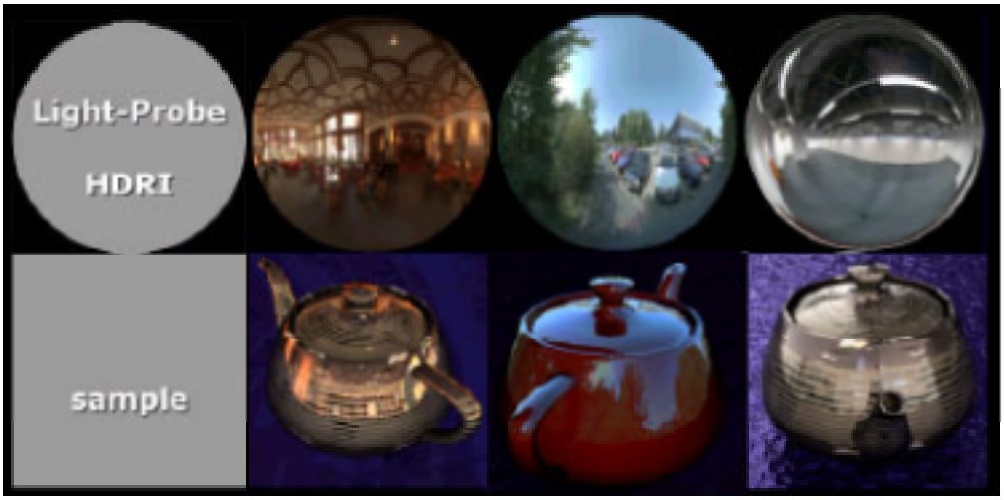
http://www.debevec.org
http://www.spheron.com

Camera and Software/VR background as a source of illumination

HDRI and RayTracing



HDR Domelight