

Interactive Viewing of Panoramic Images *

K. Der, A. Basu

Computing Science
University of Alberta
Edmonton, Alberta
T6G 2H1

J. Reyda

Panoramic Viewing Systems Inc.
24 Riverside Crescent
Edmonton, Alberta
T5N 3M5

Abstract

A software system that allows users to interactively view immersive images is described. The immersive images capture large fields of view, typically 360° around for panoramic and panosphericTM ¹ images, with vertical fields that vary from 70° to complete spheres. The input images were captured using various imaging sensors including panoramic cameras, conic mirrors, and fish-eye lenses. These images are inherently distorted due to the non-planar projections involved. The software simulates reality by mapping the captured image onto a 3D model, such as cylindrical for panoramic images and spherical for fish-eye and panosphericTM images, and then allows the user to interactively view the scene with the aid of a virtual camera. The innovative component in our work involves an inexpensive image acquisition system — Panospheric imaging — which allows users to obtain an almost spherical field of view.

1 Introduction

The Panoramic Viewing System developed here is a computer program to enable the user to interactively view a scene in any direction with the use of a virtual camera. It allows the user to pan left or right, tilt up or down, and zoom in or out. This type of system falls into a category of Virtual Reality (VR) in which the goal is to recreate the real world as convincingly as possible — as opposed to the category of VR that tries to convince the users that they are in another reality of the computer's making. The basic function provided by the software is to allow the user to view warped images of a scene while correcting the distortions. The images are warped because all the information in a 3D scene is packed into a 2D image;

*This work was supported in part by Panoramic Viewing Systems Inc. (PVSI). Mr. Jerry Reyda (President, PVSI) provided several important input on designing the system.

¹Panospheric is a registered trademark of PVSI.

essentially, a non planar projection is being mapped to a planar projection. Panoramic imaging technology can be applied in many areas where conventional static images may be inadequate, or where synthetic computer models would be difficult or time consuming to build. A major problem with conventional Virtual Reality systems is the labour intensive process of building models. Also, rendering of the model would be computationally intensive. The technology we have developed allows the use of a simple generic 3D model and maps the captured image of the scene onto that model, thus not only simplifying the model building process, but also decreasing the computational complexity of the rendering process. This method does not involve extracting 3D models from static images and then manipulating and rendering the model.

2 Previous Work

2.1 Mosaicing

Mosaicing is a process by which a sequence of smaller images is patched into a bigger image[8]. Panoramic images can be generated using this technique. It has also been used as a means of compressing video of a scene[5]. Omnimax images have been created from multiple perspective views using elliptical weighted filters [3].

2.2 Panoramic Lens

Panoramic images can be captured using a special lens designed to capture a panoramic field of view. Many such optical blocks or lenses exist, one of which is based on the optic block in Figure 1. The lens block designed by Powell [6] is capable of projecting a full 360° cylindrical field of view into an annular format. The light rays, represented by the dotted lines, enter the optic and undergo a total of two refractions and two reflections before exiting.

2.3 Conic Mirrors

Conic mirrors have been used in a number of sensing applications where the desired field of view was

