

The Visorama System: *Technology Issues*

Luiz Velho

IMPA - Instituto de Matemática Pura e Aplicada



Visorama, what is it?

Definition:

*“A Virtual Reality System
Based on Panoramas”*



Outline

- Real and Digital Panoramas
- Visorama: Virtual Reality with Panoramas
- The Hardware Device
- Visualization of Panoramas
- Authoring Mechanisms
- Current and Future Work



Real Panoramas

- Paintings



- Photographs

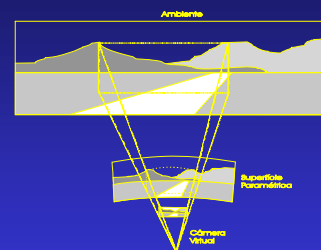


Digital Panoramas

- Mathematical Concept
 - Model
- Computer Implementation
 - Creation
 - Visualization
- Applications
 - Multimedia
 - Virtual Reality



Model of Panorama



Creating a Panorama 1:

- Image Capture and Pre-processing



Shooting

Registering



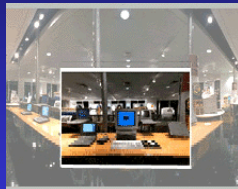
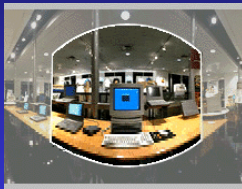
Creating a Panorama 2:

- Stitching the Panorama



Viewing a Panorama:

- Camera Transformation

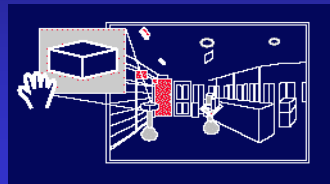


Warping



Navigation

- Hyperlinks (Hot Spots)
 - Moving Between Nodes
 - Ativate another Application



Production Tools

- Creation and Authoring



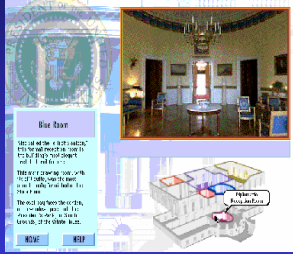
Hardware

- Networked Personal Computer



Software

- Multimedia (CD):
 - Director
- Web Applications
 - Netscape



Current Panorama Systems

- Characteristics
 - Small Images, Embedded in Applications
 - Interactive, but Not Real-Time
 - Low Performance, Consumer Hardware
- Formats and Companies
 - QuickTime VR (Apple)
 - Real Space (Live Picture)
 - PhotoBubble (Omniview)
 - Surround Video (IBM)



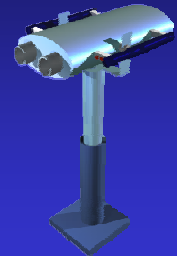
Visorama: A New Concept

- Virtual Reality based on Panoramas
 - Photo-Realism
 - Immersive
 - Natural Interaction
- Complete System
 - Dedicated Hardware
 - Viewing Software
 - Authoring Environment



Equipment Design

- Binocular device
- Stereo Sound
- Degrees of freedom
 - Fixed viewpoint
 - Pan and tilt rotation
 - Zoom



Visorama is a good idea

Less is more philosophy:

Restricts navigation to a fixed point to increase immersibility

- Avoids difficulties of virtual reality systems
- Based on panoramas (effective technology)



Fixed Point Restriction

Increases immersibility by simplifying interaction

- Prevents invalid operations
- No motion feedback required
- Simple and intuitive interaction
- Easy determination of focus of attention



Panorama Visualization

Panoramas have the same fixed point restriction

- Effective image-based rendering method
 - Photorealism
 - Images obtained from the real world
- Visualization not affected by scene complexity



Advances in Image Based Rendering

Visorama is one of the first immersive systems to use image based rendering

- Different requirements
- Novel visualization schemes



Immersive Visualization Requirements

- Synchronization with observation device
 - Constant and interactive frame rates
- Detailed virtual environment
 - Minimum screen resolution
 - Support large panoramic images
 - Adapted image resolution



Software Solutions

Requirements met using a combination of techniques

- Hardware implemented texture mapping
- Cache management
- Multiresolution image representation

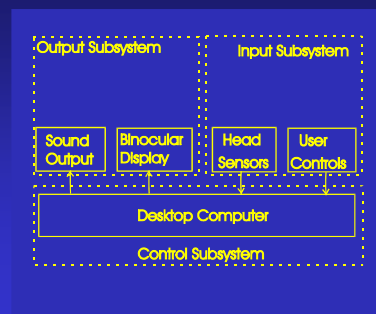


The Visorama System

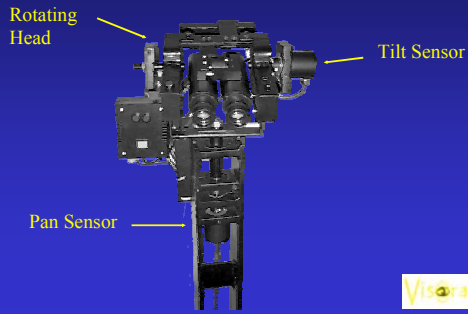
- The Visorama Device
 - Executes during user interaction
 - Hardware and software components
- Authoring Environment
 - Panorama creation
 - Specification of interactions in the virtual world



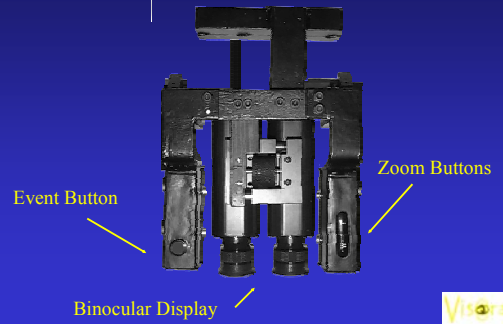
Hardware Architecture



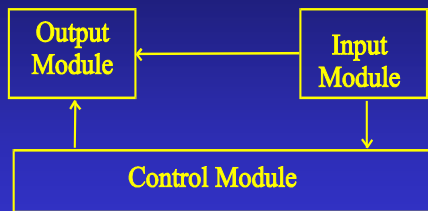
Observation Device



Rotating Head

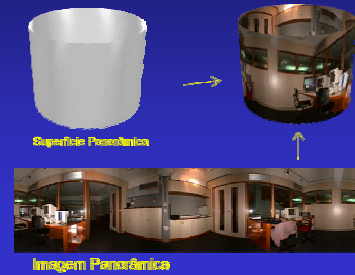


Software Architecture



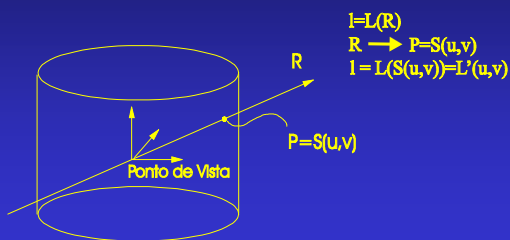
Output Module

Cylindrical Panorama Model



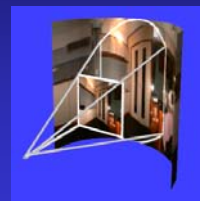
Rendering Panoramas

- 3D Visualization



Viewing Transformation

- Polygonal Model
- OpenGL Textures



- Virtual Camera



Current Work

Rendering Panoramas in Real-Time

- Basic Requirement
 - Realism
 - Immersibility
- Mechanisms
 - Multiresolution Panoramas
 - Predictive Cache



Multiresolution Panoramas

- Motivation
 - Arbitrary Levels of Detail (zoom)
 - Adapted Display Resolution

Image Pyramid



256 x 256



128 x 128



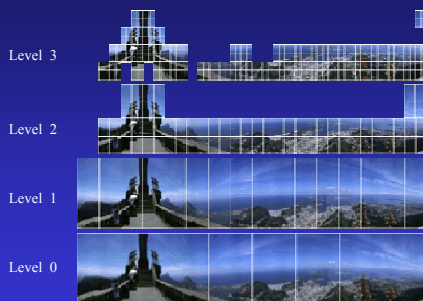
64 x 64



32 x 32



Adapted Multiresolution Tiling

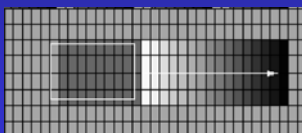


Caches of Panorama Database



Predictive Texture Load/Unload

- Based on Viewing Window
- Criteria
 - Temporal
 - Spatial



Example



Future Work

- Multiresolution Panoramas
- Authoring environment
- Audio
- Animated panoramas
- Improve ergonomics

