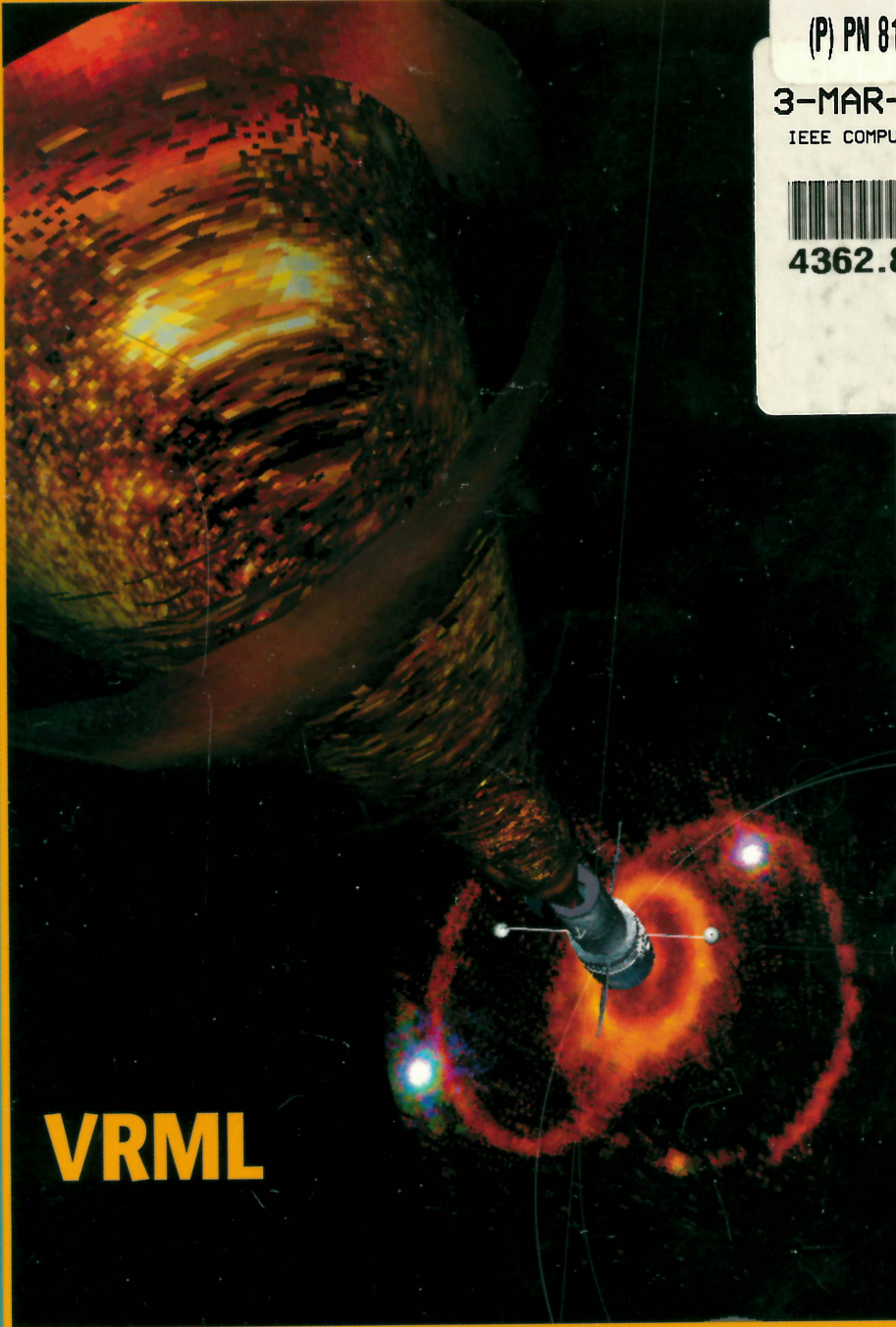


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VRML

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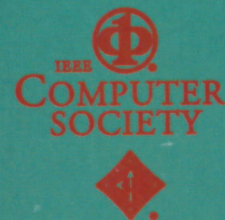
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<http://computer.org/cga/>

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TerraVision II: Visualizing Massive Terrain Databases in VRML

Martin Reddy, Yvan Leclerc, Lee Ivers
and Nat Bletter
SRI International

To disseminate 3D maps and spatial data over the Web, we designed massive terrain data sets accessible through either a VRML browser or the customized TerraVision II browser.

Researchers have increasingly turned to Virtual Reality Modeling Language (VRML) to represent geographic information. In VRML's early days, the result was a few toy examples that did not scale well, such as coarse, single-resolution elevation grids. Today, VRML is drawing more serious interest from researchers across the spectrum, including geographers, cartographers, geologists, and computer scientists, as the sidebar "Related Work" describes. As Theresa-Marie Rhyne noted, geographic information system (GIS) and scientific visualization tools have begun to expand into each other's

domains,¹ and VRML offers cartographers the potential to disseminate 3D map data over the World Wide Web. However, we have not seen useful large-scale VRML geographic data sets.

We aim to enable visualization of near-real-time 3D models of terrain that can be on the order of gigabytes. This might include digital terrain imagery for particular regions, elevation models and auxiliary information for geographic analysis.

The following scenario indicates the type of information required. Say a user wants to find a particular city in a particular city. Her journey begins with a map of the earth viewed from space. This map is derived from satellite imagery of 100-meter resolution—that is, each pixel in the texture represents a region on the planet's surface covering 100 meters. To find the city, the user first rotates the earth

Related Work

Currently, interesting and significant work addresses the problem of representing geographic data in VRML. In the earth sciences, Kate Moore described the work of the Virtual Field Course (VFC) project,¹ which is developing software tools to familiarize students with fieldwork locations and aid data collection and analysis. The VFC project uses VRML and Java to provide interactive 2D and 3D views of geo-referenced data to enhance students' cognition of the real environment.

The US Naval Postgraduate School is currently working on a project to develop a 3D model of the Monterey Bay National Marine Sanctuary. They aim to create a VRML representation of the sanctuary based on raw bathymetry (below sea level) data for a 2.5 × 2.5 degree region of the bay. Their representation uses multiresolution techniques to deliver these large data amounts over a 28K modem connection.

Michael Abernathy and Sam Shaw described their work using VRML to visualize the 197-mile relay race through the San Francisco Bay Area.² They did this using standard USGS (USGS) 7.5 arc min digital elevation models (DEMs) for the terrain geometry and referenced satellite imagery draped over the terrain. Their system also used Global Positioning System (GPS) input to create a line representing the race's course over the terrain.

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1. K. Moore, "Interactive Virtual Environment for Field Course Work," *British Cartographic Society*, 1998, available at <http://www.geog.le.ac.uk/~kmoore/>
2. M. Abernathy and S. Shaw, "Interactive Information in VRML Models," *Proceedings of the ACM SIGGRAPH '98 Conference on Computer Graphics and Interactive Techniques*, VRML, ACM New York, 1998, pp. 1-10.

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8th January 2016

Dear Ms Anderson,

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