

TerraVision™ is a system for interactively browsing 3-D representations of large geographic areas. It can retrieve and merge massive volumes of remotely located data, including aerial and satellite imagery, topography, weather data, buildings, and other cultural features. The data can be terabytes in size, distributed over multiple servers across the Web, and can be automatically discovered using SRI's GeoWeb technology.

THE VISION

The user starts TerraVision™ and sees a 3-D view of the Earth. As the user travels around the globe, browsing for a particular area, TerraVision™ automatically fetches data distributed across many sites throughout the Internet by querying the GeoWeb. The user flies down to ground level and is able to find all nearby restaurants, places of interest, and even the local garage sales on that day.



TERRAVISION

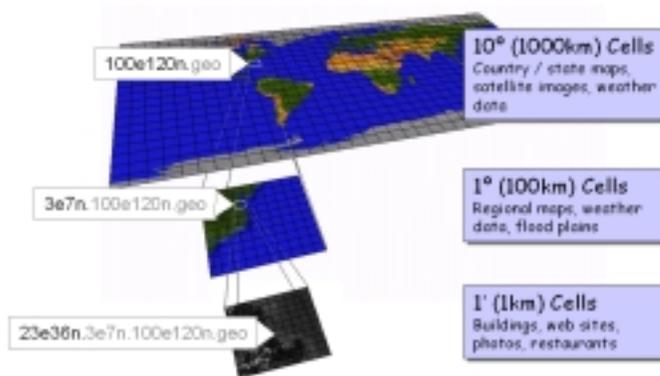
To interact in real-time with massive, remotely located repositories, TerraVision™ employs a tiled, multi-resolution data representation. This involves segmenting the original data into rectangular tiles over a range of resolutions, where each tile contains the same number of pixels or elevation data. By employing customized caching, culling, and data fetching optimizations, the number of polygons and texture maps required for rendering remains approximately constant, independent of dataset size and the viewpoint. Tiles are requested for an area using a coarse-to-fine progression so that TerraVision™ always has low-resolution data for the area of interest.

TerraVision supports the open standard GeoVRML format for representing building, weather, and other 3-D entities. GeoVRML is an extension of the ISO standard VRML97 format (Virtual Reality Modeling Language) that supports accurate, rich geographic applications. Refer to the GeoVRML home page at <http://www.geovrml.org/> for more details.

TerraVision™ handles multiple types of imagery; allowing the user to select or blend between different datasets, e.g., full aerial and weather Earth models where parts of the surface will have imagery down to 1m resolution. The user can navigate the terrain data with standard software on a personal computer connected to the Internet. A user can employ a graphics workstation connected to a fast network with high-speed disk servers to quickly navigate around a large area, but can also access this same data from a laptop machine over a wireless link when working in the field

GEOWEB

The GeoWeb (aka .geo) is a completely scalable infrastructure for indexing and searching for all georeferenced data on the Internet using the existing Domain Name System (DNS). The infrastructure involves creating a hierarchy of Web servers where each server has a unique DNS name that represents a given geographic area of the earth, e.g., 1e5n.10e20n.geo. It is then possible for any client across the Web to easily calculate the name of the server that contains data for a particular section of the planet. This opt-in scheme supports the integration of many disparate data sources, with no one-server bottlenecks, and transparent load balancing



FEATURES

Distributed Data - TerraVision™ can browse data that is distributed over a wide-area network, e.g. the Web, as well as locally installed data. TerraVision™ was specifically designed to cope with the inherent unpredictabilities of accessing data over a network.

Massive, Scalable Datasets - TerraVision™ can view massive datasets, in the order of terabytes. It achieves this by employing powerful optimization algorithms including: view frustum culling, terrain and imagery level-of-detail, horizon culling, caching, and prediction.

Entire Earth Visualization - TerraVision™ can handle datasets in a variety of geographic coordinate systems, e.g. lat/long, UTM, LVCS, and can transform these on the fly to a round-earth, or geocentric, representation.

Multiple Datasets - TerraVision™ can view multiple datasets at once. For example, you can have a 1 km resolution globe model, with a 25 m model of the San Francisco Bay Area, and 1 m inset for Palo Alto.

Multiple Viewers - TerraVision™ lets you open up multiple viewer windows. This lets you look at the same dataset from different perspectives at the same time, or different combinations of sets. You can even slave the view of one viewer to another.

VRML Model Overlays - 3-D models can be overlaid on the terrain to provide support for cultural features, such as buildings and roads, and atmospheric simulations, such as wind vectors and clear air turbulence models. We use VRML97 and GeoVRML to represent all models.

Flight Paths - You can set up predefined flight paths by marking a number of viewpoints and then telling TerraVision™ to fly a path connecting those viewpoints. You can vary the velocity, loop the path, close the loop, and select linear or spline interpolation.

Viewpoint Bookmarks - If you like a particular viewpoint, for example if you have found your house, then you can bookmark that viewpoint and TerraVision™ will remember it so that you can fly back to it later, or next time you use TerraVision™.

Heads Up Display - A simple HUD is available to provide information such as viewer location (in lat/long), orientation, number of tiles display, data burst rate, and frame rate.

Documentation - A web-based user guide is available to help new users familiarize themselves with the TerraVision™ system. TerraVision™ offers Help menus that bring up appropriate sections of this user guide in their web browser.

PLATFORMS

TerraVision™ uses a single code base for a number of platforms. Current platforms supported are SGI IRIX (6.3 and up), Linux, and Windows 98/NT/2000. We also plan to support Macs in the near future. Minimum platform requirements: (a) Intel: Windows NT/2000 or Linux, 400 MHz PII, 128MB memory, graphics card with drivers that provide hardware OpenGL support, and (b) SGI: IRIX 6.3, O2 class machine.

NETSCAPE PLUGIN

TerraVision™ functionality is available as a web-based terrain visualization system that lets you browse

massive geographic datasets that can be distributed over the web. This viewer is available as a Netscape plugin for Windows 98/NT/2000. The TerraVision™ plugin provides the following features: integrate multiple terrain databases over the web, multi-resolution streaming for interactive access to massive datasets, overlay VRML97 and GeoVRML models on the terrain, LiveConnect interface to enable control of the plugin from within a web page.



ActiveX COMPONENT

TerraVision™ is also available as an ActiveX component. This means that it can be embedded in any Microsoft application that supports the ActiveX interface, e.g. Internet Explorer, Microsoft Office, Visual Basic, C++. The ActiveX component delivers the same TerraVision™ functionality as the Netscape plug-in.

PERFORMANCE

TerraVision™ enables users to interact with a single image dataset at frame rates of 10-30 Hz on an SGI O2 or Windows platforms with accelerated OpenGL graphics support.

APPLICATION

Performance scalability and portability make TerraVision™ (and its associated data) a useful tool for numerous applications, such as military personnel performing mission planning and battle damage assessment, emergency teams fighting a forest fire or organizing disaster relief efforts, environmental workers evaluating a floor, or other time-critical conditions.

FUNDING

TerraVision™ has received DARPA funding support as a Digital Earth application initiated as part of the Next Generation Internet (NGI) program and as part of the MAGIC and Battlefield Awareness and Data Dissemination (BADD) programs.

For Additional Information:

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