Cartographic Visualization for the Internet. Case Study: Iqaluit, Nunavut (Northern Canada)

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In this poster preliminary results of the ongoing Iqaluit Electronic Mapping Project are presented. The poster is based on screen captures of the Internet-Based Cartographic Visualization Project conducted by the Mapping Services Branch of Geomatics Canada, Natural Resources Canada in Ottawa. The convergence of digital mapping and the Internet is paving the way for new mapping and interactive GIS applications. The Iqaluit Mapping Project is aiming to investigate and test various methods and tools for a more effective use of the Internet for cartographic visualization. The resulting cartographic products may be used to improve cartographic communication and also for decision-support applications in selected areas such as mapping, city planning, environmental studies and sustainable development.

Iqaluit is the booming capital city of the Canadian newly created territory of Nunavut on the Baffin Island, northern Canada. Large amounts of geo-spatial information are needed to support the management of natural resources, the protection of wildlife and environment and to promote new economic activities such as eco-tourism. The project investigates new tools and methods for a better representation of geospatial information within the context of new mapping applications such as Distributed Geographic Information (DGI), virtual worlds and fly-throughs.

New generation of cartographic information are being produced out of conventional cartographic products such as integrated vector maps, Digital Elevation Models (DEMs) and 2D raster images including aerial photographs, remote sensing or imaging radar data. Among those are ortho-mosaics, colour oblique stereo-models, composite Terrain images, 3D animation and fly-bys. Further, the project is also investigating multimedia components including voice maps, and places name maps. Preliminary results of the Project are available at the following Web (URL) address : <*http://www.maps.NRCan.gc.ca/Visualization/*>.

Key-words : GIS, Cartographic visualization, Internet Mapping, Tools, Online Applications, Decision-support, Iqaluit, Nunavut, Canada.

INTRODUCTION

The Internet as a new cartographic environment :

What is the Internet? A world wide computer network

- What is new?
  - A computer-based medium for communication
- What is different?
  - It is a digital world : electronic mapping
- Why is it so special?
  - Because of some advantages : fast distribution, easy access, interaction

THE IQALUIT CASE STUDY

- Justification :
  - Prototyping : data readily available in CTI (Iqaluit Commemorative Map Project)
  - Promotion of CTI products to potential users and the public
- General Objectives
  - Specific goals
    - Promotional : showing CTI topographic product and geomatics expertise
    - Scientific : display of data, products, tools, methods and applications. Advising about procedures, standards and techniques for Web mapping
    - Educational : Showing how to make a better use of Web-enabled geospatial information
    - Socially beneficial : how to better serve decision-makers (serving information to help communities, exchanging knowledge and know-how)
- The research issues :
  - How to comply to Web mapping design requirements (screen mapping)
  - How to address limitations of the Web environment? Screen, colour, storage facilities for large data sets, fast processing and data transmission, response time for query and downloading of large files (animation, 3D map features, images)
  - Map generalization (compromise)
  - How to
- Methodology :
  - An original cross-disciplinary approach
  - Data sources
  - Hardware and software
  - Procedures and standards
- Preliminary results
  - In map design
  - In 3D terrain visualization
  - In interactive map interfaces
  - Geographic interpretation
- Achievements and discussion
- Conclusions and prospects

Brain storming on research issues

GIS issues
- Data integration
- Data transfer/Interoperablity
- DGI functionality
- Interactive control over fly-bys and other animation
- DEM data accuracy : resolution and up-to-date?

Cartographic issues
- Java applets to enhance animated maps
- Enhancement of terrain shape using 3D effect : DEM z value exaggeration

Map design issues
- Color selection
- Text placement
- Multimedia : integration of sound, voice, animation, graphs, text, etc. in maps
- Use of mapping icons

Internet connectivity issues
- System architecture
- Network requirements
- File transfer protocols (high-bandwidth connections)
- Visualization in VRML

What is specific to the North? Area of Study

The threat to the sensitive equilibrium of the Arctic ecosystem from the rapid advance of technology can only be countered with solidly based knowledge (Fritz Müller 1977).

Pretty flat area : highest altitude around Iqaluit 160 m.
To simulate terrain configuration the Z value was exaggerated 3 times

Area with little map coverage
Map need to be updated (recent coverages are scarce)
Few high-scale maps (not suited for urban/land use studies)

Area with specific environment
Poor tundra landcover (permafrost, with few lichens and many exposed rocks)
Complex sea-ice distribution (boundary of shoreline, navigation and marine life)
Complexity of interrelations ice-wind-snow-water in the Arctic region may help understanding climate change mechanism
Man incrasing activity in the Arctic demand a better knowledge of the local environment so as to understand the effects of man interference. This may be achieved through mapping

Isolation and scarce human settlements
⇒ In the Arctic regions people live in small, remote communities frequently unconnected by modern communication and transportation infrastructure
⇒ Getting connected to the World is vital for community : the Internet allows tremendous opportunity to communities to break up their isolation, to share and to exchange among themselves and with the outer world
⇒ Gathering information or participating into collection of data, information and

knowledge on land about their own living environment thus contributing to databases and map updating

Mapping knowledge of the Arctic : because of limitation to conventional mapping (based on aerial photography and stereorestitution), new approach may be tested, based on radar and remote sensing tools.

Protection of lifestyles and health of northerners
Improvement of their living conditions, development of infrastructure, power engineering, building and transport
Establishment of a scientific base for nature use, management of animate nture resources from the viewpoint of ecological and economical expediency taking into account the centuries-old experience of indigenous peoples in nature use, the concerns of present and future generations
Study of minerall and raw resources of Arctic regions and countries as well as potentialities for coopreation between regions on the use and mutually beneficial exchange of natural reserves, implementation of advanced technologies on mining and processing minerals
Conservation and development of the unique circumpolar culture of Arctic and northern regions

Streaming mode (RealNetworks RealPresenter Plus) is based on compression / decompression algoritms (codecs).
Once the slides are created, a quick click on a link in the upper left of the outline starts the audio and video wizard. Plug a microphone in and you can record narration as you time your slides.

What is VRML?

- VRML the Virtual Reality Modeling Language is how to do 3D over the Internet. VRML is a file format. The VRML format is capable of representing the geometry and behaviors of objects such as cubes and spheres, monsters or virtual cities. VRML files or 'worlds' can be integrated to the Web by linking them to other 'worlds' or web pages.
- A VRML browser is a needed in order to End-users can view and interact with VRML files through Internet browsers (plug-in) such as CosmoPlayer. The Directory of Virtual Cities web site shows samples of VRML applications.
- The Web3D Consortium group is working to set up the as an official ISO standard (ISO 14772).
- Approach is simple : only a text editor, an authoring tool such as Spazz3D or ISA and a good understanding of the file format are needed to create VRML.

Research issue : How to map VRML?
The Web 3D Consortium adopted SRI GeoVRML. GeoVRML was developed by SRI International as an extension of VRML and a new standard in web-based three-dimensional viewing technology. GeoVRML allows the ability to integrate all forms of 3-D rendering of geographic data into real world scenes within the Internet by a conversion of feature elements local coordinates (x,y,z) into standard geographic or UTM coordinates. Those are then converted to Java to produce the GeoTransform package. The procedure is based on the SEDRIS Spatial Reference Model, an earth reference model that currently supports 12 coordinate systems.

MapQuest SVG is a scalable vector format that allows to keep the maps relatively small while providing a great deal of detail with vector graphics. Its main features include smooth zooming and text searches, and the capability to turn layers on and off. Users can also purchase customized layers packaged for their specific needs. As a two-dimensional graphics standard, SVG is an extensible markup language (XML) allowing graphic elements (map objects) to act as adaptative and interactive elements, using animation and compression capabilities.

Sample of new electronic mapping products
Maps for CD-ROMs
Web Site Mapping Technology
Map Animations
3-D Mapping
Products for Bundling
Screen-Ready Electronic Maps
History, Geography & Map Skill Products
Make-a-Map Products
Electronic World Atlases
Trip Planners, Travel Guides & Street Atlases
Multimedia Encyclopedias
Video

The concept of scientific visualization

Scientific visualization is a way of communication based on display of computer graphics on screen, or « the process whereby humans use software to do the work of converting number to image that nature does by physical processes » (Larry L. Smarr 1993)[*].

Scientific visualization aims at translating results of computer simulation, modelling or analysis into pictures, images and animations to allow a better interpretation and understanding of underlying information by human beings (viewers or researchers).

[*] Wolff, Robert S. and Yaeger, L. 1993. Visualization of Natural Phenomena. New York, TELOS, Springer-Verlag.