Internet GIS

(Geo-)information is an essential asset for managing protected areas. Although plenty of (geo-)information is in place today, the challenge is to bring it to widely distributed users. The authors developed an information system based on internet GIS which enables dissemination of information over the web to serve users ranging from specialists to policy-makers and the general public.<P>

The International Union for Conservation of Nature (IUCN) aims at promoting 'the establishment and effective management of a worldwide, representative network of terrestrial and marine protected areas' (www.iucn.org). Monitoring, analysing and planning action-oriented programmes for conserving ecological wealth in protected areas (PA) are complex tasks for which good (geo-) information is essential. Studies based on remote sensing and GIS have resulted in useful data; however, this has seldom been widely applied, thanks to the lack of an efficient and easy-to-use delivery mechanism. Today the web provides new dissemination opportunities, and this will improve PA management and decision making.

Requirements

The web allows visual interaction between data and people. By setting up a web server, clients can produce maps and charts for viewing by others, and this helps speed up management and decision making. Furthermore, since the internet is ubiquitous, such geospatial data can be accessed and worked on from almost any location. Today access to data and its visual presentation represent primary limitations. The availability of maps in India is heavily restricted due to policy frameworks. Creating an Information System in the public domain is supposed to encourage awareness. To develop the PA Information System (PAIS), a GIS Web Development Cycle was formulated. The best solution for the development of any internet GIS depends on good identification of application requirements. Careful analysis of these greatly simplifies development and aids arrival at correct decisions regarding choice of best architecture, a critical factor for good network performance. Requirement analysis was based on input from scientists, whilst existing web pages were reviewed and their functionalities also considered. A user-centred conceptual design and a flow diagram were then framed. Users were categorised into four classes:

-General Users, such as tourists
-Hobbyists, such as bird watchers
-Researchers without GIS capabilities
-Researchers with GIS capabilities.

The framework fulfils the requirements of all these users: the interaction is simple, while complex queries can be handled.

Tools

The framework is based on the OGC reference model. However, we separate layers with geographic features that can be queried via WFS and encoded in GML2 (Geography Markup Language, 2002) from those of which coverage can only be displayed. All datasets were transformed into the same projection system (Lambert Conformal Conic). Shifts and data integrity was checked with the help of overlays. GIS systems ArcGIS 9.2, ArcView 3.2 and ArcIMS 9.2 were used, while ERDAS 8.6 of Leica Geosystems was employed for all remote-sensing analysis and digital-image processing. Java applets were used for GIS functionality on the client side. Data processing is broken down into server-side and client-side tasks. A client is typically a web browser, and the server-side consists of a Web Server, Web GIS software and database: a configuration that exists widely within enterprises. The server runs the proprietary GIS, adding a client interface at the client side and middle-ware at the server side to communicate between client and GIS. ArcIMS 9.2 has multi-tier architecture consisting of presentation, business logic and data tiers, and is able to manage a web-mapping site.

Data Transport

Communication to and from the Application Server and to and from the Spatial Server is handled through ArcXML, an implementation of XML used with ArcIMS. ArcXML elements and attributes provide the structure for:

-map configuration files
-metadata configuration files
-requests
-response.

An ArcIMS request is first handled by the web server, passed through one of the connectors and then forwarded to the ArcIMS Application Server, which dispatches the request to an ArcIMS Spatial Server for processing. The response follows the same path in reverse order. Connectors are necessary because the Application Server can only process requests written in ArcXML; the connectors carry out translations. A web server handles requests from a client using HyperText Transfer Protocol (HTTP). ArcMap Image Service was used for map creation and display. A Feature Service delivers map content to the user as streamed features that remain available as long as the client is open. Requests are sent to the Spatial Server only when additional data is needed. Clients that can read this stream include the Java Standard and Custom Viewers, ArcExplorer-Java Edition, and ArcMap. Java Applets are used to handle map and note edits. Display property of all the GIS layers have been set for best visualisation. Various GIS Layers were prioritised and the scales defined. General, scientific and management queries were predefined to address the requirements of the users, and the dataset was accordingly structured for fast and better results.

Concluding Remarks

The capability of the internet to make spatial data easily accessible to and sharable among a wide audience will have important impacts. Users will be able to conduct GIS analysis over the web and developers may broaden their market share, while within and among institutions integration and co-ordination of departments and functions will be facilitated. The integration of GIS with the internet is a rapidly

growing trend, and the GIS community should monitor and define its course. Database normalisation and indexing will provide the best performance for internet GIS, and the concept of ArcGIS geo-database is an initiative towards this end. Since protected areas cross national boundaries, projection systems, data/spheroid issues and map policy need to be revised.

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