

Creation of a Web Based GIS Application for Spatial Wasteland Information System for Uttarakhand State Using Effective Open Source Software

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Abstract— The use of the capabilities of spatial technology in the decision making and other planning processes requires a large amount of Geo-spatial database and a proper channel for accessing, sharing, displaying and easily processing and editing of this large amount of spatial data. Free open source web GIS system which includes Geo-server which is a web GIS server and PostgreSQL/PostGIS as an object oriented relational database management system (ORDBMS) for effective dissemination, sharing and management of spatial information over the internet had proved to be time and cost effective in the sharing of the geo-database. Web GIS can easily use for displaying of spatial information over the world and can be accessed by the any user over the internet. Graphical user interface is needed for this kind of application so that it is suitable for the user to look over their interested place with the single mouse click. These free open source software and servers can be effectively used in web-GIS technology. Wastelands which are needed to be identified and mapped in GIS environment are very important so that it can be used for alternate uses as per the conditions. In this study the wasteland information system thus generated for the entire state of Uttarakhand state which has been generated using GIS and Remote sensing techniques, had been used to be displayed and viewed through Geo-and web-server.

Keywords— GIS, Geoserver, ORDBMS, HTML.

INTRODUCTION

A “geographic information system” (GIS) is a computer-based tool that allows you to create, manipulate, analyse, store and display information based on its location. GIS makes it possible to integrate different kinds of geographic information, such as digital maps, aerial photographs, satellite images and global positioning system data (GPS), along with associated tabular database information (e.g., ‘attributes’ or characteristics about geographic features). Using GIS, you can incorporate all of this information into a single system and execute common database operations. For example, GIS allows you to perform statistical analysis or spatial queries, to explore ‘what-if’ scenarios, and to create predictive models.

Web GIS is closely related to two other terms: Internet GIS and the geospatial Web. Internet GIS and web GIS are often used synonymously. Strictly speaking, however, the

two are slightly different. The Internet supports many services, and the web is only one of them. GIS that uses any of the Internet services, and not just the web, can be considered Internet GIS-making Internet GIS theoretically broader than Web GIS. In reality, the Web is the chief attraction of the Internet and is the most commonly used Internet service. Thus, Web GIS is the most pervasive form of Internet GIS.

Internet based geographical data services involve management spatial and non-spatial (attribute) data. Geographic Information System (GIS) has come to be an indispensable tool for analysing and managing spatial data. Data pertaining to spatial attributes can be efficiently managed using Relational Database Management System (RDBMS). The development of a Web-based system by integrating GIS and RDBMS would serve two crucial purposes. Firstly it would allow the user to operate the system without having to grapple with the underlying details of GIS and RDBMS technology. Secondly, it would allow sharing of information and technical expertise among a wide range of users. In the present paper we describe the salient features of spatial database that was developed by integrating the Open Source Software (OSS) Geo-server and PostgreSQL Object-Relational database into a Web based client/server environment.

A. Study area

The study area had been selected the hilly state of Uttarakhand. Uttarakhand has a total area of 53,483 km², of which 86% is mountainous and 65% is covered by forest. Most of the northern part of the state is covered by high Himalayan peaks and glaciers. Uttarakhand lies on the southern slope of the Himalaya range, and the climate and vegetation vary greatly with elevation, from glaciers at the highest elevations to subtropical forests at the lower elevations. The highest elevations are covered by ice and bare rock. Below them, between 3,000 and 5,000 meters (9,800 and 16,400 ft) are the western Himalayan alpine shrub and meadows. The

temperate western Himalayan subalpine conifer forests grow just below the tree line. At 3,000 to 2,600 meters (9,800 to 8,500 ft) elevation they transition to the temperate western Himalayan broadleaf forests, which lie in a belt from 2,600 to 1,500 meters (8,500 to 4,900 ft) elevation. Below 1,500 meters (4,900 ft) elevation lie the Himalayan subtropical pine forests.

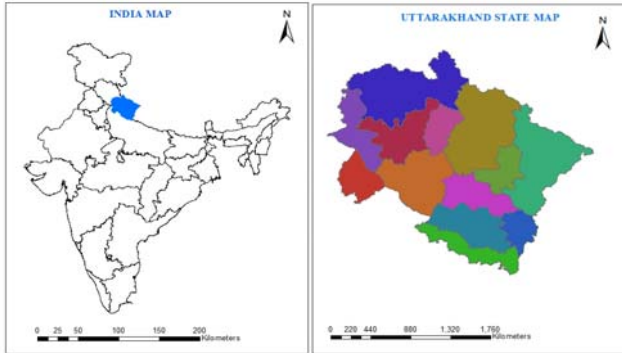


Fig: 1 Study Area

B. Application Architecture:

1) *Geoserver*: Geo-Server is an open source web mapping server written in Java platform. It is a subset of a web server model specially designed to share and publishes the Geographical information over the internet. It utilizes Web Mapping Service (WMS), Web Feature Service (WFS), Web Coverage Service (WCS) and many other open protocols for transfer the Geographical information, such as maps, spatial attributes and Feature data sets. Through these protocols Geo-Server can serve the data and maps in an efficient and powerful way. Geo-Server supports the most common data sources like, Geo Tiff, Shape file, ArcGrid, JPEG200 and GDAL formats and various databases viz., PostGIS, SQL Server, DB2, Oracle Spatial and ArcSDE..

2) *PostgreSQL/PostGIS*: PostGIS is a spatial database extender for PostgreSQL object-relational database. It adds support for geographic objects allowing location queries to be run in SQL. In addition to basic location awareness, PostGIS offers many features rarely found in other competing spatial databases such as Oracle Locator/Spatial and SQL Server.

3) *HTML*: Hyper Text Mark up Language, commonly abbreviated as HTML, is the standard mark up language used to create web pages. Along with CSS, and JavaScript, HTML is a cornerstone technology used to create web pages, as well as to create graphical user interfaces for mobile and web applications. Web browsers can read HTML files and render them into visible or audible web pages. HTML describes the structure of a website semantically and, before the advent of Cascading Style Sheets (CSS), included cues for the presentation or

appearance of the document (web page), making it a mark up language, rather than a programming language.

4) *Java Script*: JavaScript is a prototype-based scripting language that is dynamic, weakly typed and has first-class functions. It is a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles. JavaScript was formalized in the ECMA Script language standard and is primarily used in the form of client-side JavaScript, implemented as part of a Web browser in order to provide enhanced user interfaces and dynamic websites. This enables programmatic access to computational objects within a host environment.

5) *Open Layer Library*: Open Layers easily supports a wide variety of various map sources - WMS, WFS, Google Maps, Microsoft's Bing, and many more. There are many built into tools, such as scale bars, overview maps, zoom bars, and many more; but Open Layers also supports custom tools and allows for intricate configuration of existing ones.

6) *PHP Programming*: PHP is a powerful language and the interpreter, whether included in a web server as a module or executed as a separate CGI binary, is able to access files, execute commands and open network connections on the server. These properties make anything run on a web server insecure by default. PHP is designed specifically to be a more secure language for writing CGI programs than Perl or C, and with correct selection of compile-time and runtime configuration options, and proper coding practices, it can give you exactly the combination of freedom and security you need.

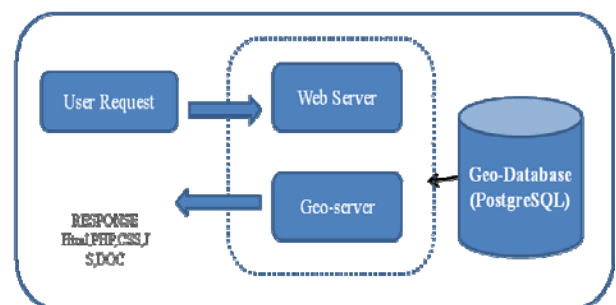


Fig: 2 System Architecture of Application

C. Application Interface

Graphical user interface is the main viewer of the application to show raster and vector spatial data. The major components of the viewer include navigation tools, selection tool, map viewer tools, query tool, legend tool, search tools and identification tool. In right side of the top frame of the viewer (Figure 2) shows the various navigation tools: (i) zoom in: helps to zoom the layer displayed in viewer window, (ii) zoom out: helps to zoom out the layer displayed in viewer window and (iii) pan: helps to pan the image/map displayed in the viewer

window. We can select any area with the help of mouse then it will show all details of this area in table form below the map. In this information district wise wasteland information will be show and also overall state information will be show. Users can easily access spatial and non spatial data with the help of graphical user interface. Some user interfaces are shown below.

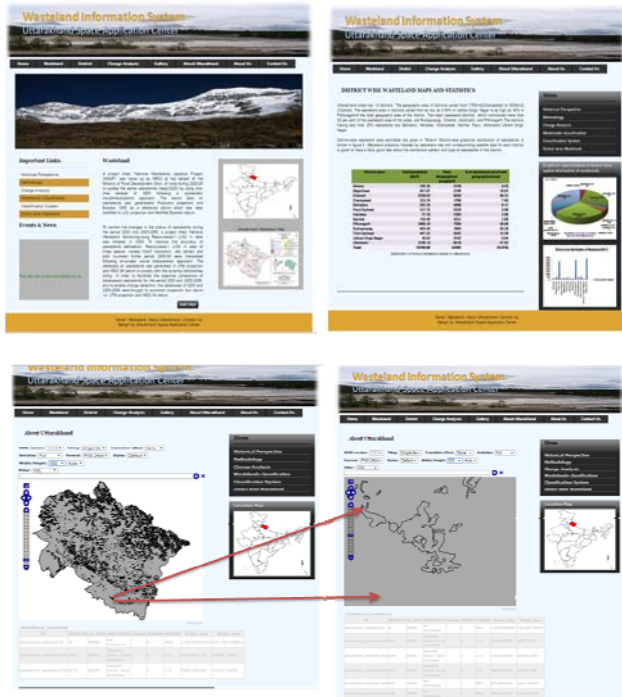


Fig: 3 Snapshot of web pages

RESULT

Development of web GIS based wasteland information system consist of various GIS tools like zoom in , zoom out, pan and any other required tools in this study .We can easily access spatial database with the help of PostgreSQL and PostGIS and non-spatial data .Any user can easily share spatial information through internet and used for implementation and other uses. This database is also used for decision making and further uses. This information also contains district wise information of wasteland. Free open sources software is very useful to generate a mechanism for to viewing spatial data freely in World Wide Web through internet. PostgreSQL is used to develop a strong GIS database.

CONCLUSIONS

After the analyses of the entire study it is clear that the GIS and remote sensing techniques in the generation of Geo-spatial database can be carried out with open-source software and their use in decision making processes which required the access of these database to the concerned department or persons on time require the server which is now possible using free open source servers such as geo-server.

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