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OPEN SOURCE GIS FOR PUBLIC INFORMATION MANAGEMENT

Information Technology

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ABSTRACT

In this present age Open Source GIS is one of the fastest emerging development fields for GIS developers. Simply it is a combination of Mapping figures and database. It can be used as a public service utility tool for various fields such as Transportation, Land bank development, Land information system development, feasible study for future industrial and social development etc. In this paper a public information system is being proposed with the help of Open Source Web GIS development.

KEYWORDS:

Land bank map, land use map, query through GIS mapping, mapping on development map.

Introduction:

Web GIS is a GIS system that uses web technologies. It originates from a combination of web technology and the Geographical Information System, which is a recognized technology that is mainly composed of data handling tools for storage, recovery, management and analysis of spatial data Web GIS is a kind of distributed information system. Country like India, it is a very challenging job. Surveying and mapping of any areas are not modernized in India in present days. Most of the states in India deals with the hard copy cadastral maps. The overall scheme is defined as four important aspects. Those aspects are (i) Preparing base map of an area and generate different layer maps such as transportation, estates; project works etc. with the help of the base map and collected data through GPS survey. (ii) Upload the base map and other digitized layer maps into the centralized web base map server and input the required data into the spatial database and (iii) Build up a web GIS application with four different informative sub schema, which are (a) Estate map of any organization, which shows the estates of an organization upon their base map, (b) Land bank map of any area, describes the available land parcels may be used for future industrial or social development, (c) Development works of any organization, defines the implemented projects of an organization and (d) Land use map of any area with the unique colors specifies the classification of the land with a query generation tool.

The main administrator controls both map server and database server. He or she is also responsible for any changes in the web GIS applications and manages data in a systematic way for both the servers and allocating sub administrators with specific permission for each area. The sub administrators prepare the raw maps (such as base map, estate map, transportation map etc.) and upload all the information for each area through the web GIS application. The end users or public views can view the required map through that web GIS portal.

Some open source layers such as Openstreetmap, Bhuvan satellite imagery are also integrated for better perception of the viewer.
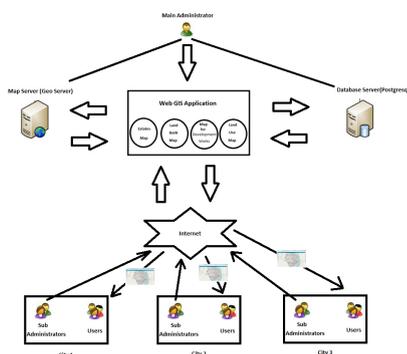

Figure 1.1 : The overall process

1.1. Scheme

The overall process starts to build up the base map of the proposed area. It is a very important aspect of the whole technique. Because without any base map, the further steps cannot be proceeded. Section 1.1.1 deals with the detail description about preparation of GIS base map with the help of scanned cadastral village maps. Sections 1.1.1.1 to 1.1.1.5 describe the step by step process with some error controlling techniques, digitization process and also checking the vector data with the help of satellite image.

1.1.1 Preparation of GIS base map:

In this section a common GIS base map preparation technique is being proposed. There are a few techniques available for developing a GIS base map for a particular area. But the most common and cost effective technique is 'Develop GIS base map with the help of the scanned cadastral village (mouza) map'. The cadastral maps are mostly developed through manual traverse mapping survey or total station survey. There are so many open source software in the modern days for digitizing the scanned raster maps such as Q-GIS, Grass etc.

Algorithm
Input: Scanned Raster images, Output: Geo Referenced digitized base map

Step 1: Stitching all the raster village maps of the whole planning area.
Step 2: Geo - referencing the stitched image.
Step 3: Digitize the geo referenced image into various vector layers.
Step 4: Inserting the data obtained from field verification into the attribute table of each layer.
Step 5: Superimposing the digitized map on the Satellite image.

1.1.1.1 Stitching all the raster village maps of the whole planning area. Stitching of the scanned raster village maps is the first phase. Every village (mouza) map consists of so many features such as Name, Legend, Scale, Signature etc.

After scanning from the hard copy map, there may be some shrinkage error or angular deviation error in the raster map. This error can be removed through proper rectification with the help of the map scale (normally it is in the ratio of 1:3960, but it can be also available in the ratio 1:1980 and 1:990).

1.1.1.2. Geo - referencing the stitched image:

When the overall stitched image is completely prepared for further steps, Geo-referencing is required before digitizing the whole raster data. For Geo-referencing, the user needs to collect some coordinates (Latitude, Longitude) depending upon some known places and ground control points. Firstly measuring the center point of that raster image and split it into four numbers of quadrants. To complete the Geo-referencing, at least 3 nos. of coordinate are required. But more number of coordinate gives more accurate geo-referenced image. The accuracy rate of the Geo-Referenced map depends upon the number of

coordinates in each quadrant. If the coordinates in each quadrant are proportionate, then it will give us the better result. The ground control points can be selected manually with referenced to some known features such as schools, water body, tri junction points etc. The coordinates of those ground control points can be collected through GPS survey or satellite imagery such as Google satellite image, Bhuban satellite image, Openstreetmap etc.

After collecting the coordinates, it requires to impose those points on the raster image with specific known location. The correct sequence of imposing points is to put from periphery towards the center of the image.

1.1.1.3. Digitize the geo referenced image into various vector layers:

Digitization of the overall Geo-Referenced image is done depending upon the different physical features (such as roads, canals, railway lines, water body etc.). Each physical feature can be digitized separately as separate layer. But the most important feature is the plot level digitization; means digitize each plot or polygon side by side. These plots are the main unique entity of the base map. Three kinds of layers can be formed by digitization process, those are polygon layer, line layer and point layer. The base map is mainly built with the polygon layer where each plot represents one single polygon. The roads, railway lines etc. are formed with line layers. The unique identified features like temples, church, heritage building etc. can be formed in point layers. At the end, each layer can be exported into shape files.

1.1.1.4. Inserting the data into the attribute table of each layer:

The real time data of each layer can be inserted into the attribute table of that layer as per requirements. Those data may be collected from the field survey or some other source. Normally there are three types of physical feature available in the mapping part; those are point feature, line feature and polygon feature. Each physical feature can be differentiated with different. The dbf file hold the information related to each figure. Such as in case of a single plot, the polygon stored in the shp file and the attributes (like owner name, land classification, area, plot no, mouza name, jl no etc.) related to that polygon are stored in the dbf file. This information can be inserted manually after digitization.

1.1.1.5. Superimposing the digitized map on the Satellite image:

To check the accuracy and correctness of the digitized layers, it is being required to impose it on the Geo-Referenced satellite image (as given in the figure 1.2). This checking process can be done in many ways. One of the better and faster ways is to put all the layers on Quick bird satellite image. But quick bird satellite image is not freely available; the user needs to purchase it from the National Remote Sensing Centre. Due to that, the user needs to follow some other topology. The best way is to convert all the layers into separate kml files through any open source software like Q-Gis, Grass, KML Editor etc. and open it one after another using Google earth or Bhuvan satellite imagery.
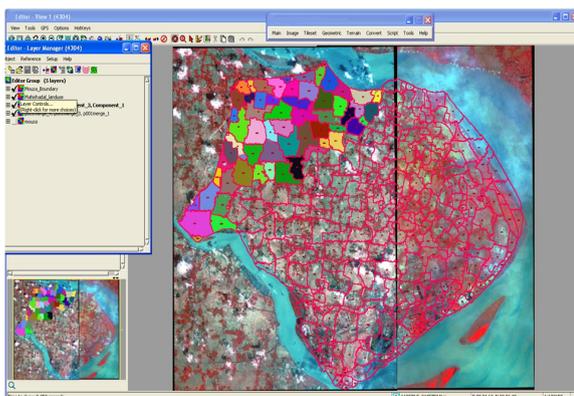

Figure 1.2: Vector layers on Satellite image.

1.   Web-based Spatial Data Acquisition

Two new centralized servers map server and database server are required to store the vector maps and map related information in a systematic way. There are many open source OGC based map servers like Geoserver, GDAL, MapServer etc. and also spatial database servers like Postgresql, MSsql available.

2.1 Insert vector maps into Geo-Server or Map Server

Geo-Server is an OGC compliant implementation of a number of open standards such as Web Feature Service (WFS), Web Map Service (WMS), and Web Coverage Service (WCS). Some additional formats and publication options are also available including Web Map Tile Service (WMTS) and extensions for Catalogue Service (CSW) and Web Processing Service (WPS).

After logged in, the sub administrator uploads vector files into specified workspace guided by the main administrator. He or she has to keep in mind that all the vector files to be uploaded need to have same projection system (normally it is in WGS84).

2.2 Styling of each vector layer

Every vector layer needs some styling features, such as an agricultural land required green filled polygon, in case of a residential plot it will be yellow color and also there may be required to insert some labeling features like plot no., name of the road, mouza name etc. The main administrator is responsible to design all the styling features of each land classification. He or she can easily design those style features (called as SLD file) through Styles menu in Geo-Server or can design it in a separate xml editor and upload that xml file in Geo-Server.

2.3 Insert data into spatial database server

When all vector maps uploaded successfully into the map server, the insertion process on the database server is required for completion of overall uploading technique. The core information can be stored into the spatial database. Some basic information such as present owner, previous owners etc. are stored into the database server [2] against each plot.

2.   Web enabled GIS application

In this section we will discuss what the utility of those vector layers are in short how it accentually works. The entire subject can be equally divided into four sub parts. Those sub parts are (i) Showing the estates of any organization on the base map, (ii) Displaying Land bank map of a proposed area, (iii) Showing development works of an organization on the base map and (iv) Produce the land use map of an area with query generation tool. All the sub parts will be discussed in the section 3.1 to 3.4.

Conclusion :A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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