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# Extraction and Visualization of Geospatial data from Spatial Database: A Case Study

**Hiremath P. S.[1], Kodge B.G.[2], Mankari M. P.[3]**

*[1]Department of Computer Science, Gulbarga University, Gulbarga, Karnataka*
*[2]Department of Computer Science, S. V. Mahavidhyalaya, Udgir, Dist. Latur*
*[3]Department of Geography, Maharashtra Udyagiri Mahavidyalaya, Udgir, India*
*Hiremathps53@yahoo.com*
*kodgebg@hotmail.com*

***Abstract* :**

**In this paper, the visualization of extracted information from spatial data base into geographical representation is demonstrated. The visualization techniques are essential for easy understanding of the information content of the data sets collected during the field survey for a particular study. The data mining techniques are used for extracting the information content of the data sets. The objective of the present study is to employ the information visualization techniques and data mining techniques for the spatial data base pertaining to a particular geographical region. The spatial database is built for the Latur district in Maharashtra state of India. The use of the database in the form of knowledge discovery is demonstrated visually in the geographical representation.**

**The objectives are as given below:**

- **Extraction of information using data mining techniques like collection, classification, tabulation, clustering, and association rule mining are used on different classes of spatial and non spatial attributes.**
- **Designing and plotting of data to prepare maps like road map, taluka maps, water bodies, railway, contours, village locations, etc. with their different attributes.**
- **Making user friendly access to Latur district information like searching for a village location or measuring distance between two or more locations etc.**
- **Visualizing class clusters through geographical representation.**
- **Village wise visualization of population, sex ratio and literacy.**

***Keywords*** :Geo-Visualization, Data Mining, Geographical Information System, Spatial Database.

## I. INTRODUCTION

### A. Study Area :

Latur District is in the south-eastern part of the Maharashtra state in India. It is well known for its quality of education, administration, food grain trade and oil mills. Latur district has an ancient historical background. The King 'Amoghvarsha' of Rashtrakutas developed the Latur city, originally the native place of the Rashtrakutas. The

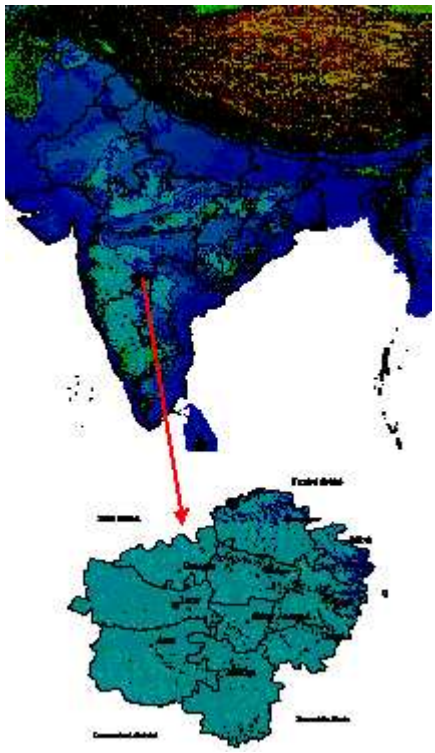

**Fig. 1 Location of Latur District**

Rashtrakutas who succeeded the Chalukyas of Badami in 753 A.D called themselves the residents of Lattalur. The entire Latur district has 415 meters to 700 meters of elevation, and it has an average elevation of 551.15 meters (1808.23 feet). The district is divided into three sub-divisions and 10 talukas (sub-districts). The number of village in Latur district according to the 2001 census, are 943.

Latur is located at 18° 24' N to 18.4° N and ? 76° 35' E to 76.58° E? / 18.4; 76.58 and is situated at 636 meter above mean sea level. The district is situated on Maharashtra-Karnataka boundary. On the eastern side of the Latur is Bidar district of Karnataka, whereas Nanded is on the Northeast, Parbhani district on the northern side, Beed on the Northwest and Osmanabad on the western and southern side as shown in fig. 1. [10]

## I. SPATIAL DATABASE FOR LATUR DISTRICT

A spatial database is a database that is optimized to store and query data related to objects in space, including points, lines and polygons. While typical databases can understand various numeric and character types of data, additional functionality needs to be added for databases to process spatial data types. These are typically called geometry or feature. Database systems use indexes to quickly look up values and the way that most databases index data is not optimal for spatial queries. Instead, spatial databases use a spatial index to speed up database operations.

In addition to typical SQL queries such as SELECT statements, spatial databases can perform a wide variety of spatial operations. The following query types and many more are supports.

- Spatial Measurements: Finds the distance between points, polygon area, etc.
- Spatial Functions: Modify existing features to create new ones, for example by providing a buffer around them, intersecting features, etc.
- Constructor Functions: Creates new features with an SQL query specifying the vertices (points of nodes) which can make up lines. If the first and last vertex of a line are identical the feature can also be of the type polygon (a closed line).
- Observer Functions: Queries which return specific information about a feature such as the location of the center of a circle etc.

### A. Hierarchy of Spatial Database

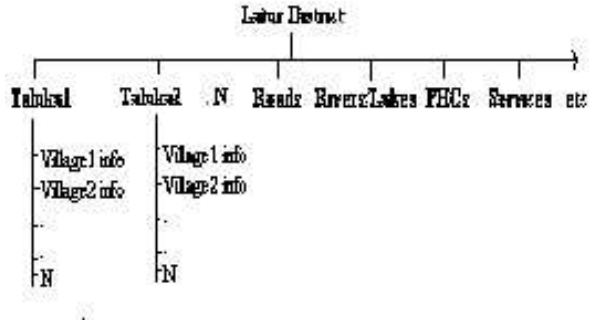


**Fig. 2 Hierarchy of Spatial Database**

The figure 2 shows the hierarchy of Latur district spatial database. The database is created using a spatial database system called NRDB Pro 2.6.1 and we uses the backend database MS-ACCESS 2003 for storing the spatial data attributes.

### B. Structure of Latur district Spatial Database

In this spatial relational database there are more than 50 tables designed and implemented for different data classes and their attributes of Latur district using a hierarchical data model. The structure of the database with table names and some important field names are shown in figure 3.

### 3. Map digitization in spatial database

As for the structure of Latur district spatial database (fig. 3) is concern, most of the tables/fields consists of spatial data elements like administrative boundaries, rivers, lakes, district locations, taluka (sub-district) locations, roads, elevation, villages location etc. are in the form of points, lines and polygon geometries. So that the first step is to digitize the data in the database, because has been only 15% digitized data is available and remaining data has been digitized manually using available resources.

Digitization of data in the spatial database done through following steps

- Before going to start any digitization in the spatial database, the first step in the spatial database is to

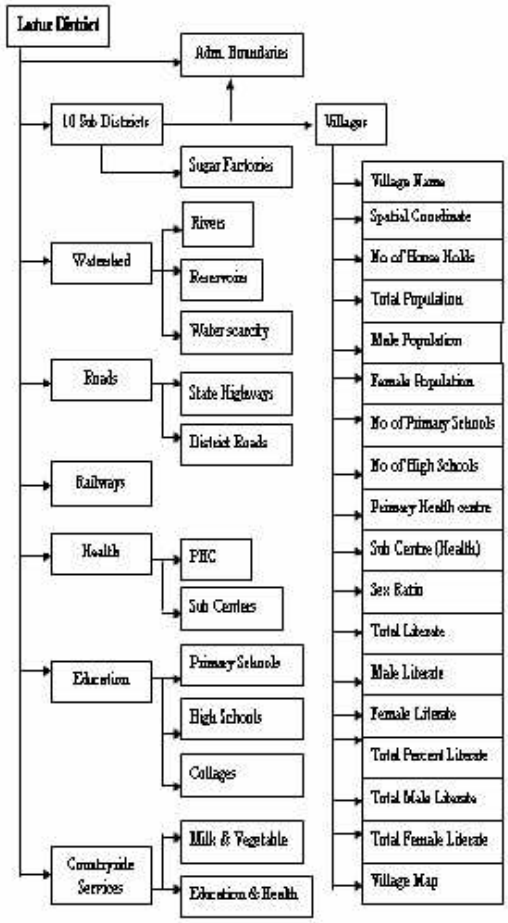


**Fig. 3. Structure of Latur district spatial database**

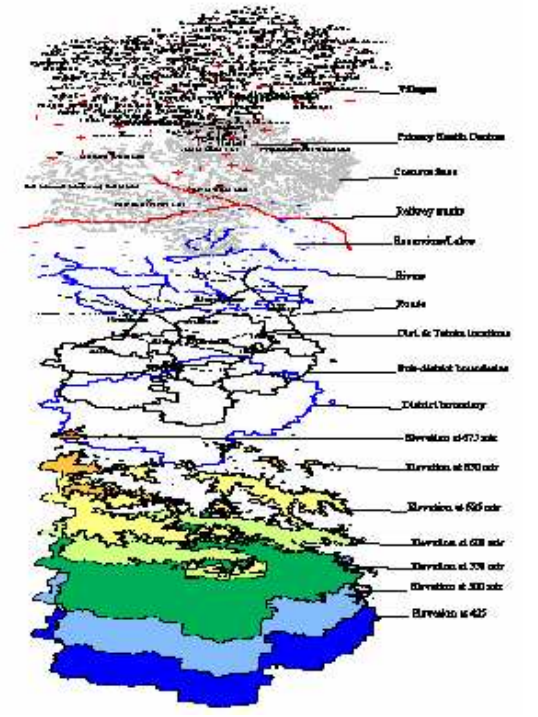

**Fig. 4 Exported map layers from Latur district spatial database.**

assign the map projection and ellipsoid for that map/ project. we have used UTM (Universal Transverse Mercator) projection and WGS-84 (World Geodetic System 1984) ellipsoid for Latur district spatial database.

- Next we have to create a spatial database tables for required maps/spatial elements with number of required fields with respect to their data types.
- The third step is georeferencing the map images, which will be used as base maps for digitization of that spatial data class/region. If the resource map is in the computer readable form than directly we can georeference that image and can use as a base map for digitization using the prescribed scale as mentioned on that image map. If the map is a chart/ paper map, than we have to scan it first, and use it as base map image after georeferencing.
- The fourth step is the digitization, which is the process of creating digital vector maps in the spatial database using available resources like digitizer, mouse etc.
- After completion of digitization process the digitized geometries will be stored into the database and will be available for further processes like, querying, joining, updates, analysis, etc.

Similarly I have digitized and compiled number of maps for different purposes in the Latur district spatial database and they are shown below in figure 4.

The following figure 5 shows the complete layered map of Latur district extracted from Latur district spatial database.

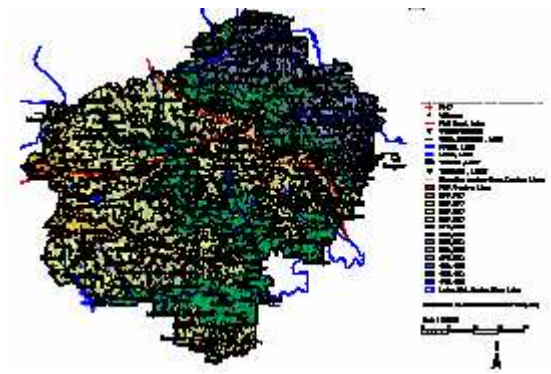

**Fig. 5. An Overlaid map layers of Latur district**

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## I. EXTRACTION AND VISUALIZATION OF SPATIAL DATA SETS

### A. Taluka level Analysis.

The data mining with respect taluka is a process of computing, querying and mining important and inter-related data sets of individual taluka. The basic data sets of individual taluka is stored in the Latur district spatial database and queried accordingly for necessary information of taluka wise statistics. The taluka wise statistics of all 10 talukas are calculated for sex ratio, area wise comparison, number of villages, total, male and female literacy attributes. The result chart of all queries are shown in figure 6 and geographically visualized in figure 7.

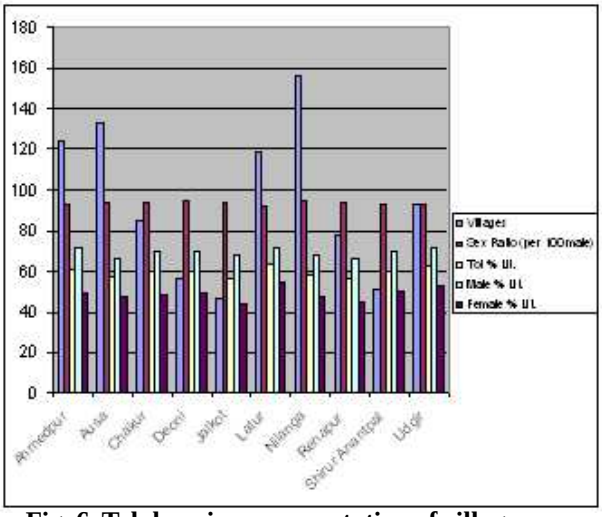


**Fig. 6. Taluka wise representation of villages, sex ratio and literacy.**

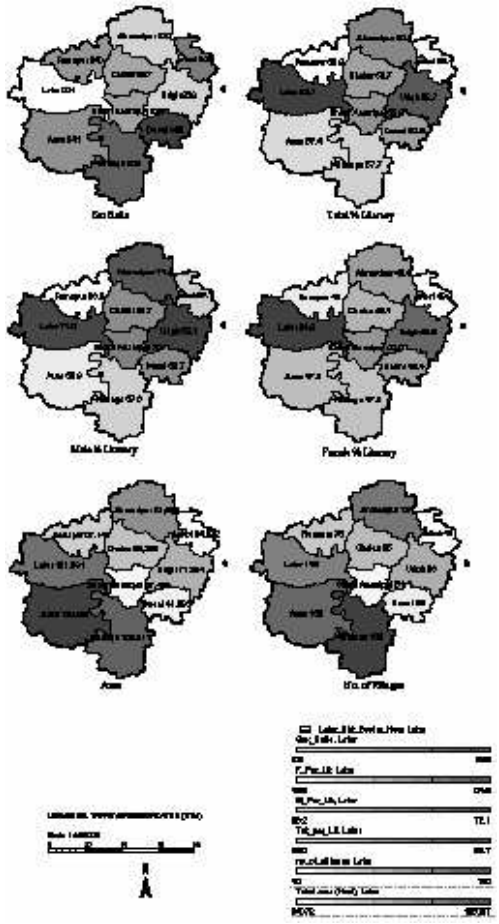

**Fig. 7 Geographical representation of Taluka level statistics**

### B. Village level Analysis

The villages are a name of spatial data table for village locations represented by point geometry with several attributes in the Latur district spatial database. In this section I have demonstrated few village level statistics through calculating new attributes like sex ratio, total percent literacy, male percent literacy and female percent literacy of individual village based on the values of existing attributes like total population, male population, female population, total literacy, male literacy and female literacy (census 2001) in the spatial database.

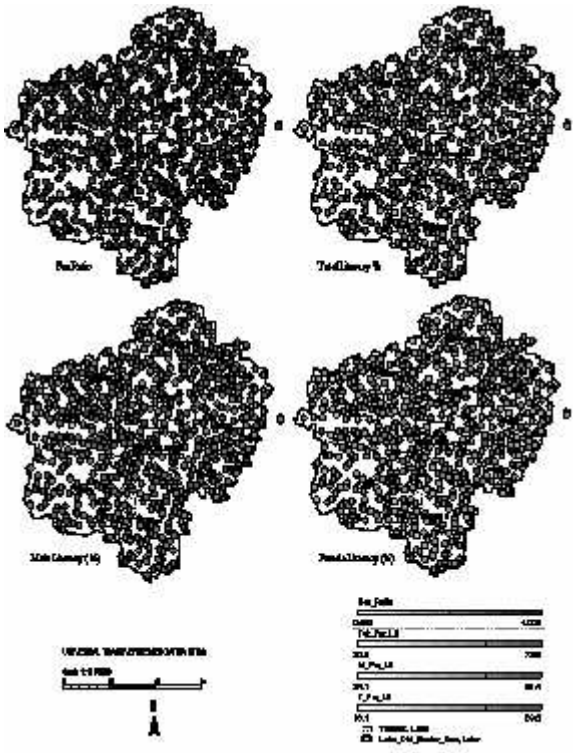

**Fig. 8 Geographical representation of village level statistics**

## I. CONCLUSION

The paper presents the geographical information system of Latur district, can fulfil the some information required for the further future developments in district/ taluka / village. It will provide educational, population, health, area information, political boundaries, maps, etc. related information. Now this paper can helps us to think about to maintain the ratio of male and female population in Latur district. Through the reference of this paper any one can show any live (geographical) data on screen by using the same methods of information visualization and data mining techniques. This can also used to evaluate the current developments and also for the further developments plans of Bidar district like in P.W.D. (for road developments), educational developments, Health departments, Rural and Panchayat raj department, Electricity boards, Telecom departments, etc. It is for the e-governance.

## II. ACKNOWLEDGEMENT

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