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RESEARCH ARTICLE

ADMINISTRATIVE INFORMATION SYSTEM USING VIRTUAL GEOINFORMATICS.

***Tisha Dey¹, and Dr. N.K. Baghmar².**

1. Research Scholar, Department of Geography, Pt. Ravishankar Shukla University, Raipur, India.
2. Professor, Department of Geography, Pt. Ravishankar Shukla University, Raipur, India.

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***Corresponding Author**

Tisha Dey.

Abstract

The present paper addresses the problem as well as solutions associated with the integration of data between dissimilar administrative boundary systems. Presently, the majority of spatial boundaries are designed in an uncoordinated approach with individual boundaries to meet individual needs. When same boundary from different organisation superimposed they do not match. As a result, recent technology for analysing geospatial information such as Geographic Information System (GIS) is not reaching their full prospective. The main aim of this research is to introduce a hierarchical model to aid in the clearness between data layers both horizontally between agencies and vertically between layers in the administrative boundary hierarchy. Administrative boundaries are often used for the display and analysis of spatial information, health, wealth, population etc. The solution proposed within this research involves the reorganisation and readjustment of boundaries into one ordered system. The study area has been taken as a newly formed Bemetara district for the formation of administrative information system. Data mainly used are scanned hardcopy maps, orthorectified satellite imagery with other attribute information. The prototype WEB-GIS has been developed using various software like Arc GIS, PHP, HTML, MYSQL etc has been used.

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Introduction:-

Internet has shaken the traditional approach and has brought paradigm shift in the process of thinking and societal interactions based on technological developments. The convergence of GIS and Internet has changed the mapmaking and cost-effective way to share or provide public access to geo-informatics worldwide. Web mapping is the process of designing, implementing, generating and delivering maps on the web. Arc IMS enables the distribution of geographic information over the internet or intranet and supports the wide varieties of tools for geo-processing, user specific spatial queries and generating analytical maps. The use of the web as a dissemination medium for maps can be regarded as a major advancement in cartography and opens many new opportunities, such as real-time maps, cheaper dissemination, more frequent and cheaper updates of data and software, personalized map content, distributed data sources and sharing of geographic information. It also implicates many challenges due to technical restrictions.

In planning process, integration of various spatial data and their characteristics is required to arrive at different alternatives. GIS is a useful tool for the integration and analysis the multi-thematic information for a particular application. This provides managers and planners with necessary information required for planning. GIS can be effectively used for generating new information from existing thematic layers of information required for particular need. In GIS, both spatial and non-spatial data may be integrated and set of spatially registered layers can be analyzed independently or in combination. Complex spatial analysis in GIS rapidly offers quantitative as well as qualitative advantages. Planning scenarios, decision models, change detection and analysis and other type of plans

can be developed in GIS by making refinements to successive analysis. GIS is a decision making tool in the hands of planners, and is increasingly being used for planning, protection and management of resources.

In fact there are few areas of the economy and environment, which do not rely either directly or indirectly on the integration of data attached to administrative boundaries for planning, maintaining or rationalising activities (Eagleson et al.,2001 a).

One of the greatest problems faced by geospatial information users has been the no coterminous alignment of different administrative boundaries that have accumulated (USGB,2001). This problem has essentially occurred because in the beginning organisations hand drafted the majority of boundaries on hard copy maps. With advances in technology, these hand drafted maps have been digitised for incorporation into GIS a technology for which they have not been adequately designed. Administrative boundaries are a product of the era in which they were developed and change is now required to meet the changing needs of geospatial information analysts.

Study Area:-

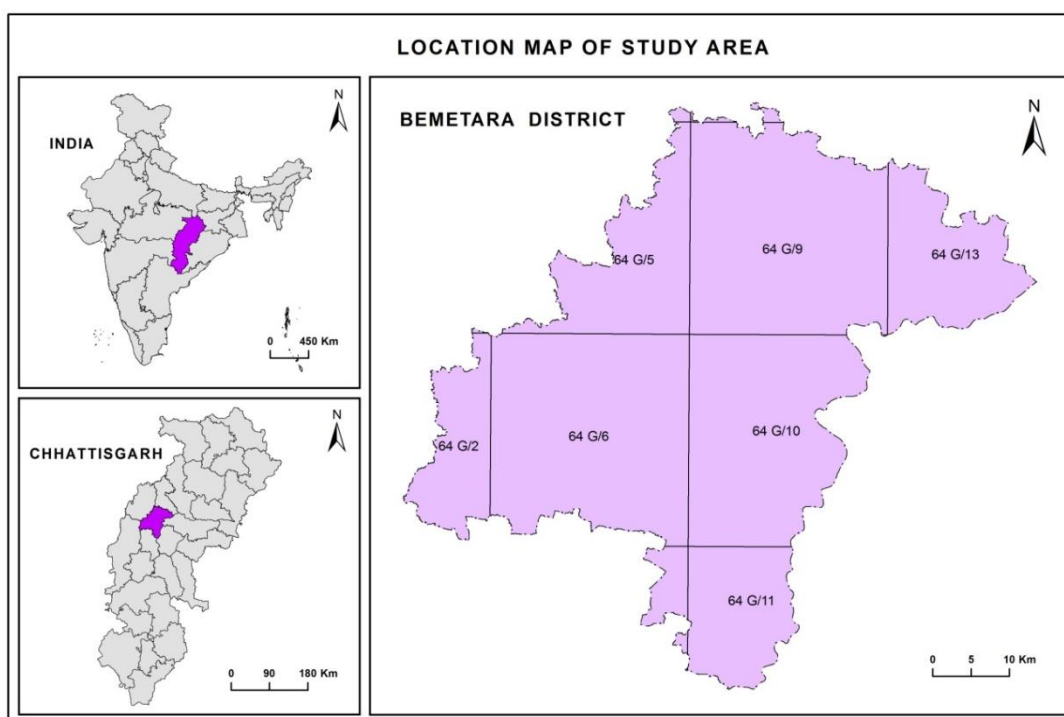


Fig 1:- Location Map of Study Area

Study area has been chosen as a newly formed district of Chhattisgarh that is Bemetara district. Bemetara district has been bifurcated from Durg District in the year 2012. The main purpose of bifurcation and formation of new district is for decentralized planning and for effective planning and proper implementation of different government scheme.

The study area lies between $21^{\circ}20'79''$ to $22^{\circ}1'24''$ latitude and $81^{\circ}10'22''$ to $81^{\circ}56'8''$ longitude. It covers a total geographical area of 2886.94 sq.km. Bemetara district is also known as 'Unhari District'. It mainly comes under Chhattisgarh plain and it is agriculturally sound district. Important river flowing in the district is Sheonath river. As per 2011 census, total population of the district is 599737 in which 298374 is male population and 302363 is female population. Density of population is 104 person/ sq.km. Literacy rate of the district is 71%. Sex-ratio has been found is 1015.

Bemetara district has been divided in two sub-division that is Bemetara and Saja. Total number of block is four namely, Bemetara, Berla, Nawagarh, Saja. Total number of Gram Panchayat in the district are 334 and total number of villages are 700. The district is divided into total 8 RI circles. (Fig 1) shows the Location Map of Study Area.

Material and Methods:-

A wide variety of data has been used in the present study. Following are the data listed given below:-

- ❖ Survey of India Toposheets 1:50000 (64 G/2,5,6,9,10,11,13)
- ❖ Scanned Hradcopy Maps
- ❖ Cadastral Maps, Village Maps
- ❖ Satellite data- Cartosat-I, LISS-IV, Cartosat-I & LISS- IV merged product (Orthorectified)
- ❖ Land Record Data
- ❖ Revenue Inspector Circle data, Patwari Halka Data
- ❖ Updated Gram Panchayat data (based on 2011 census),
- ❖ Hard copy data of newly elected Sarpanch (President) (2015)

Different types of software has been used in this study they are as follows:

Free & Open Source Software	Descriptions
MYSQL	Database management tool
HTML & CSS	To design web page
PHP	It is a server side scripting responsible for the communication of server side components
JQuery, JSON, Ajax	Client side scripting language
Sublime Text Editor	Used as script editor

Proprietary Software	Descriptions
Arc GIS 10	Used in digitizing, spatial adjustment, defining projection, view data, database creation, map generation.

Methodology used in the present study can be divided into two parts one in GIS environment another is in Web-GIS environment. For creation of Administrative Information System, administrative hierarchy has been taken as major unit. The methodology followed top to down drill approach from district to cadastral level information generation. GCP collected from toposheet, registration of toposheet with orthorectified satellite data for exact boundary demarcation. Spatial adjustment of boundary, formation of new boundary which is still not existing, hardcopy data converted into geodatabase, map generation, finally exporting all data into Web GIS platform.

Result and Discussion:-

For generation of Administrative Information System administrative hierarchy is followed.

(Fig 2) showing the hierarchy based upon which whole work has been carried out.

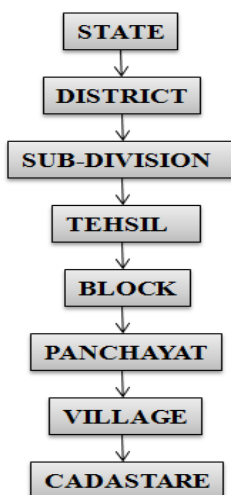


Fig 2:- Administrative Hierarchy

With the formation the system main emphasis has been given to rural local government hierarchy. Because rural local government play an important role in strengthening the Decentralised Planning of any area. As strong decentralised planning can help in Grassroot Level Development. (Fig 3) shows the hierarchy of rural local government.

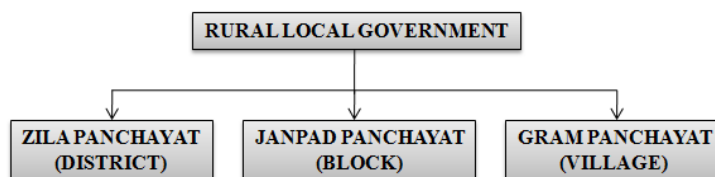


Fig 3:- Rural Local Government Hierarchy.

Rectification of Toposheet with Satellite Imagery:-

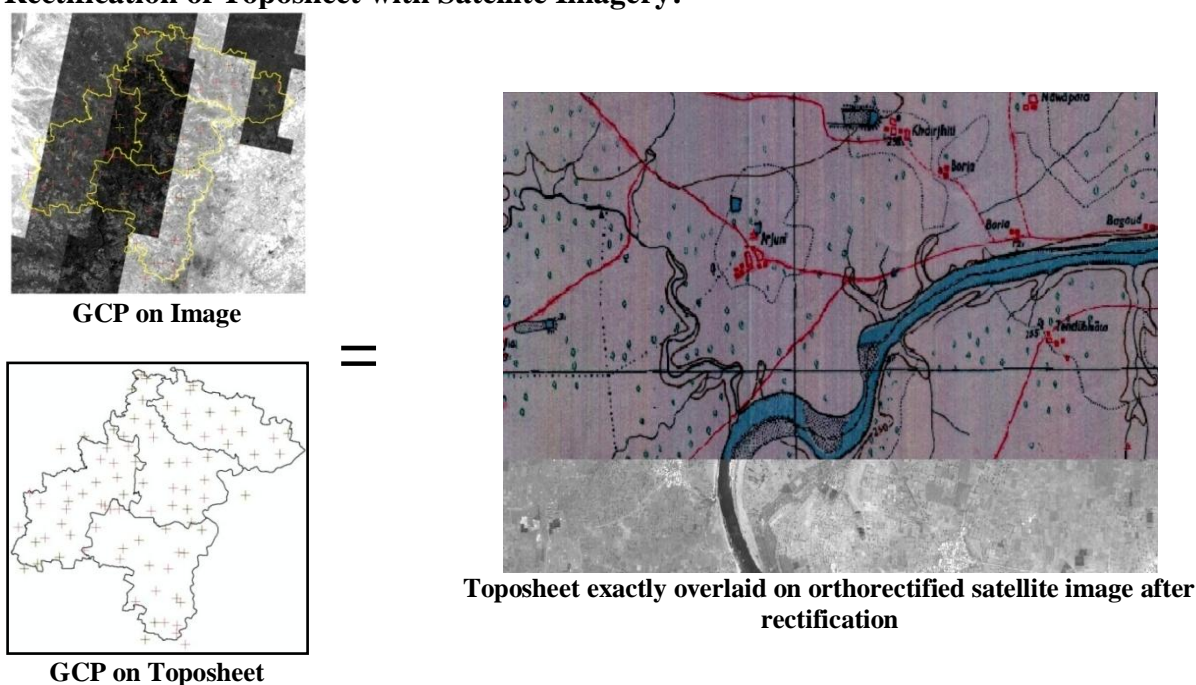


Fig 4:- Rectification of Toposheet.

In Geospatial perspective their establish a relationship between georeferenced based toposheet with the image coordinate system of the satellite image. As toposheet is one of the important source of administrative boundary demarcation. Therefore, from the figure it showed after rectification toposheet is exactly and accurately overlaid on the orthorectified satellite image. No whatever boundary will be demarcated from toposheet can be fitted on satellite image accurately, showing in (Fig 4)

Spatial Adjustment Of Existing Boundaries:-

As it has earlier mentioned that different departments have different boundary of same administrative unit, which they use according to their use. When the same boundary from different departments overlaid on each other they do not coincide. Which is one of the major issue because of which boundary dispute problem arise. To avoid this problem spatial adjustment of boundary has been done, so that all the department can access same boundary for their purpose and there will be no boundary dispute. Using this process boundary adjustment has been done in GIS environment for the study area showing in (Fig 5).

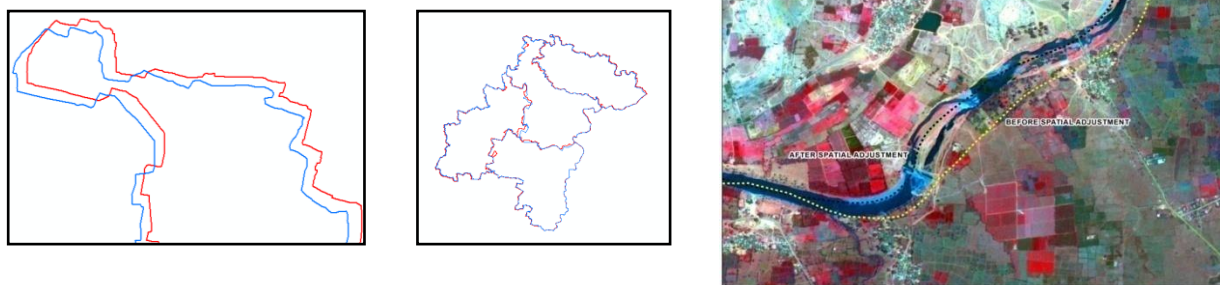


Fig 5:- Spatial Adjustment of Administrative Boundary.

Creation of Spatial Village Map with Attribute Informations:-

District and Block boundaries were drawn from Survey of India Topographical maps. These were brought in an Arc GIS after following the standard procedure that is digitizing, geo-referencing etc. Block map collected from the local government offices in the district, contain village boundaries. This block map which does not show geographical coordinates system were traced, marked the GCPs with respect to the SOI base map, digitized and brought to the real world coordinates system after projecting the maps. Each village in this map was assigned unique ids (user defined) in a regular sequence. Thus, Block map with village boundaries within built table have areal extent, village ids, gram panchayat name & code, etc. has generated for study area. (Fig 6) showing village map with attribute database.

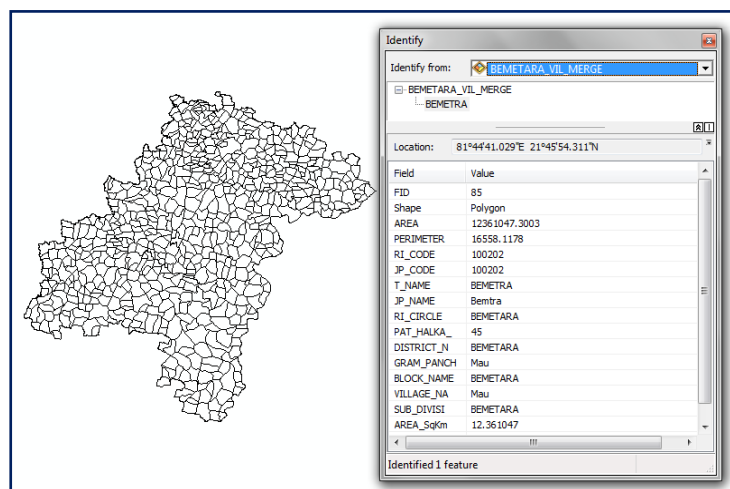
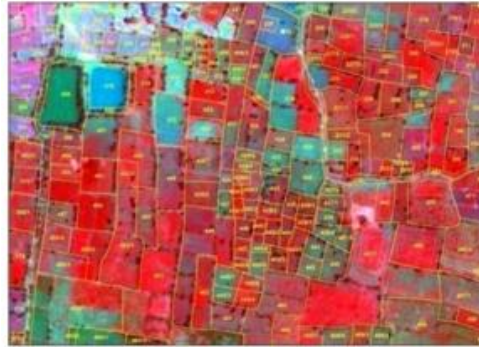


Fig 6:- Village Attribute Information

Creation of Spatial Cadastral Map with Attribute Informations:-

Cadastral data is usually stored in hardcopy registers and updated manually where available. Where a digital database is being prepared, map production often continues to be done manually in parallel. Often map showing land ownership are in the form of sketches, which are not to scale. Therefore, exact demarcation of the much of the land is impossible and time consuming. Most of the information about land is in the experienced hands of key personnel in separate departments. Due to the absence of any other information system, they are treated as the primary information sources. As a result of this, information can be easily lost. When information linked with the Land Registration and GIS based cadastral maps of land, it will become a valuable asset for the state, district, block and village. Through one can navigate through each plot of the land, can make specific queries. The aim should not only be to digitize the existing cadastral maps, but also plan the resources at grassroot level. Using such system revenue department can properly estimate the revenue to be generated and a farmer can easily settle his land related problems. (Fig 7) shows georeferenced cadastral boundary overlaid on satellite imagery.



(Fig 7) Overlay of Georeferenced Cadastral Boundary on Satellite Image

Creation of Spatial Gram Panchayat Map with Attribute Information:-

After creation of spatial village map attribute information has been entered into its database. Now village database has all the information regarding Revenue Inspector Circle, Patwari Halka No., Gram Panchayat Information, Elected Sarpanch Information. All this hardcopy information has been transferred into GIS environment which is also known as spatial information. Now one can easily generate Gram Panchayat map by dissolving village boundary. In this way Gram Panchayat map has been generated. Each Gram Panchayat has assigned with Unique IDs UID. Now a new database has been created for Gram Panchayat in which attribute information are available like Gram Panchayat UID, District, Sub-Division, Block, RI Circle, Patwari Halka No., No. of dependent villages (asrit gram), GP Sarpanch Name with their personal informations. Like this way GP map has been generated which is having all basic informations. All attribute informations are dynamic in nature which can be changed according to time and purpose. (Fig 8) shows the formation of Gram Panchayat map.

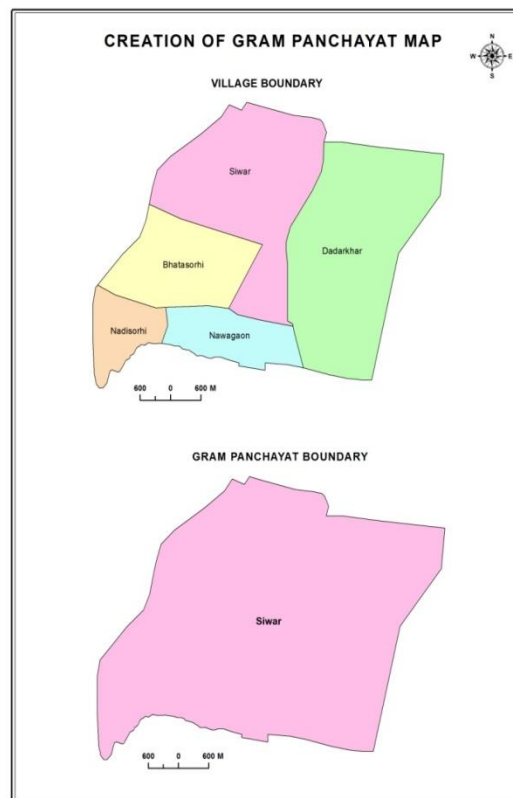


Fig 8:- Creation of Gram Panchayat Boundary.

With the help of satellite imagery all the village settlements are digitised in polygon form. (Fig 9) showing all the settlement polygon. From this settlement panchayat headquarters has been identified overlaying the GPS point which has been taken in field. With the help of GPS enabled digital camera picture of all Gram Panchayat offices has taken. Main feature of this camera is that it record latitude and longitude information along with the photograph taken in that particular place. (Fig 10) showing the a sample picture with its property taken from GPS enable digital camera. Advantage of this camera is one cannot manipulate photographs.

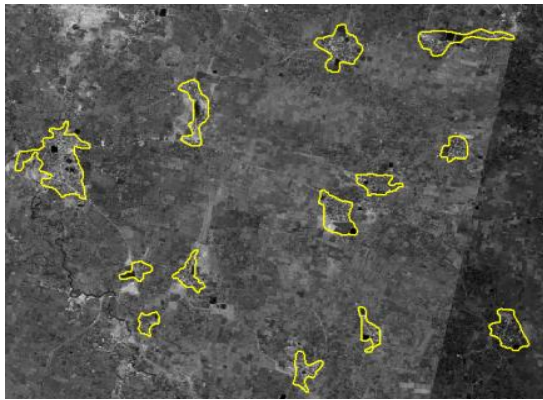


Fig 9:- Settlement Polygon over Satellite Image



Fig 10:- Geotagged Photograph of GP Office

Spatial Data Sharing by all Line Departments:-

Web based GIS join up the services via sharing of data across the borders of the departments. GIS is often the only common glue which can connect information residing in different departmental system and make them joined-up services a reality. The fact that a very larger percentage of the information we all work with is location based. However like every other local authority, most department worked in isolation and very little information sharing took place. (Fig 11) showing the methodology of spatial data sharing by a central server system.

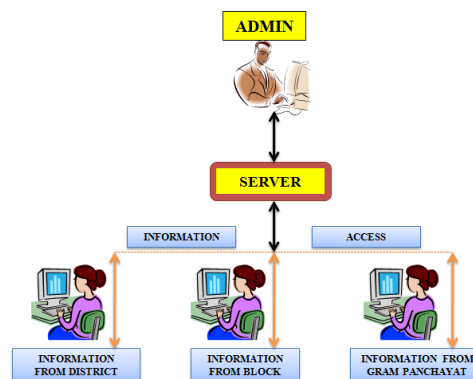


Fig 11:- Data Sharing.

Improved Decision Making:-

Decision making can be improved, because the official has instant access to other department's data. They can therefore see how their decisions are influenced by information residing in other departments. All the necessary information may be accessed from one computer. The citizens interested in all the information about a particular location can find out everything he needs from one source. Preparing and configuring the above files allowed to run the proposed web based GIS system. Application running has been done by using the common web browser such as Google Chrome etc. Tested by running a URL <http://localhost/bemetaraGIS/home> using the above web browser will lead us to the development of Administrative Information System of the study area. The developed web-GIS is an interactive Web-GIS system every click on its result the web and application server to send parameters to the server and reloading of map with other information take place.

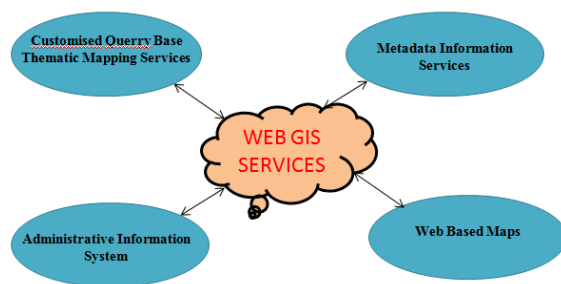


Fig 12:- Types of Web GIS Services

Development of Graphic User Interface (GUI) for Administrative Information System:-

A Graphic User Interface has designed in order to access and to share all the administrative information of the study area by all the lined department and for citizens in a single platform in order to reduce data redundancy, data transparency, data sharing for better decision making and planning and for other purposes. (Fig 13) shows the GUI of Administrative Information System as it is the home page. A simple title has given to the GUI as Bemetara Zila Gramin Vikas Darpan.

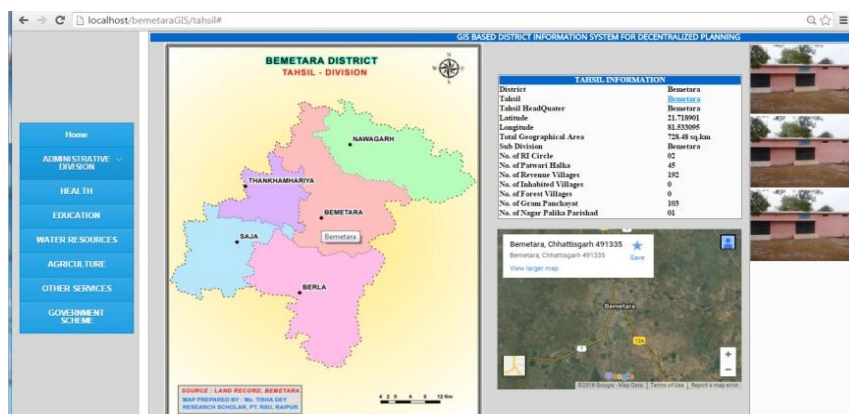


Fig 13:- Showing Homepage of GUI

(Fig 14) shows Tehsil information with the taluq boundary map. A single click over the taluq gives you all possible spatial and aspatial information. One can download the table in pdf format according to his purpose.



Fig 14:- Webpage of Tehsil Information

(Fig 15) showing Gram Panchayat Boundary Map with GramPanchayat Headquarters with all attribute informations. One can get latitude and longitude information from here and can access this point on GOOGLE EARTH according to their purpose. This page also gives yor Gram Panchayat Sarpanch informations in a single click of mouse.

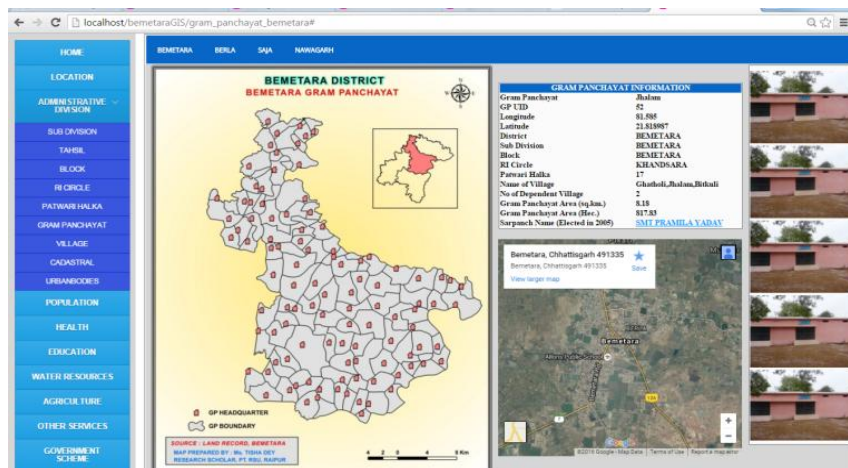


Fig 15:- Webpage of Gram Panchayat Information.

(Fig 16) showing the Sarpanch (President) information elected in 2015. If you click on Sarpanch name one can get all the information regarding sarpanch like sarpanch name, father/ husband name, category m/f, education qualification, address, most importantly contact number. This all important information are still not available in state portal . This information you will get in hardcopy from from Zila Panchayat office. This GUI will help to access all important data and save time also.

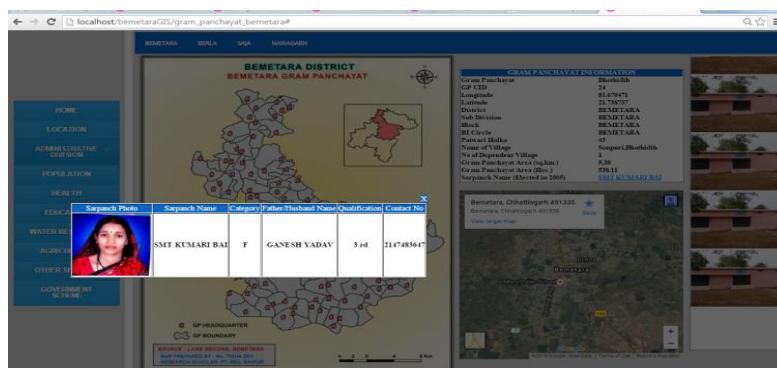


Fig 16:- Web Based Gram Panchayat Sarpanch Information.

Conclusion:-

This research is about the development of a Administrative Information System based on Web GIS. The major and significant conclusions emerging out of this study to generate a information system with a motto turning data into information integrating the spatial village maps with a non-spatial information from gram panchayat directory. This information system also established its usefulness to the decision-makers in the district to generate views for decision making at local level. This community GIS tool will serve as a first step towards the development of Decision Support System for decentralized planning at Block and Gram Panchayat level. From this study it has been also observed that high-resolution data like Cartosat- I and LISS IV show tremendous potential to prepare the base map at large scale of the village. The information system at village level would be helpful to plan out development policies for the village, Gram Panchayat and Block and District.

By efficient use of these data a GIS based information network has been developed which will flow between Gram Panchayat, Panchayat Samiti, Zilla Panchayat, District administration and various lined department. This paper has focussed on the role of administrative boundaries within the SDI and the development of an organizational framework for development of administrative boundaries, which support the objectives of SDI allocation of

administration boundaries, offers a solution to the problem of boundary delineation and provides the means for accurate data exchange between agencies. It facilitates a quick, objective and improved method to administrative boundary subdivision. In conclusion, this research aims to complement effective data management strategies so that the full potential of spatial data can be truly realized. WEB-GIS are one of the most obvious benefits of E-Government to the citizen. The communication with the authority, as well as delivering of services to the citizens is achieved irrespective of the boundaries between the local government areas. Therefore, the citizens may find the information they need no matter which authority delivers the service. Developing a Web based GIS for Information System using free and open source software with the least cost of development can be used to develop an integrated Administrative Information System based on Web GIS. This present a chance to local governments to store, maintain and disseminate integrated data from different sources. The web base information system provides users with the visualization of information and ready to use analytical tools. This helps decision makers and land developers in making sound decision making.

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