Internet Based GIS Applications for Local Level Planning and Development in the State of Chhattisgarh

Dr. Tisha Dey[1]

[1](Chhattisgarh Space Application Centre, Raipur, Chhattisgarh, India)

Abstract:
The convergence of GIS and internet has changed the map making a cost-effective way to share or provide public access to geo-informatics worldwide. Internet has changed shaken the traditional approach and has brought paradigm shift in the process of thinking and societal interactions based on technological development. For preparation of local level plans and functioning, it is becoming increasingly essential to have decentralized database and Web-based GIS functions for local or decentralized planning.

The datasets contain all geospatial database created for integrated rural development of Bemetara district of Chhattisgarh state. These datasets contain two types of data spatial and attribute data of all concerned lined departments. Geospatial layers used as dataset for creation of web based Decision Support System. Web materials used in generating Web Based Decision Support System are Database Language, Open Source Server For Sharing Geospatial Data, PHP Framework, Application Programming Interface, Application Programming Interface. The overall methodology followed in making Decision Support System is that 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. Organizing and constructing the above files approved to run the proposed web based GIS system. Application running has been done by using the common web browser such as Google Chrome.

Web map on the WWW is both served and consumed. Web based GIS emphasis geodata processing aspects more involved with design aspects such as data acquisition and server software architecture such as data storage and algorithms. Open source software that provides web map services capability is Geoserver. Proprietary standalone that is client side software that allow viewing web map services include GOOGLE EARTH. In this research open source software that supports WMS include Open Layers.

Rapid progress of internet with combination of GIS has paved the ways for web distribution of spatial data. Online accessibility of thematic maps will provide a clear picture of any attribute, as it would help the planners associate various parameters together to examine the effect of any plan and to effectively monitor the utilization of funds. Sustainable development can be result of successful integration of spatial and aspatial data and implementation of Web GIS applications with proper planning at the local levels.

Key Word: Database; Development; Internet; Planning; Web-GIS;

I. Introduction

Web mapping is the method of designing, applying, generating and bringing maps on the web. ArcIMS enables the distribution of geographic information over the internet and intranet and supports the wide varieties of tool for geo-processing, user specific spatial queries and generating analytical map. The convergence of GIS and internet has changed the map making a cost-effective way to share or provide public access to geo-informatics worldwide. Internet has changed shaken the traditional approach and has brought paradigm shift in the process of thinking and societal interactions based on technological development. Situations have changed now, for preparation of local level plans and functioning, it is becoming increasingly essential to have decentralized database and Web-based GIS functions for local or decentralized planning. In context of an increasing emphasis on decentralized planning, the need for collection and dissemination of spatial and aspatial data at the district and local levels has been increased in the recent past. Use of the web as a dissemination medium of geographic data in the form of interactive maps can be regarded as a major advancement in digital cartography and open many new opportunities such as real-time maps, cheaper dissemination and decentralized sharing of geographic information. The Web-based GIS functions are being expaned to serve geographical data on web for decentralized planning intention. Rapid improvement of internet with the amalgamation of GIS has paved the way for web sharing of spatial data. User can access the spatial data through WebGIS website, make thematic maps and perform all types of spatial queries analysis. Decision support system (DSS) is defined as computer-assisted system that allows sharing several key characteristics including:

Helping users in their decision building in a flexible and interactive manner; solving all modules of inconvenience, incorporate, ill-structured one; having a central and user-friendly interface; having a data inspection and modeling mechanism; enabling the user to unite models and data in a elastic approach.

On the whole, the web-based GIS is a great platform to distribute and handle the geographical associated information in a ubiquity, visualization and interactive way. These kinds of characteristics in web-based GIS assemble the needs for managing and presenting the Portuguese traditional food products which are closely associated with their geographic distributions. Various work has done in this field. The user interface functionality has progressed from simple document fetching to more interactive applications. HTML, CGI, JavaScript to increase user interface capabilities (Byong-Lyol, 1998). Vector and data handled by a standard Web-browser with extended functionality. The user gets a more functionality with vector data. The amount of vector data sent over Web could be three to four times less than the amount of raster data needed for equivalent resolution resulting faster response time and greater productivity (Nayak, 2000). The choice of transferring data (from vector or raster) varies with application and the existing infrastructures (Leukert & Reinhardt, 2000). The geo-data and geoprocessing tools could be distributed with the largest flexibility virtually anywhere in the network. The geo-data and geo-processing components do not have to be in the same site, but they should be able to cooperate or integrate whenever they are needed to finish a specific task (Yuan, 2000). In performing the GIS analysis tasks, WebGIS in similar to the client/server typical three-tier architecture. The geoprocessing is breaking down into server side and client side tasks. A client typically is a Web browser. The server side consists of a Web server, Web GIS software and database (Helali, 2001). Alesheikh & Others (2002) studied the technology and application of Web GIS. They mainly analyse the current Web GIS architecture and purpose of Web GIS development process. It focus new challenges such as technology innovation, voluminous data transfer rate and non-specialist users. . The web-based GIS provide basic GIS functions to users with browsers. The capability to pan, zoom, turn data layers on and off and more significantly, to query and analysis attribute data linked to mapped objects, is extensively available (Drummond and French 2008). Lwin & Murayama (2014) found that the use of mobile communication device such as smart phones and cellular phones, in field data collection is increasing due to emergence of embedded GPS and Wi-Fi Internet access. They introduce a web-based GIS system to collect the field Data from personal mobile phones.

II. Material And Methods

The datasets contain all geospatial database created for integrated rural development of Bemetara district of Chhattisgarh state. These datasets contain two types of data spatial and attribute dataof all concerned lined departments. Following are the geospatial layers used as dataset for creation of web based Decision Support System.

   i. Administrative layers- district, tehsil, block, RI Circle, Patwari, gram panchayats, village, cadastral boundaries
   ii. Population layer ,based on Census, 2011 data
   iii. Health layers- CHC, PHC, SHC, Anganwadi centeres
   iv. Education layers- primary, middle, secondary and high secondary school, colleges
   v. Water Resource layers- surface water and ground water vi. Agriculture Resource layers- landholdings, crops and livestock
   vi. Government Scheme layers- IAY, ration card, BPL card, MGNREGA etc.
   vii. Geotagged photographs

Web materials used in Generating Web Based Decision Support System are:

- MySQL (Database Language)
- Codeignitor (PHP Framework)
- Geoserver (Open Source Server For Sharing Geospatial Data)
- Open layer (Application Programming Interface)
- Google Map API (Application Programming Interface)

Methodology

The overall methodology followed in making Decision Support System is that 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. Organizing and constructing the above files approved 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 **BEMETARA GRAMIN VIKAS DARPAN** portal of the district of Chhattisgarh state. 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.

**Web Technologies for Web-Based GIS**

Following are the brief introduction of some web technologies which are used in the prototype.

- **Web Server** is the server that allows HTTP appeal from clients and provides them HTTP responses alongside with optional data contents, which generally are web pages such as HTML documents and correlated objects such as images. PHP is widely-used general-purpose scripting language that is especially suited for web development and can be embedded in HTML. It is usually run on a web server, captivating PHP code as its input and generating web pages as output. The advantage of PHP is that it could create the dynamic web page get back information from database in the server side.

- **Geo-Server** is an open source software server written in Java that allows users to share and edit geo-spatial data. Designed for interoperability, it publishes data from any major spatial data source using open standards. Geo-server forms a core component of the Geo-spatial Web. It supports the most of GIS functionalities rather than only publish spatial data.

- **JavaScript Libraries** Many JavaScript libraries have been developed for GIS nowadays. Open layer is a fundamental one which has used in this project. Open layer is an open source JavaScript library license for displaying a dynamic map in web browsers. It makes available an API for building well-to-do web-based geographic applications similar to Google Maps.

- **Server Side Applications** the clients only have user interface to communication with the server and display the results. All the processing is done on the server shown in Figure 10.3. The server computers usually have added power than the client and handle the centralized resources. Figure shows schematic communication between web-browsers, web-servers and GIS web server Application Programming Interfaces (API). The user on the client side does not necessitate any knowledge about the linkage of the IMS at the server side, but the system administrators or application developers should be recognizable with these techniques. Advantages of this model motivated from database centralization are central control, easy data updating, latest version, good cartographic aspects, etc. shown in Figure 1.
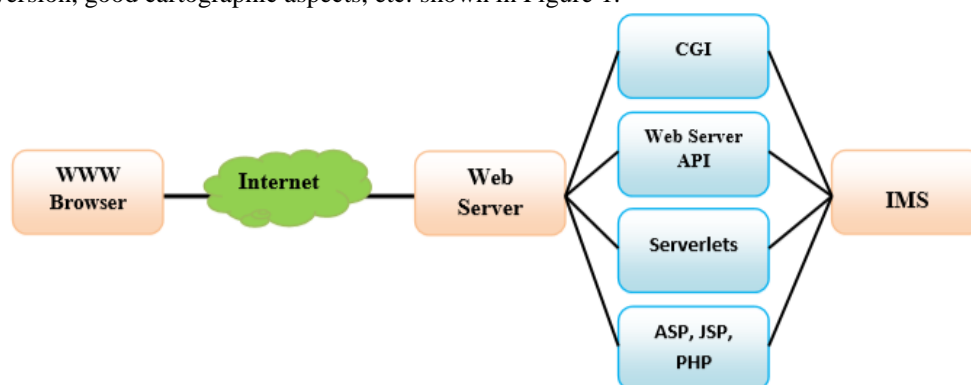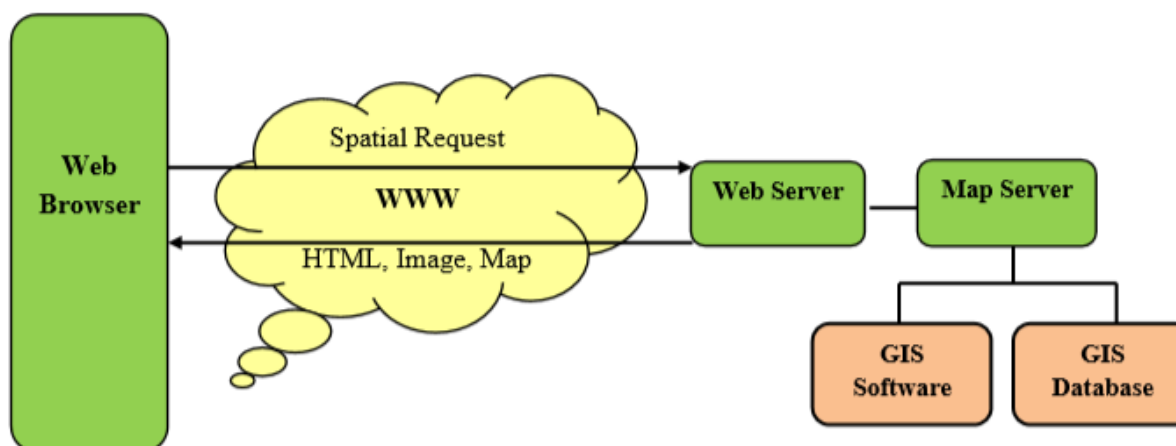

Figure: 1

- **Client Side Application** in general, a Web browser can handle HTML documents and embedded raster images in the standard formation. To deal with other data formats like vector data, clips, video, the browser's functionality has to be extended. HTML is a Standard Markup Language used for creating web pages. In this project web pages are designed using HTML & CSS. HTML defines contents of web pages & CSS is used to specify the layout of web pages. The user interface functionality has progressed from simple documents fetching to more interactive applications. This program is as follows: HTML, CGI, Java applets to provide client-side functionality. JavaScript is used to define behavior of web pages. In this project JavaScript is used for creating interactive effects within web browsers. In this project jQuery is used for Event handling, Animations & Ajax interactions for rapid web development. Currently user interface capability combined with remote invocations shown in Figure 2.
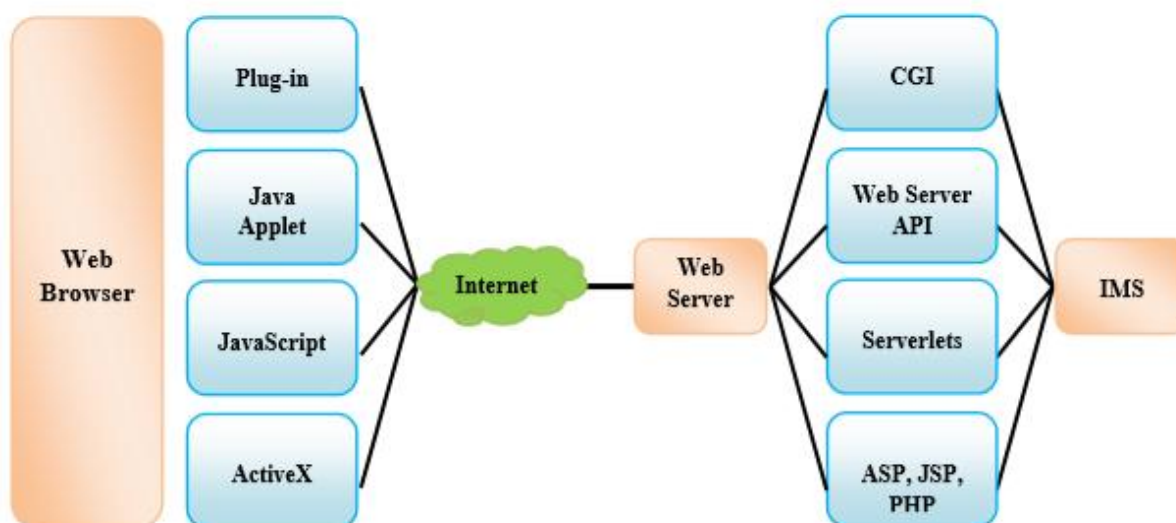
Figure: 2

- **Web GIS Architectures** in performing the GIS analysis tasks, Web GIS is similar to the client/server typical three tier architecture. The geo-processing is breaking down into server-side and client-side task. A client typically is a web-browser. The server-side consists of a web server, Web GIS software of database. Figure 3 (Helali, 2001). This model of network widely exists within enterprises, in which some computers act as servers and others act as clients. A middle ware in server side to communicate between the client and the proprietary GIS software.
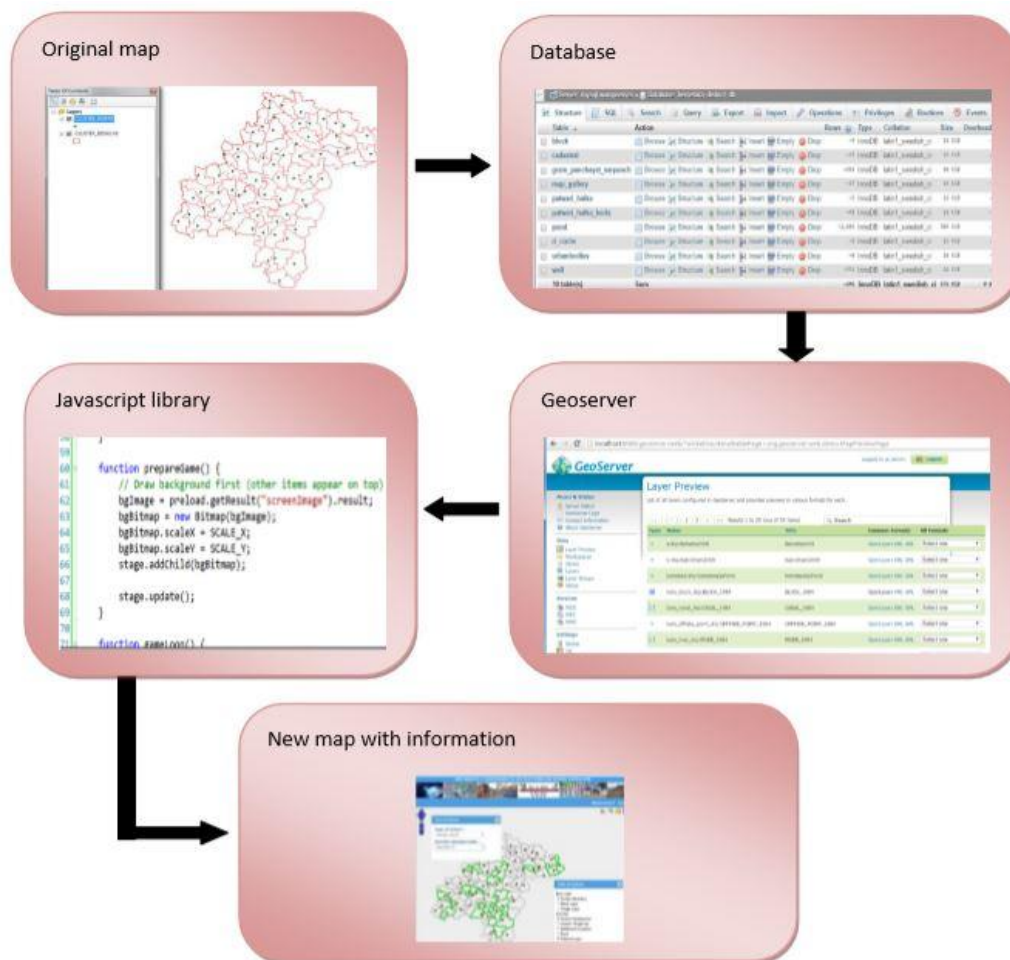

Figure: 3

III. Result

Creation of Web Map Service

Web mapping is the process of using maps delivered by Geographical Information System (GIS). A web map on the WWW is both served and consumed. Web based GIS emphasis geodata processing aspects more involved with design aspects such as data acquisition and server software architecture such as data storage and algorithms. Open source software that provides web map services capability is Geoserver. Proprietary standalone that is client side software that allow viewing web map services include GOOGLE EARTH. In this research open source software that supports WMS include OpenLayers. Shown in Figure 4.

Figure: 4

Web Application

The layout of the default webpage is shown in Figure 5. There are four sections in the webpage. In the top, it is the title of the website. The main map panel is shown in the center of the webpage with a toolbar panel attached under the title of the panel and the control panels in the left of the map. Next to the map panel, it has the panel including two sub-panels which are for layers and legends in the left side, while in the right side it is the panel providing information based on querying.

Components of Web Map are explained in details and are following:

Main Map: It is located in the centre of the webpage and is the main component to show geographic information and link non-geographic information of resources. Its size could be adjusted by the left and right edges.

Zoom Bar: It provides the button of zoom in and out on the top and bottom of the bar respectively. In the middle of the bar, it shows the current zoom level in a good visual indicator and is able to zoom to specific zoom level in first single click.

Navigation Panel: It offers intuitive and precise panning. The function forms zoom bar and Navigation Panel could be made simpler and quicker by rolling or moving mouse.

Toolbar: In the toolbar, the first three buttons provide the functions related with zooming and moving. One advantage of zooming button is that it could zoom in or out either by the simple left click to zoom one level up or down, or by drawing the box to zoom in or out to the selected areas. The left and right arrows offer going backward or forward the history of main map. The left panel next to the main map includes layer and legends and its width could be adjusted by the edge or hidden by the arrow button on the top.

Layers: It is the place to list available layers in the map. Considering the list of layers is long, the list is grouped by their characteristics. Figure 10.8 The layers related with products are grouped by two ways, listed by their names or by their categories. These grouping are done by PHP code, and the information needed for grouping are retrieved from database. These layers could be chosen multiple in the clickable box. Legends: The panel of

legends will automatically generate the name and the legend for the layers, except base map. Legend will help in understanding the map.

Measurement Tool: This tool helps in measuring any feature like line or polygon online. For line feature it will give measurement in meter or kilometre whereas for polygon feature it will measurement in hectare or sq.km. One can also measure distance between two points also.

Area Calculator: With the help of area calculator user can calculate area of particular polygon.

Get Information Box: Get Information Box is mainly giving the attribute information of feature on which user click to know about it. This information are mainly fetched from feature shapefile which has created in desktop GIS platform. Check and un-check facility is there according to user need.

Buffer Tool: This is an important tool which helps in proximity analysis of any feature like point, line or polygon. User can enter distance based on their need. Analysis can be done for schools, health centres, road, water bodies etc.

Query: Query tool is mainly to know about the feature based on user's question. It is mainly fetched with database. User can get query information either in map from or in table form. It is an important tool help to find feature among large number of features based on user query.

Scalebar: It is mainly shown on left side of the window. Based on zoom in and zoom out it automatically adjust the scale. User can set a scale according to their need in which they can see the features on the screen.

Figure: 5

Development of District GIS Web Portal

Objective of this part is to develop a web based Geo Portal to acquire, process, store, distribute and improve the utilization of geo-spatial data. It acts as a data cleaning house a gateway for spatial data generated by various agencies in the state. To support 'Decentralized (Local Level) Planning' process using geospatial technologies. Shown in Figure 6.

Development of integrated digital database for generating
1. Resource profiles
2. Query-based information
3. Static & dynamic outputs based on Spatial Decision Support System (SDSS)

To create awareness among end-users about the utility of GIS technologies. The Portal will essentially be used for the following objectives:

* Bringing collectively geo-spatial knowledge and information underneath a common platform, this till date has existed as a dissimilar system and unfamiliar to broad segment of the general public.
* Gateway for various data generating agencies to share the information across various government departments, NGOs, academics, scientific organizations, etc.
* Provide spatial data dictionary and map directory for the district and the State.
* Analyzing the needs of various government agencies.
* Facilitate decision support system and help in local level planning.
* Updating with the data from time to time can be made possible.
* Helps in report generation.
* The Decision Support System consists of the login page and homepage from which different window open.
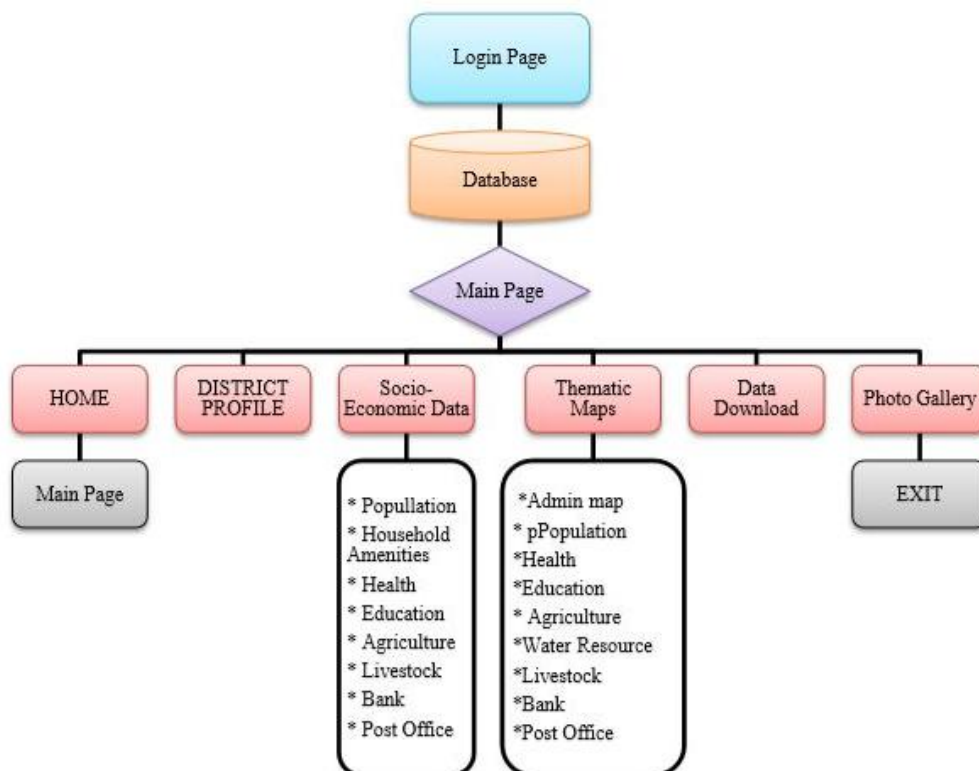
Figure: 6

Login Page: The login page is designed with username and password tabs through which only authenticated users can enter into the project main page and visualize and download the data. In login page user have to register first by giving some personal information.

Homepage: It is the first and the main page of the portal giving detailed information and provides links to its other parts. It serves as an index or table of contents for other documents. From homepage all the operations of the application can be performed like viewing the map, photographs, data, report generation, etc. shown in Figure 7.

Figure: 7

Information Panel: The purpose of this panel is to provide the non-geographic information of feature which has selected. The tip in the panel is to help user easily learn what function is available. All non-geographical

information is retrieved from database, while the tip is trying to help user to quickly know the functions provided by the website. If the layer is available in the map, it will give the clickable box be able to show its distribution in the map. The layer in information panel helps the geographical and non-geographic information to be related. Shown in Figure 8.

Main Menu: The main menu of Decision Support System consists of following tab: a) Home b) District Location Info c) District Profile d) Various Recourse Information e) Thematic Map Gallery f) Photo Gallery g) Data download. For each main menu, there exist the corresponding submenus.
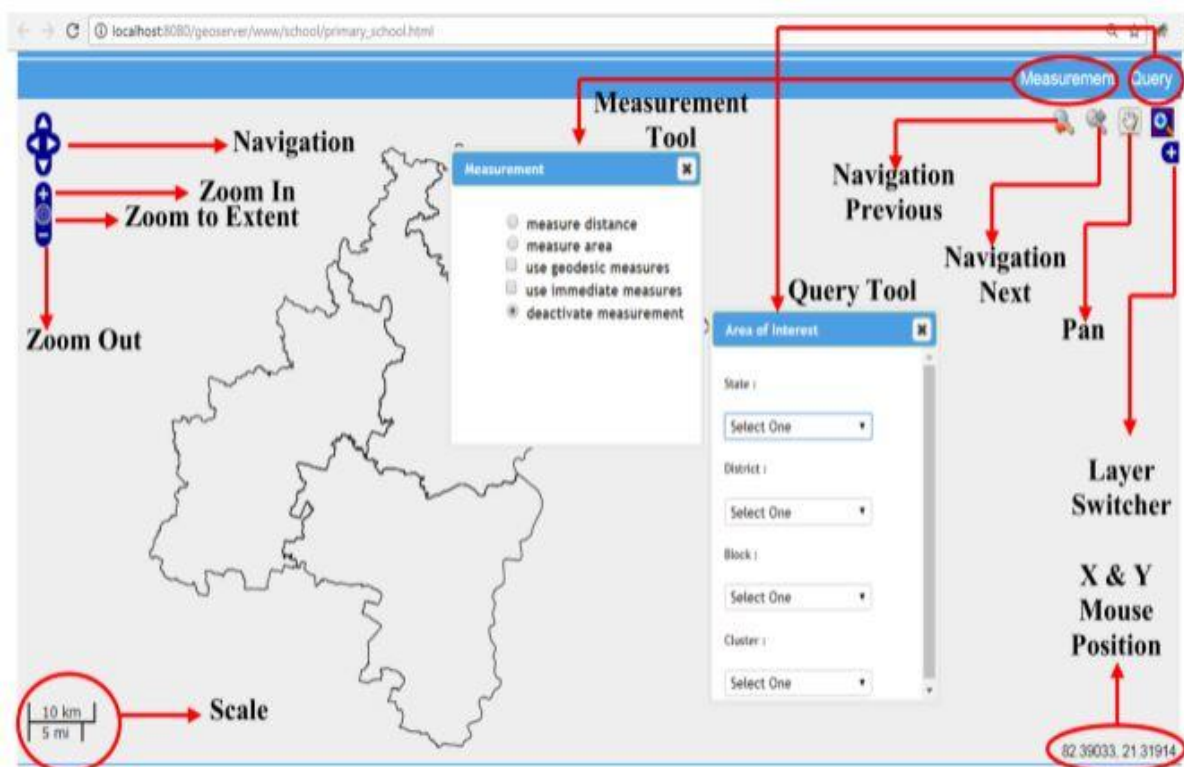
Figure: 8

Citizens Centric Services of Web GIS Portal
- Web GIS application will be available will be available in 62G and 62C domain and the accessibility will be available on 24 x 7 x 365 basis.
- Generation of thematic maps at local levels interactivity.
- Citizen Representatives can identify inter-village panchayat, inter-block, inter-district and it can generate the demand for developing the under developed area.
- Instant displaying of multiple data sets and queries to derive more useful information in comparison to the static traditional maps.
- Internet mapping services are being used to deliver maps and spatial information in cellular phones and other handheld devices.
- It reduces the time lag, increases the consistency and accuracy in the data, cost efficiency and transparency in the system.
- Dynamic availability of planning atlases to citizen through the website.
- Integrating villages, Gram Panchayats, block, tehsil, district, state level datasets can be created.
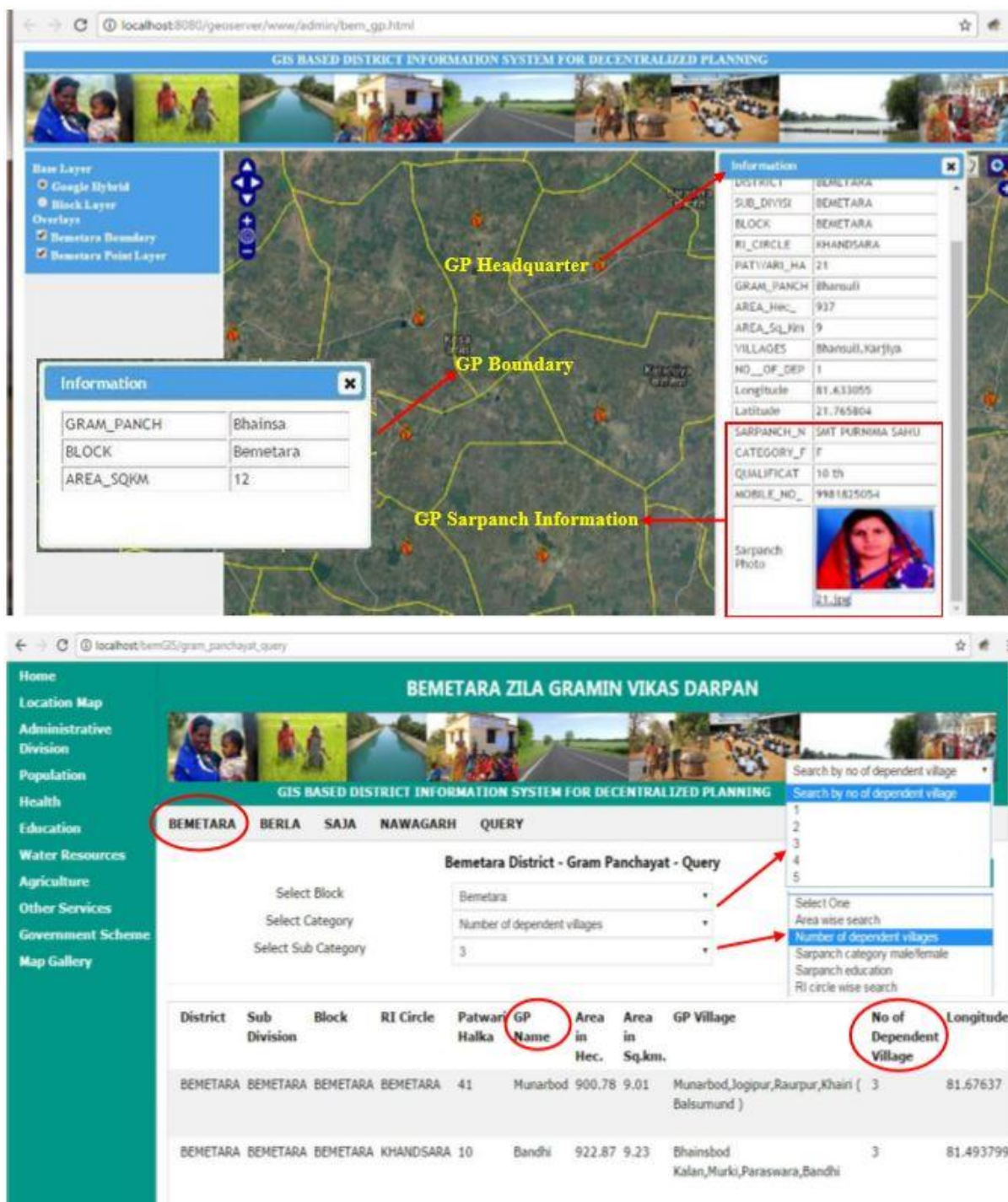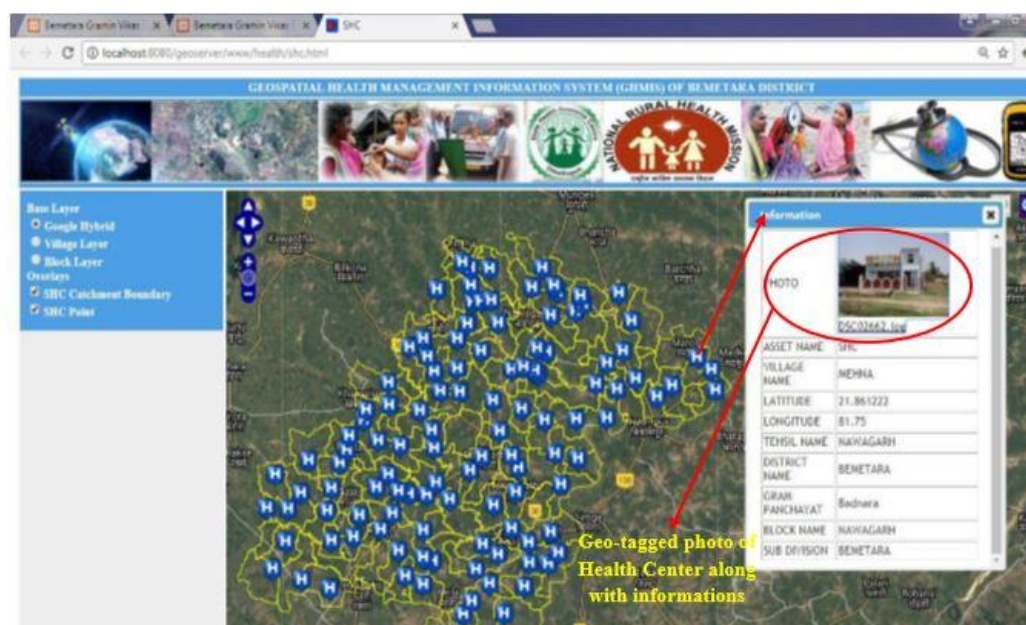
Figure: 9

It provides the information about administrative boundary based on its hierarchy. One can get attribute information and boundary information from district to tehsil to block to R1 circle to Patwari Halka to Gram Panchayat to Village to cadastral level in a single click of mouse. Gram Panchayat Sarpanch details with photographs are seen geospatially. New Gram Panchayat boundary layer is available based on 2011 census data. Shown in Figure 9. Survey number wise query of cadastral boundary spatially has done in this part. Shown in Figure 10.
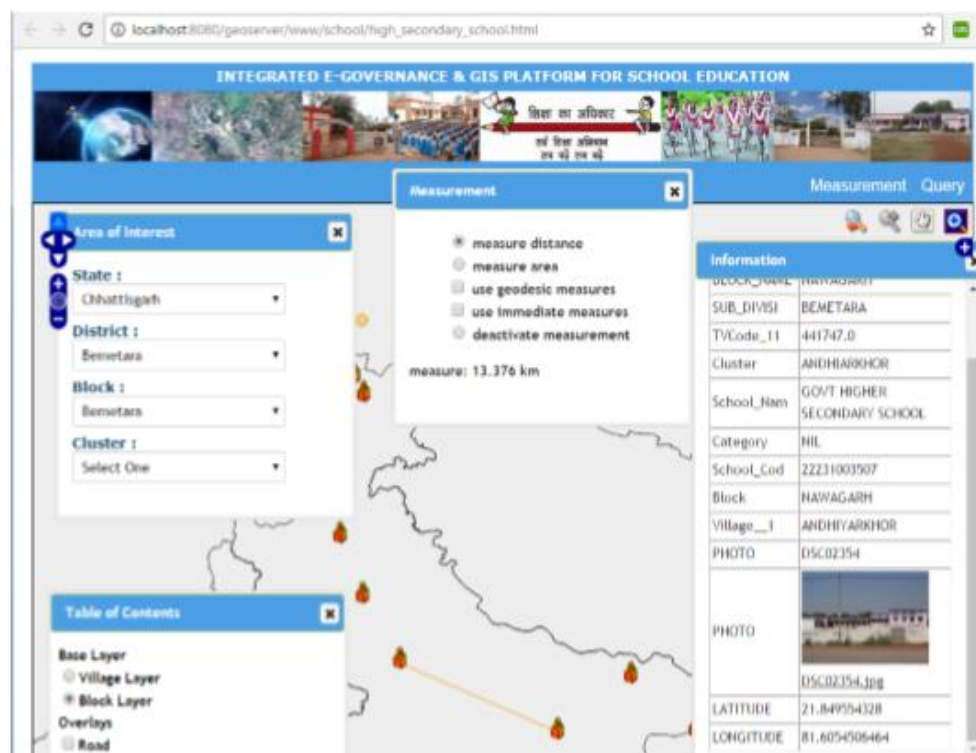
Figure: 10

Geospatial Health Management Information System has generated in this part. All the rural health centres like CHC, PHC, SHC can be access spatially with their attribute information along with photographs. Query tool is also available for user need based search. It is for visualization and act as a decision support tool for users, decision makers and planners. It is dedicated to professionals and to public health care decision makers for rural area. It can be used as a multi-stored information system. Users can access various functionalities: zooming, selecting geographic areas, viewing additional neighboring zones by easy roll over. Shown in Figure 11.

Figure: 11

This Decision Support System has designed as per the norms provided by education department. In a single click user can access number of information i.e. district wise, block wise and cluster wise list of schools, list of habitations etc. Overall information about school GIS can be navigated through gateway page.Query can be performed on the basis of criteria. Measurement tool box provide distance between two or more points. User can perform online distance measurement tool to get the real time distance over the map. Buffer analysis on different types of schools is also available online. Shown in Figure 12.

Figure: 12

IV. Conclusion

The existing infrastructure of Gram Panchayat (Govt. Head Office for Village), Janpad Panchayat (Govt. Head Office for Tehsil) & Zila Panchayat (Govt. Head Office for District) and will require the computer at least one at each Gram Panchayat and Janpad Panchayat as per need. Application software is required to be designed and once being designed this could be issued to various Gram Panchayat and Janpad Panchayat as such. The concerned staff of Gram Panchayat and Janpad Panchayat need only to be able to read simple english text, identify icons or symbols properly. Computers of all Gram Panchayat are connected to the Tehsil computer at Janpad Panchayat Office, so on so forth, all the Tehsil computers are further connected. In this way, merely seating at Tehsil Office, all necessary and accurate information can be collected analyzed and presented to the District Head Office i.e. Zila Panchayat for further information and effective decision making as such.

The developed Web GIS portal consists of a range of useful GIS tools for spatial data visualization, analyzing, querying and at very last creation of maps in the form of map print. The approved approach and its implementation using PHP, HTML, JAVA, Apache, Geo-server to build up users data sharing and mapping services. It shares the information and geospatial datasets allowing users with limited GIS knowledge to access the information customized and geospatial datasets allowing users with limited GIS knowledge. The GIS and various web technologies can be efficiently combined as a mechanism to share spatial information freely, openly & easily. Rapid progress of internet with combination of GIS has paved the ways for web distribution of spatial data. Online accessibility of thematic maps will provide a clear picture of any attribute, as it would help the planners associate various parameters together to examine the effect of any plan and to effectively monitor the utilization of funds. Sustainable development can be result of successful integration of spatial and aspatial data and implementation of Web GIS applications with proper planning at the local levels. The recommendation should strictly followed by government in order to get a good governance system for rural people and also for whole state. The whole work act as a model study for further implementation.

When all the data and information of all concerned department has brought into a single GIS platform, the data will flow smoothly and there will be no duplicity of information. Visualization of work is clearly assessed by all departments from a single window with the help of internet. Good governance for rural development is only possible though this geospatial based work.

Acknowledgement

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