

Development of GIS database and Web application for Aurangabad Tourism

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Abstract: Tourism has been noted to be one of the important and growing sectors of the Aurangabad economy. Tourism is a highly complex activity which requires tools that aid in an effective decision-making to come to terms with the better economic, social and environmental demands of sustainable development. Geographic Information System (GIS) is one of such tools for tourism. GIS being Associate in Nursing system that's capable of responsive questions about wherever facilities and resources are placed represents monumental edges to the commercial enterprise sector of any economy. The power of GIS lies not solely examine spatial relationships, however additionally on the far side the space to the holistic read of the globe with its several interconnected parts and complicated relationships. The use of GIS technology could assist the Maharashtra State government as well as the Aurangabad Corporation with better planning of tourism location, infrastructure and dissemination of such infrastructure as well as production of better quality maps showing tourists sites etc because of the dynamic capability of GIS tools to include changes that occur over time to its database. A GIS database for tourism in Aurangabad city will be created using tourist attractions and facilities, some selected roads with the help of base maps and GPS. This paper presents the significant role that GIS can play in tourism for development in Aurangabad when complete GIS database for tourism in the City is designed and developed.

Keywords: Geographic information systems (GIS), Aurangabad, CMS, XAMPP.

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I. Introduction

Tourism is one amongst the necessary major sources of financial gain within the world these days and a vital export business and chief of exchange in several countries like us of America (U.S.A.), UK, Germany, China, and European country commercial enterprise is currently the greener pastures most developing countries have centered attention to because of its huge advantages like infrastructural development, job creation, conservation of atmosphere etc. In Aurangabad, it's a vital sector that's under development. Touristy has traditionally been dependent on the character of the destination, together with manmade attractions, Historic attractions and resorts. It's a trendy activity that needs the provision of sure parameters (e.g. accessible road networks, normal accommodation facilities, attractions etc) and knowledge on potential and existing attraction sites. data on these parameters and attraction sites will be gathered, processed, organized and hold on using tools like global Positioning System (GPS), Geographic information system (GIS) in addition to remote sensing. once gathering the required information a couple of destination, the information should be hold on in an exceedingly recoverable kind to boost touristry, and this will be achieved with the help of GIS.

Geographic information Systems (GIS) is one amongst the most outstanding technologic innovations in touristry designing and decision making. "Both GIS and tourism share a typical characteristic, that is, each cross the boundaries of disciplines and application areas. GIS has been applied in several fields together with geography, forestry, urban development and designing, and environmental studies. Similarly, tourism has been a subject matter of interest to geographers, economists, business, environmental planners, anthropologists, and archeologists. This makes the potential applications of GIS in tourism vital. Moreover, maps are best-known to play important roles in identifying and locating traveler attractions. GIS but provides the ability to extract completely different sets of knowledge (e.g. tourist attractions, hotels and their distances from each other, roads, settlements, vegetation, land use information, changes in tourism resources) from a map and use them as needed, as a result of the dynamic capability of GIS tools to include changes that occur over time to its database.

II. Related Work

The use of GIS in tourism studies has been marginal although GIS technology has been in tourism related literature over the years. Dogru et.al (2004) designed a dynamic map browser interacting with the earthquake data for Turkey. The online mapping application provides information regarding earthquakes that provides facilities for perform spatial and attribute question by the users on the net [1]. Using Map Objects build the GIS application and MOIMS was used as a gateway program. The drawn maps are displayed on the web browser as a picture.

Seker et al (2002) applied GIS for supporting the design activities for tourism in Manavgat, situated in southern coast of Turkey, and targeted on the analysis, management, decision making using GIS techniques, and result was given on the net[2].

A Georeferenced information system (GeoRIST) has been applied in developing the tourism facility of agra, india for the travelling community at international and national level by Singh and Sharma et al. (2011) that integrates spatial information, statistical knowledge with textual data for developing a data model that may offer actual and full information for analysis and designing[3].

An integrated tourism data system was applied by Zografos et al (2002) on travel and tourism that offer real time data whereas being on move with a value additional service (VAS) for the individual[4]. Tyagi (2014) developed a web based customized tourism data system (TIS) for eastern U.P., designed on GIS platform. the application offer an interactive dynamic mapping by showing the location of tourist destinations moreover as location of restaurants, travel firms, hospitals, security, passport office etc[5]. The Open source Map Guide was used for customizing and displaying the database on the internet once ready in Arc map. Hypertext markup language was used for designing the online page the eastern U.P. tourism web portal.

Hussain (2006) developed an interactive internet primarily based GIS application prototype for Hyderabad city to push the town's traveler activities and provide the users with an innovative idea to access the spatial contents of the city. The study was done to develop a GIS enabled on-line interactive guide for the tourists and in addition for the residents of Hyderabad through a prototype internet site, created using Arc IMS interface Developer and hypertext nomenclature was used for online page style[6].

Thecla. I et.al (2014) had designed and developed a GIS database for Anambra State of nigeria to induce economic benefits for tourism business[7]. GIS provides information concerning the locations, facilities for tourist and resource that represents benefits to the tourism sector of any economy. The employment of GIS technology may assist the Anambra government additionally as the Nigerian government with higher designing of tourism infrastructure, location, production of upper quality maps showing tourist's sites. Jovanovic & Njegus (2008) has done a study related to the applying of GIS and its components of in tourism and applied the GIS to style and develop the tourism destinations in Zlatibor (Cajetina) and Zlatar areas of serbia[8]. Mohan Lalit et. al prepared an interactive tourist maps for Chandigarh city using the online GIS techniques and presenting the results on the web to produce the desired data on tourism/hospitality for the tourists[9]. The study developed a prototype application for promoting the tourism for town adding an appropriate query tools for the prototype system. A presentation was created by Aamir Ali on web and mobile GIS application development, together with the online GIS function, mobile GIS function, architecture, regarding the server side implementation for spatial database Postgis, oracle, web services WMS WFC WCS and server side implementation for mapping on GIS server like Geoserver, ARCIMS, Map server etc.

Marson et al. 2015 focuses on a GIS-based spatial decision support system (SDSS) application integrated with GIS functions and SDSS designs using user friendly graphic user interfaces (GUI) that may facilitate the tourists to decide on and set up their activities, according to their convenience for the Langkawi Island of malaysia. tourism database, GIS Server, web client and Desktop GIS application together consist the tourism decision support system (TDSS) that are necessary for creating a GIS based decision support system[9].

Kommana (2013) used the open source software primarily Geoserver to design an online map application and creating it offered on the net that may be employed by any institute or organisation. the info revealed into Geoserver are often shared worldwide[10]. The user can overlay the Geoserver WMS layers, by choose background e.g. Google Earth, Open Street Map, etc. and adding the zoom in and out, pan, navigation, switch layer, layer summary using totally different symbols and designs. to make the dynamic website hypertext markup language, CSS and JQuery are used in this project.

Kumar et al (2015) developing an online GIS primarily based land information system for Bhopal city in open source environment. An online GIS prototype was created for geospatial data of Bhopal city that gives some practicality like pan, zoom, and basic query analysis that additional with the web mapping application[11]. POSTGIS database and Open Layers libraries, Geoserver was used to set up and enhance the web site functions. Using three tier design the system was designed which contains 3 layers client layer, Application Layer and database Layer. Web page design was finished hypertext markup language, ajax and Java Script and Open Layers.

Agrawal et al. (2014) focuses on develop web GIS framework on WAMP and apache tomcat on open source environment. they have been used WAMP server, ALOV, Quantum GIS and MySQL for first frame GIS work, on the other hand for second web GIS framework, Apache tomcat server, Geo Server, Quantum GIS, PostgreSQL and Post GIS are used[12].

III. Study Area-Aurangabad (Maharashtra)

Aurangabad city is a historic city in situated within the heart of Maharashtra. A tourist hub enclosed with several notable historical and culture monuments and natural resorts together with the Ajanta and also the Ellora Caves, Bibi Ka maqbara and Panchakki and development of the tourism information with its trendy tourist facilities, destinations, and activities. it is speedily turning into a hot spot for tourist from around the world due to its exotic locations and facilities offer by the govt.. the city is located between 19°53'0"N Latitude and 75°20'00"E line of longitude and also the total geographic area of the is 135.75sq.k.m .The city of 54 Gates however only 13 have survived over period of your time and therefore the presence of those can be felt as going on one drive within the city. In presently there are 35 tourist attractions/ locations in city and these days city has annual flow of 25 lakh tourists per annum and that continues to be increasing. The tourism potential of the district isn't absolutely tapped because of international gaps, connectivity, Services Quality, inadequate basics amenities and promoting promotion. However there are numerous issues faced by the Aurangabad tourism for the development of tourism a number of them are lack of correct infrastructure, Access and property, Amenities, Service level.

The appliance providing information of places and sanctioning the availability of recent good services. Geographical information permits users to look at places as if standing upon them. Tour with Themed information, that highlights tourist attractions, provides its users a virtual tour of Aurangabad city. The help of the GIS application the tourist are going to be ready to understand the information regarding the place close to city and explore regarding the tourist place all necessary information. due to the development of the GIS based tourist information the guests will be mange and arrange their visits and complete their journey with additional comfort and ease from the beginning to end which may be determined simply and consistently using by the study area and exposed with the GIS but additionally well-tried that may be applied to those studies. The GIS can be acts as potential techniques in designing, managing and promoting the tourism product. Presently the tourism is being promoted and marketed to the world through the internet and web as one of the mediums of advertising. However still it's must be projected in a very higher way to the client with the utmost potential information to increase its marketability.

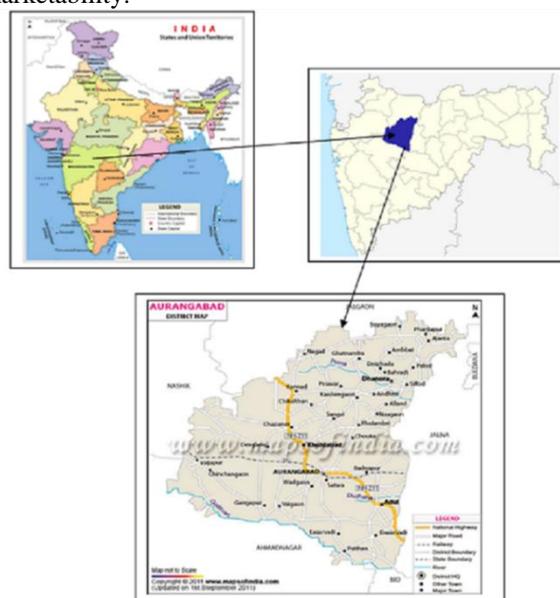


Fig 1. Study area-Aurangabad Region, Maharashtra State, India

IV. Methodology

The objective of this research is to disseminate tourism information of Aurangabad and its surroundings through the internet so that tourists can access the data easily. The requirement analysis step has been performed by making informal interview with some people that don't have knowledge and access of GIS software and by reviewing a related literature. These steps produce two critical pieces of information.

- A list of function that is needed. The required functions are the basic visualization functions such spatial query and distance measurement. Tourists can use these functions to view information about the required place.
- A master list of available /needed geographic data. Several layers for tourism information were captured by using GPS. The basic once that used in these research are major tourist spots, hotels, bus station and airport. The information gained in the requirement analysis activity went directly into the conceptual system architecture design activity.

Conceptual System architecture Design

The main architecture principles that are the basis for creation of the Tourism portal are:

- Interoperability - the architecture should ensure efficient system integration with relevant external system.
- Openness - the architecture should be open for integration.
- Flexibility - the architecture should ensure the degree of flexibility.
- Scalability - the architecture should also ensures that the system implementation can be scaled efficiently in relation to possible scenarios on growth in transactions, volume of data and number of concurrent users, etc.
- Portability - the hardware and the software should be open to several platforms considering hardware architecture and operating systems.

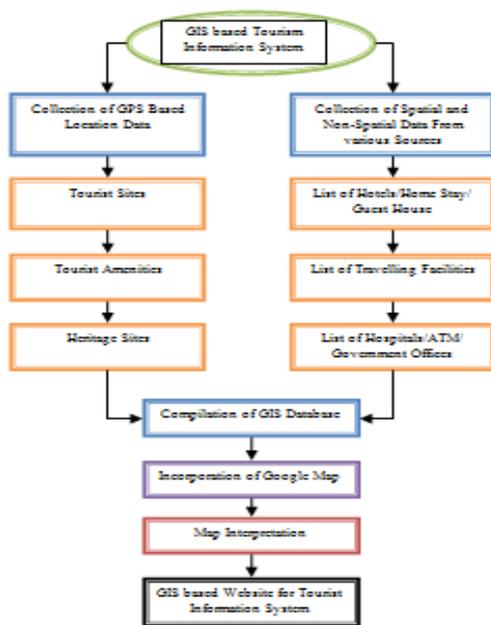


Fig 2. Schematic representation of Methodology followed in study

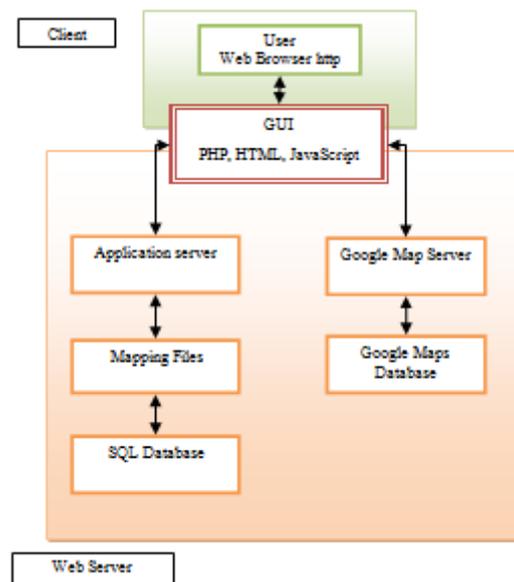


Fig 3. Conceptual System Architecture

The conceptual system architecture is designed as three tiered software architecture to full fill the main architecture principles (Fig 3). It is server side architecture. It comprise of Web application, Web Service and Spatial database. In web application, there are the website using JavaScript codes to show the information with some basic GIS functions and several web interfaces for the management. In web service, there is the web server using Apache, which supports PHP script to generate the webpage dynamically. In the data base MySQL is used to store the spatial data. Google Map Server is used to provide the external map services

A request from the client is sent through the HTTP to the Apache web server. The PHP scripts are parsed and interpreted by the PHP CGI program or Apache module, and the result are included in to the web document. Parameters for the attribute queries are passed to PHP, which is used as an interface to the SQL GIS database. As the result of such a query, attribute data are passed back the same way and are embedded in to the HTML code of a web document. If a map request reaches the web server (simultaneously or independently), it is passed to PHP/mapsript module, which processes the spatial data (read either from a file or from the SQL GIS database) and creates a result file. The result file is also embedded to the client, where it is displayed by the local web browsers.

Geo spatial Database design Method

The geospatial database design involves creating and arranging various geospatial data such as point, poly line and polygon objects with their attribute table. The color, weight, size and symbols of these objects have to be analyzed and implemented. Geo database organizes spatial data into a hierarchy of data objects. These data objects are stored in feature classes, object classes, feature datasets and raster datasets. An object class is a table in geodatabase that stores non-spatial data. All the geographical data features must contain spatial reference. The spatial reference describes the coordinate system, the spatial domain and data precision of the feature. Fig 2 shows the sources and the steps in creating the geospatial data base for this research.

V. Materials and Tools

Installing XAMPP for Windows

Since Joomla requires a web server that supports PHP and MySQL, one was required to be configured in order to start the development tasks. During the development phase, Joomla website and database was hosted on local computer that was integrated with a WAMP (Windows, Apache, MySQL and PHP) development stack.

This environment was prepared by installing XAMPP, a cross-platform Apache distribution that contains all the components (Apache, MySQL, PHP) that are required to run a Joomla website. XAMPP was chosen, because it was suggested by the Joomla documentation and it was considered the fastest way to set up the environment for a Windows operating system. (Joomla! Docs 2013e) The installation of XAMPP was rather easy and straight-forward process as it was done with a step-by-step installer wizard. Finally, the functionality of XAMPP installation was tested by accessing localhost via web browser. In this implementation, XAMPP version 5.6.3 was used containing Apache 2.4.3, MySQL 5.5.27 and PHP 4.6.5.2. All installations were done for Windows 7 operating system.

Installing Joomla on localhost

After the localhost had been configured, the installation of Joomla was started. The installation was done in two phases. In the first phase, Joomla's installation package was downloaded via Joomla's official website and the package's contents were extracted into a new directory on localhost. In XAMPP setup, a proper directory path for websites is "xampp/htdocs/", where each website should be assigned to separate directory. All websites residing under "htdocs" can then be accessed via browser by entering the URL address of the localhost or alternatively using the computer's IP address. The localhost's URL is formatted as "http://localhost:80/website/", where "80" refers to Apache's web server's port number and "website" to the namespace of website's directory. A good convention is to use short and easy to remember namespaces, because it is just temporary and it is typed often during the development.

In the next phase, the initialization of Joomla CMS was done with Joomla's browser based installation application, which was launched, when the website was accessed for the very first time. The installation was a step-by-step process, where the website's basic information and settings such as website's name, description and database preferences were chosen and configured. After the installation process was completed, Joomla deleted the contents of the installation application automatically due to security reasons and after that, Joomla CMS was set up and ready to be used. In this implementation, the website was built for Joomla 3.7.2 CMS.

Installing additional plugin: GMapFP

Initial purpose of the GMapFP is to show tourist sites or similar on a map, and to associate to this geolocation the elements necessary for their promotion under an article. With GMapFP, we can use Google Maps in our Joomla website very easily. GMapFP will simply use the various features of Google Maps to integrate maps into your website. In addition the component will offer additional features to enhance cards polygons, shortcuts to articles, etc. The basic organization of GMapFP is simple: a map with markers that identify places that could be classified by category and group category. Above or below the card to be able to display a customized and of course the description of the premises, a listing, itinerary, etc. Then simple menus customized call various works. A plugin will also allow the integration of one or more cards in articles.

VI. Implementation

Designing the information architecture

After the proper environment setup and requirement analysis, designing of website's information architecture was started. The goal of this work phase was to produce consistent and logical categorization conventions for contents and to decide how the website's navigation structure should be organized. This work phase included the following tasks:

- Defining categorization schemas and naming conventions
- Organizing and categorizing articles and other content
- Organizing content in hierarchical structure and producing the sitemap
- Choosing the media content for the websites (photos, videos etc.)
- Choosing the navigation system for the website

Designing the layout

Designing of the layout was done in order to illustrate the final presentation by excluding all underlying functionality. This was done in order to simulate website's visual presentation in an early stage and by so help the process of building the website's template. In addition, building an early design confirmed that the requirements regarding to layout would be considered in final design.

The website's layout and layout design requirements specified that:

- The website should have a home page for featured and latest articles
- The website should have subpages for an about page, categories, articles and videos
- The layout should have a static header block for displaying logo, navigation and search bar
- The layout should have a static footer block for displaying partner organizations
- The layout should have a dynamic body blocks displaying dynamic content
- The layout should be stylish that emphasizes content
- The layout should contain familiar and commonly known user-interface elements
- The layout should contain aesthetic but easy-to-read font stack
- The layout should be responsive and it should function well on every display
- The layout design should be made with modern design practices

Data migration

"Data migration is the process of transferring data between data storage systems, data formats or computer systems".

In this context, data migration refers to the process of transferring data from an Excel spreadsheet into the MySQL database of Joomla. In this implementation, the migration was done as a three stage process including data extraction, transformation and uploading activities.

Extraction

The extraction work phase was initialized by creating a new Excel spreadsheet document for the migration activities. In this document, all relevant tables were assigned into separate tabs, where each tab was organized according to database table's structure. Since the data in "#_content" had already been prepared during the data cleansing, it could be merged into the document as such. Next, rest of the remaining tables were fulfilled by inserting the missing information or using Excel's cell references whenever there were dependencies between tables. Cell referencing was done in order to avoid referential integrity errors and reduce unnecessary repetition. The most challenging task was fulfilling the tables that contained nested sets. Nested sets are a technique in relational databases to represent hierarchical structures within tables by using left and right column values. Its main purpose is to ease the logic of fetching child nodes of a parent in a hierarchical model. The biggest challenge with nested sets is that they require each left and right value to be updated whenever new rows are added into the table. In Joomla, nested sets are used in various tables, to represent hierarchies between components and content for instance.

Transformation

After all relevant data had been extracted and properly organized, the transformation process was started. The goal of this work phase was to transform the data from spreadsheets into valid SQL insert statements, which could be used later on for updating the MySQL database. The transformation was done by exporting each table as separate CSV files and converting them into SQL statements by using an online CSV to SQL conversion application. Finally, the converted statements were exported as SQL script files.

Load

Final phase in data migration was the process of merging the transformed data into database. This work phase was conducted within MySQL Workbench environment by executing the insert statements as database transactions in separate sessions. Transactions were used in order to provide rollback option, in case the statement contained errors or the outcome was incorrect. The order of statements was also planned beforehand in order to avoid referential integrity violations.

Finally after all SQL statements had been executed, data's validity and correctness was confirmed by running appearance tests via Joomla's public application residing on localhost. During these tests, the functionality of application's main components were tested by running scenarios such as displaying articles that only contain a specific tag word. When the functioning of these components was confirmed, data migration work phase was concluded.

Building the website with Joomla

After the articles and other data had been successfully migrated into database, building of the website was started. The goal of this work phase was to construct the final website by following the specified requirements, information architecture and mock-up designs.

This phase included the following main tasks:

- Setting up a template that was similar to mock-up designs
- Setting up the navigation structure by creating menu items
- Assigning components to each menu item in order to provide page functionality
- Implementing additional modules and page elements
- Customizing the template according to layout mock-up
- Optimizing the layout for mobile devices

Testing and Deployment

Testing was done in order to confirm that the website was functioning well and fulfilled the specified requirements. Because the implementation did not include development of components or major coding tasks, testing was targeted mostly for website's usability and appearance.

During the testing, the following conditions were under a review:

- Pages and components function properly
- Back-end application's features function properly
- Layout functions properly on all display sizes
- Chosen font-stacks and font-sizes are good for readability
- All type of media content scales well on all display sizes
- Recommended information security practices has been applied

Testing was done by running scenarios, where the functioning of the above mentioned test conditions were reviewed. The testing was conducted independently and they were run along with other implementation tasks.

VII. Results

Home Page

A simple home page is design for Aurangabad which shows the history of the area and with a link to the web GIS tourism portal. With a heading *AURANGABAD TOURISM*, the web page contains photos of some popular location of the district. The home page of the web portal is includes the history of the district with photos of some important tourists locations. The home tab contains submenu named as Tour to Aurangabad which contains the videos of popular tourist attractions of Aurangabad. It contains two different videos in Marathi and English language which gives overview of tourist places of Aurangabad



Fig 4. Home Page of AurangabadTourism



Fig 5. Video of AurangabadTourism

About Aurangabad City

The second tab contains all the basic information about the Aurangabad city. It gives information about the history of the city, people lives in the city , culture of people, languages spoken by people and weather information about Aurangabad city with some images describing it clearly.



Fig 6. Basic Information about Aurangabad



Fig 7. Where to Go

Where to go

The Third tab contains the information about the locations to visit in Aurangabad. It has three different submenus named as Add Attractions , View Destination and View route. By using the first option we can add any new location in the database of Aurangabad tourism. Second option shows the contents of the database i.e. all the available locations of Aurangabad tourism database. The third menu will show the route from one place to another place with instructions and on google map with all the directions.



Fig 8. Add Attraction (Part 1)

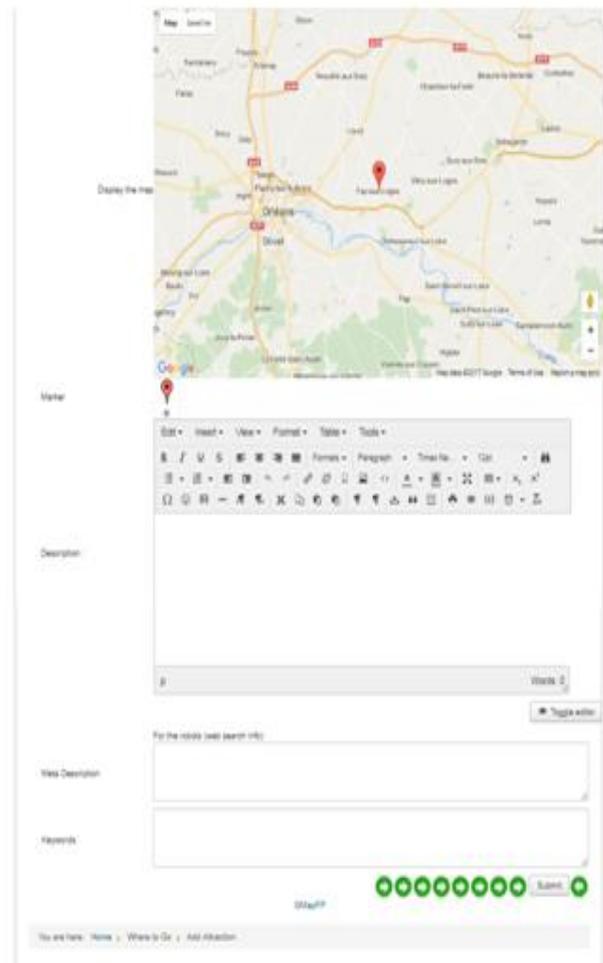


Fig 9. Add Attraction (Part 2)

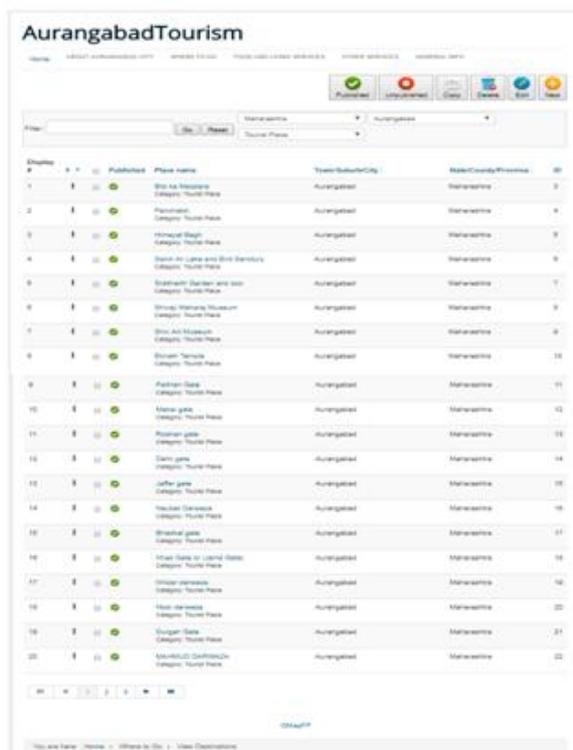


Fig 10. View Destination

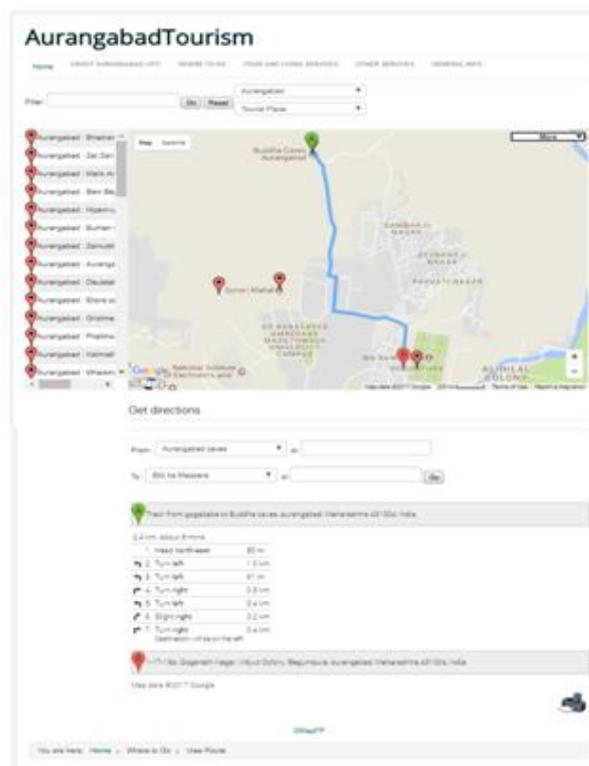


Fig 11. View Route

VIII. Conclusion and Future Scope

This research has developed an accessible Web GIS prototype, through which the spatial information related to the tourism of Aurangabad city can be dissipated to the world wide users. This integrated online tourist information system can help the tourists from far destinations to explore the city tourist activities and decide their tour in an appropriate manner by performing on-line GIS queries and analysis. This application can also assist the city tourist department to promote the tourist activities and increase foreign revenue in the state.

So far, most of the applications of GIS database in tourism were related to the inventory of recreational capacity, management of the use of space for tourism, visitor impact assessment, an assessment of the conflict between the recreation and the environment, mapping, creation of tourist information management systems and systems to help with decision-making. In tourism, the use of GIS database is different on the side of the tourist offer and tourist demand.

The side of the tourist offer mainly uses all of these aspects of the use of GIS. The side of the tourist demand is actually using GIS technology that is installed by the tourist offer. As tourism is closely linked with many other sectors, as well as various other contents as well as circumstances that are not directly associated with tourism, many are those who contribute to the collection of information that is stored in GIS and based on which, the analysis is performed and maps are produced. In short, the huge advantage of GIS is enabling the inclusion and integration of the views of all interested parties that use the tourist area, starting from the state institutions, through non-governmental organizations, to private companies and organizations. This may affect the adoption of the best possible decisions in the process of development of tourism in the area.

This application is a tourist guide specifically designed for the city Aurangabad.. Nevertheless, its architecture allows the customization in order to be used for any other city worldwide. The target city is defined in a configuration file in which the system's administrator can defines the country, the region, the area and the name of the targeted city. However, at this point this action can only be performed by system's administrator. A future support could be the application to allow users to select their destination.

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