GEOGRAPHICAL ANALYSIS

RESEARCH ARTICLE

Developing Web Based Tourism Information System Using GIS for Banswara District, Rajasthan, India

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Abstract

Information regarding tourist sites plays a vital role in attracting tourism. Tourists derive information regarding the site from traditional pamphlets circulated by travel agencies and tourism departments. But as the digital paperless economy is way ahead, Webmaps can help local and foreign tourists get information regarding tourist sites on their gadgets. WebGIS integrates spatial and non-spatial data, helping to overcome the limitations of several websites that give only factual information on tourist sites. Information regarding tourist sites in the Banswara district of Rajasthan State (India) is not properly available. This study used QGIS to create a webmap showing important tourist sites in Banswara district. Field visits were carried out to collect the latitude and longitude of sites. These locations were exported as points, and attribute data was attached in QGIS. The final output is derived using the qgis2web plugin. Plugins like HCMGIS and ORS were used to add base layers and find the shortest routes. The webmap is published using the WordPress system as a webpage to provide site-specific information to tourists, like its location, importance, and description. A usability examination showed the webmap's strengths and weaknesses. Users found the content to be precise and the overall design to be creative and interactive. With recommendations to add real-time information, there is possibility to make the webmap better in the future.

Keywords: Webmap; Tourism; Open source; Google Earth; KML

1 Introduction

Information is essential in tourism industry. While it might be difficult for tourism planners and stakeholders to deliver timely information to end users to aid in decision making, tourists need to be able to obtain information about a destination without wasting time. Tourists often know about a destination from print media, such as newspapers, brochures, magazines, books, and so on; broadcast media, such as radio and television; and internet media, such as websites and social media [(1)]. Previously, the only efficient way to provide travelers with information was through traditional tourism brochures, pamphlets, and handbooks. However, with the introduction of the

internet, these brochures were made digitally available, notably improving the accessibility of information. The arrival of the internet led to the dissemination of travel information over long distances[2] with the use of websites[3] and social media platforms[4]. In the tourism industry, the spreading of information helps in motivating actual and potential customers to travel to a destination[5]. On the one hand, there is more information available online, but on the other, spatial and non-spatial data are not integrated, making it difficult for tourists to find information at one place. Though tourists can learn about a site, they might have to rely on tools like Google Maps to figure out how to get there. Planners can create an integrated tourism information system by integrating spatially and non-spatial data using web-based geographic information systems (GIS). WebGIS makes it possible to share maps online with anybody, anywhere[6].

Because of its user-friendly nature, WebGIS have been employed by a number of researchers for marketing and promoting tourism destinations in their areas. The WebGIS database was upgraded by adding several tourism-related functions since it was first developed to evaluate the damage the 2012 earthquake caused to Italy's World Heritage Site of Emilia Romagna[7]. In the Aveiro region of Portugal, WebGIS assisted in decision-making related to tourism and also enhanced visitors' experiences, thereby accomplishing multiple purposes[8]. In the tourism industry, WebGIS also offers the chance to identify a business cluster associated with tourism industry because along with the attractions, the complementary services such as restaurants, hotels, and transportation influences visitor's experience[9].

WebGIS aids in connecting the locals, visitors, and stakeholders. One such examples of collaborative planning which increased public participation by providing all tourism-related information to the general public is the WebGIS developed for Langkawi Island[10]. Webmaps developed with GIS are interactive in nature and can be published online. These dynamic webmaps can be accessible through webpages[11]. On one hand, the number of people using web-based maps are increasing, while on the other, information and communication technology and methods of geospatial data visualization is evolving, therefore user needs are taken into account[12].

Webmap usability analysis is challenging since user needs can vary depending on their level of experience with geographic data visualization and interaction[13]. Usability study generally aids in boosting the user-friendliness of the webmap throughout the development stage[14] therefore, it is ideal to incorporate user feedback to improve the webmaps. For geospatial tools in general, Unrau and Kray[15] identified three general categories of usability evaluation techniques: "testing" involves asking users to interact with the interface; "inquiry" involves letting users assess the system and gathering their input through surveys, interviews, and other means; and "inspection" is based on heuristics or criteria that instruct users or experts to analyze the system.

The present study focuses on developing a web-based tourism information system for Banswara District of Rajasthan State (India) in Quantum GIS (QGIS) 3.20.2 (http://www.qgis.org). In this study, the Openrouteservice (ORS) plugin[16] is used to find the shortest path to a tourist destination. QGIS offers additional functionality for using various freely available plugins. OpenStreetMap serves as the foundation for the features of ORS. The final webmap is derived using the freely available qgis2web plugin[17]. For end users to utilize effectively and conveniently, the tourism information system will thus take the shape of an interactive webmap. In addition to enabling online publishing on websites, this qgis2web plugin offers options for linking it with Android applications.

Free and Open-Source Software (FOSS) such as QGIS makes it possible to create web applications without any expense or license[18]. Efficiency of the tourism information system can be increased when users can retrieve information from the system in multiple languages. In order to help users with their queries in their preferred language, Saraswathi et al.[19] created a semi-automated ontological tree in the field of pilgrimage tourism in southern India in both Tamil and English language. By developing a bilingual webmap that shows popular tourist destinations in the study area in both Hindi and English, the current study seeks to close these gaps. The usefulness of WordPress (https://wordpress.com/) and Github (https://github.com/) hosting sites for webmaps made with QGIS has also been examined. Usability analysis was performed to understand the overall efficiency, effectiveness, and ease of use of the webmap.

2 Study area

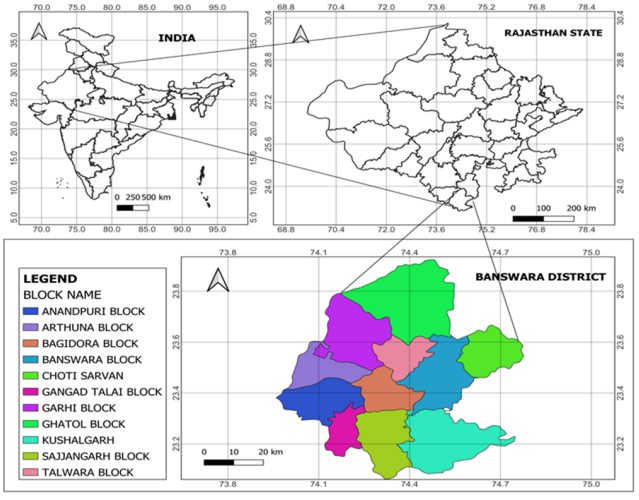

Fig. 1. Map of the study area

Banswara District (Figure 1) is located in the southern part of Rajasthan State, bordering Ratlam District (Madhya Pradesh) in the east, Dungarpur in the west, Chittorgarh and Pratapgarh District in the north, and Dahod District (Gujarat) in the south.

The district forms the upper catchment area of the Mahi River. The river has bestowed Banswara with many geomorphic features with which the local culture has interacted, and the resultant intermingling has created a number of important religious and natural tourism destinations. Banswara district is often referred to as 'Little Kashi' or 'Chhoti Kashi' as there are eleven and a half shivalinga (which are believed to be self-manifested on the surface) and also a number of spiritual pilgrimage destination known since time immemorial.

3 Methodology

The process for creating the webmap for the Banswara tourism underwent a preliminary phase followed by three major phases (Figure 2). The preliminary phase involved identifying the major tourism destination by consulting all the relevant tourism stakeholders in Banswara district, like the tourism operators, government employees from the tourism department and the local public. The first phase followed the preliminary phase which involved collecting both spatial and non-spatial information regarding tourism destinations. Field visits were undertaken to collect the latitude and longitude of the sites using a handheld GPS device (with an accuracy of 7 metres). The non-spatial information about the sites was gathered from various sources, such as brochures and pamphlets, and also through interaction with the locals who live close to the sites. This information was validated by consulting the tourism department and official publications such as the District Gazetteer (1974) and Census Abstract (2011).

In the next phase, the latitude and longitude of the sites were used to derive KML (Keyhole Markup Language) files by incorporating them in Google Earth Pro 7.3.6.9796 (https://earth.google.com). These files were used as point data in the QGIS environment. Redliner tool available on the Rajasthan Government's Raajdhara portal (https://gis.rajasthan.gov.in/gwd/Default.aspx), was used to create the polygon layer for the Banswara district. During this phase, the tourism destinations were classified into four categories using Peter's inventory of tourist classification [20] and through considering local people's preferences. Following this, attribute tables were created, and distinct symbology was added in QGIS. In the next phase, shortest path analysis was carried out using the ORS plugin (Figure 2), while the HCM (Ho Chi Ming) GIS plugin was used to add Webmap Service (WMS)/Webmap Tile Service (WMTS) layers like the ESRI topographic layer and Google satellite view as base layers; thereafter, using the qgis2web plugin and Leaflet, the final webmap was generated.

In order to assess the GIS-based webmap in this study, participants were selected from diverse educational backgrounds having expertise in fields such as tourism, geography, geoinformatics, heritage studies, and computer applications. A total of 21 participants agreed to provide feedback. A questionnaire was prepared to incorporate their suggestions. The participants were first asked to engage with the webmap and thereafter express their experience and satisfaction they derived by filling out the questionnaire.

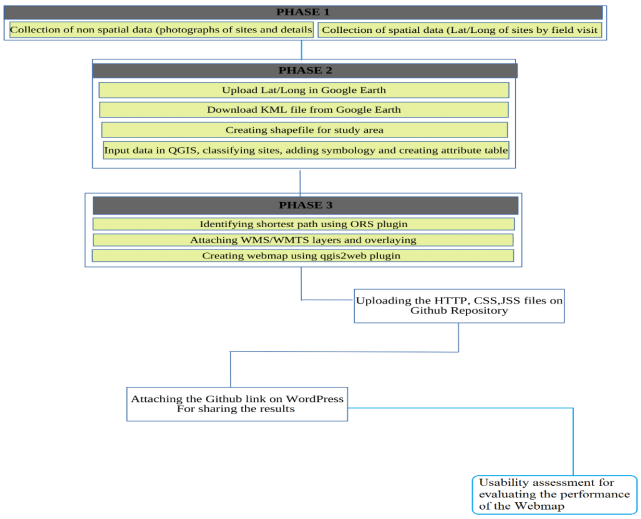

Fig. 2. Methodology chart

In the questionnaire, respondents were asked to rate important webmap features such as icon ease of use (zoom in/out, etc.), symbol/widget visualization, legend and overall information, and panning (clicking and dragging). In addition, users were asked if they had any further recommendations. The questionnaire's ratings varied from 1 to 5, with 5 being the highest and 1 being the lowest. The user's satisfaction with the webmap was reflected in the subjective evaluation, which went from 1-very low to 2-low, 3-moderate, 4-high, and 5-very high.

4 Results and discussion

Stanley Plog identified three categories of travelers: allocentric, midcentric, and psychocentric [21]. When analyzed using this typology, a few well-known pilgrimage destinations such as Tripura Sundari temple, Ghotia Amba, and so on can be considered as midcentric tourist destination. Apart from these, the Banswara district can be considered a destination for allocentric tourists because there are a lot of unexplored areas. There are a number of religious sites near geographical landforms, such as caves, river confluence points, and plateau hinges. This gives ample of scope for different stakeholders, be it tourism planners or the explorers to continuously look

for new tourist spots that can help in promoting tourism.

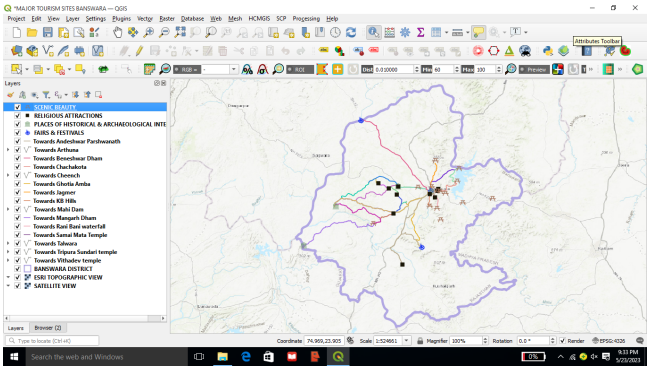

Fig. 3. Visualisation of tourism destinations in Banswara District in English language in QGIS

It can take a while for traditional pamphlets and brochures to incorporate new information, so reaching tourists can be quite time-consuming. Webmaps created using GIS can help disseminating the information faster which otherwise can be hampered by traditional pamphlets and brochures due to difficulty in regularly updating it. Explorers can report new potential destination to the district tourism authority, and it can be made available on the webmap, thereby expediting the marketing and promotion of tourist destinations. This way, a webmap created using geospatial techniques can help bring new sites into the spotlight quickly.

In order to display the main tourist destinations in the Banswara district along with relevant information such as the place name, point of interest, description in both Hindi and English, and photographs, the current study attempted to create a webmap in QGIS using the qgis2web plugin (Figures 3 and 4). The ability to export layers in Openlayers, Leaflet, or Mapbox GL JS is offered by the qgis2web plugin (Figure 5).

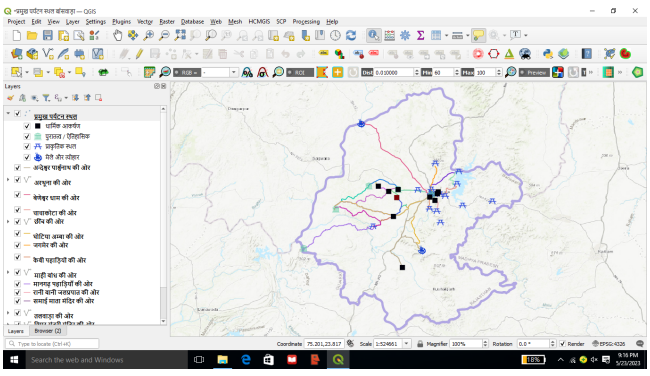

Fig. 4. Visualisation of tourism destinations in Banswara District in Hindi language in QGIS

Based on the primary significance of the site, tourist destinations were divided into four main categories. Different symbols were used to show these categories that can help the user to visually understand the presence of different types of tourist attractions in Banswara district at the first glance of the interface (Figure 6**A**). While some sites are natural attractions, they have been labeled as religious attractions because of their connection to the locals' faith and beliefs. A comprehensive list of all the layers that are attached to the webmap is displayed in the legend in the webmap's right-hand corner (Figure 6**B**). The legend provides option to the user to limit their search by unchecking the attributes based on their interests and requirements. By clicking the symbols in the map, the user can get more information related to the tourist attractions such as its description, photograph, and others (Figure 6 **C**).

The ORS plugin in QGIS was used to calculate the shortest distance between a site and Banswara city. The closest and shortest routes between the locations are also computed. The shortest distance to all of the sites was determined from Banswara city, which is the principal administrative location where transportation services are available to visit any site in the district. With the aid of these interactive webmaps, tourism planners can also gain a better understanding of the road connectivity component. Since there are tourist attractions along State Highway 10 that are well-connected to one another, travelers can get attracted and make a visit out of curiosity. However, some sites, like Jagmer, are only well connected to Banswara city and are difficult to reach from other tourist destinations.

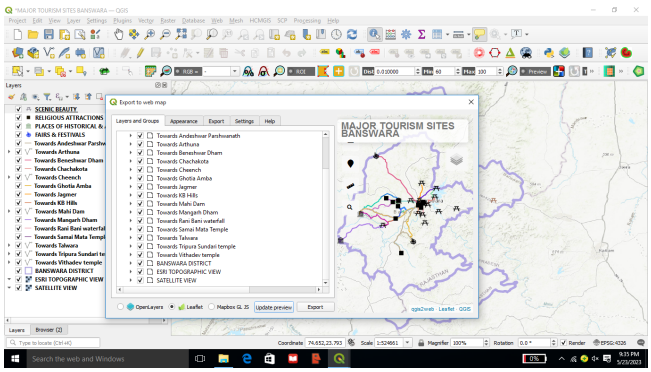

Fig. 5. Creation of webmap using qgis2web plugin in QGIS

If there are any nearby sites of tourist importance, the shortest route between them indicates how connected one site is to the others and provides visitors with additional options for where to go (Figure 6**D**). Visitors to Banswara might be familiar with locations like the well-known Tripura Sundari Temple, but they might not be aware about Ramkund, a nearby cave which is a religious site. In case even if they get to know about Ramkund, they might not know where it is or, if they do, they might not know how to get there. With the help of this integrated webmap, visitors will be able to locate

locations close to the site and get directions. The base layers of this webmap are WMS/WMTS layers of ESRI Topographic and Google Earth that are derived using HCM GIS plugin in QGIS.

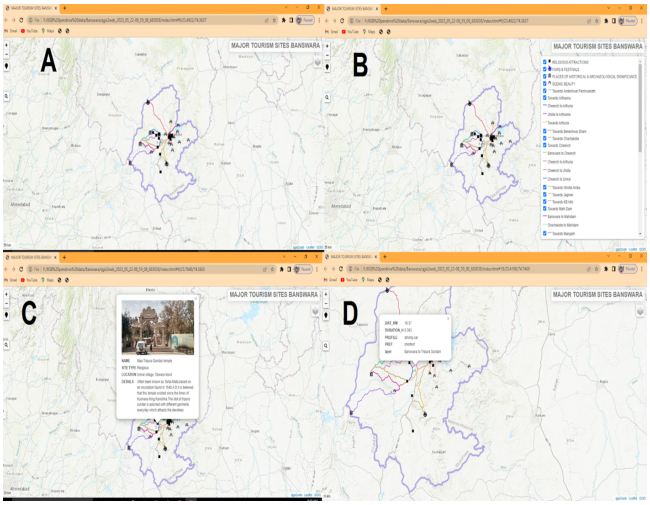

Fig. 6. A) The Webmap interface. B) showing legend of interface. C) showing information of a site. D) showing information related to shortest route

The webmap comes with several default settings, such as the ability to zoom in and out, find the current location, and calculate the linear distance between two points (Figure 6). The output file formats provided by the qgis2web plugin, like HTML (HyperText Markup Language), CSS (Cascading Style Sheets), and JSS (JavaScript Style Sheets) can be uploaded to a hosting platform. The file(s) created for this study using the qgis2web plugin were posted to GitHub as repositories. Github offers a social coding and hosting platform that promotes open-source software development, which ultimately depends on teamwork[22]. GitHub allows hosting pages from the repository uploaded. Additionally, it offers HTTPS (HyperText Transfer Protocol Secure) encryption. In order to facilitate easy access, the generated web link was published online via the WordPress domain.

The results of the usability analysis are shown in Figure 7. Every user-submitted rating for a particular aspect is displayed independently in a graph and examined. The ratings provide information about the user's level of satisfaction with the webmap during interaction. When navigating the icons in the upper left corner of the webmap, users were asked to rate their level of satisfaction. The users were able to zoom in and out, find their location, measure the distance in a straight line, and search for an exact location using these icons. A total of 76% users reported high to very high satisfaction while interacting with these icons, as seen in Figure 7**(A)**. The remaining 24% were not very satisfied with these icons' ease of use. One user suggested making the "Show me where I am" function even more user-friendly.

Widgets/symbols are important interative element of a webmap. According to Sternlicht et al.[23] "A map widget is a small program that may be embedded on a website to display geographical information. It frequently contains elements such as interactive navigation, location information, and customisable aesthetics". Figure 7**(B)** depicts the percentage-wise split of user's satisfaction when interacting with the widgets/symbols displaying information about tourist attractions on the webmap. Approximately 81% of users were satisfied with the widgets/symbols. However, some of users suggested the improvisation in terms of the color of the widgets/symbols that could help differentiate it more clearly.

Wood and Fels (2008) in their study[24], cited legend as an important component of 'paramap', which encompasses all the elements produced and viewed surrounding the map such as 'title', legends, scale etc. An appropriate legend increases the map's cognitive usability[25]. Around 85 percent of the users found satisfied while interacting with the legend as they found it simple and useful (Figure 7**C**). Users also found the overall content and information including the photographs interactive, insightful, and concise.

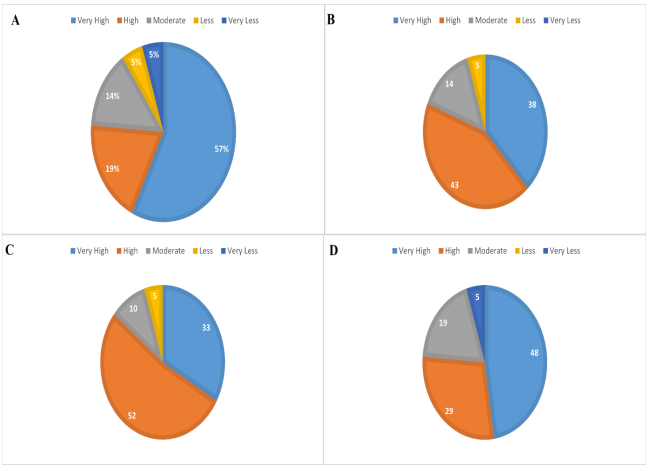

Fig. 7. Users satisfaction: A) Regarding icons. B) Pertaining to widgets/symbols. C) Opinion regarding legend and content. D) Views regarding panning. (Values in percentage)

"Panning," as defined in the report "Guidelines for best practice in user interface for GIS," is the process of shifting the position using many methods, such dragging, scrolling, and so forth, without interfering with the scale of the view (European Commission)[26]. Users were asked to rate their experience with clicking and dragging the webmap's content. The findings are shown in Figure 7**(D)**. A large percentage of users (77 percent) acknowledged the panning feature.

Overall, majority of the users found the webmap innovative, efficient, and interactive in nature and therefore expressed their satisfaction in interacting with different

aspects of the webmap. Users also acknowledged the availability of webmap in two languages and expressed their recommendation for a more enhanced intuitive navigational design suitable for both desktops and mobile devices and also the need of emergency widgets in the webmap. Feedback pertaining to the adding of real time information was received as well more innovative ideas such as adding virtual tours and information on eco-friendly travel routes were recommended.

5 Conclusion

The primary goal of this paper was to comprehend how QGIS is used to create web-based interactive maps that highlight the main tourist attractions in the Banswara district, Rajasthan state. The study identified the primary tourist attractions in the Banswara district and classified them into four categories through consultation with relevant literature and stakeholders, such as general public and government authorities in charge of tourism planning. The study also integrated non-spatial and spatial data into a single platform, allowing tourists to access all important information about major tourist attractions and their accessibility from a single platform. Usability analysis revealed the strengths and limitations of the webmap. The potential for increasing tourism through webmaps created using QGIS plugins has been recognized. With user feedback regarding the flexible design needed for both mobile and non-mobile devices, this webmap can be turned into an Android application with more features and improved accessibility for all stakeholders, including the district administration. Real time information such as weather parameters can be integrated in future. More research on the tourism of Banswara district can be done to get additional information pertaining to its local eco-friendly travel routes and further collaborative effort can lead to enhanced webmap for Banswara tourism.

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