



Utilization of WebGIS for Visualization of the Distribution of Tourist Destination Religious Objects in Nagari Batuhampar of Lima Puluh Kota Regency, West Sumatera Province

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Abstract—Nagari Batuhampar has several tourist attractions planned as object tourist destinations in the strategic plan. However, publication and presentation on social media are less effective in promoting the unique characteristics of tourist attractions. This research aims to identify the distribution of tourist destination objects in Nagari Batuhampar, followed by comprehensive information. The type of research used is descriptive survey research with the waterfall method, which consists of requirement analysis, system analysis, system implementation, system testing, system evaluation, operation, and maintenance. Data collecting techniques include observation using GPS and documentation, interviews to obtain information for web development, and questionnaires. Furthermore, the built-in data application QGIS 3.32.3” Lima” is open source. WebGIS, built using the Database Management System (DBMS) approach, is designed as software to manage big data. Big data is meant to be a collection of lots of data tailored to the project being carried out, such as mapping the distribution of public facilities and village potential. In this research, DBMS focuses on spatial data and religious and supporting tourism attributes. This is focused on data on religious and supporting tourism attributes. The result found that historical religious tourist attractions dominated the distribution of attractions in Nagari Batuhampar. The WebGIS of Tourist Destination Object was constructed using a waterfall method that was effectively created. This development was conducted through system evaluation tests, resulting in most respondents being satisfied with the process's performance.

Keywords— WebGIS; waterfall method; religious tourism objects.

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I. INTRODUCTION

Tourism is an activity that aims to provide services, objects, attractions, products, and other businesses that can increase the potential for economic growth within a particular area. The tourism business offers a diverse variety of tourist destination products, ranging from nature tourism, cultural tourism, educational tourism, culinary tourism, religious tourism, and various other tourism product options [1]Indonesia is a religious country with a lot of potential for religious tourism. Many historical artifacts, such as buildings or sacred sites, have special meanings for Indonesian religious people. The development of global religious tourism is quite

rapid, requiring active participation in developing the most potential religious tourism objects in Indonesia.

Religious tourism has become a spiritual necessity for religious followers worldwide. Pilgrimage activities to sacred sites are not only a form of religious guidance implementation. Still, it has also become a routine culture that must be carried out within a certain period. The interest in religious tourism derives from people's need to identify and explore their beliefs. Religious tourism is founded on human desires and beliefs; hence, attractiveness or other elements that typically attract visitors to tourist destinations are only as valuable or contribute less than the desires and beliefs of each individual.

Nagari Batuhampar has a strategic location near the Payakumbuh and Bukittinggi traffic roads. Nagari

Batuhampar is located close to the center of Payakumbuh City. Nagari Batuhampar is one of the Nagari in the Lima Puluh Kota Regency. The area has attractive tourist objects and promising potential to be developed as a tourist area [2]. Nagari Batuhampar, located in the Akabiluru District of the Lima Puluh Kota Regency, has historically been recognized as an essential point for developing the Islamic religion of Minangkabau before the 19th century. However, this village's management and tourism services could be more experienced because it is spontaneous, sporadic, and straightforward. The development of religious tourism potential in this village is up-and-coming, primarily if managed professionally. However, trip planning is one of the problems that requires a clear understanding of the target destination [3].

The Internet has the potential to serve as a medium to distribute regional tourism information [4]–[6]. The accessibility of the Internet appears to be on the rise in large populations [7], [8]. An example is the utilization of augmented reality for the distribution of tourism information [9]. Moreover, one of the efforts to support tourism promotion is utilizing a website based on Geographic Information Systems, also called WebGIS. Promotion is a communication strategy aimed at delivering information to consumers or potential tourists [10]–[12]. The extensive utilization of information and communication technologies in the tourism sector has resulted in significant improvements in fundamental travel processes [13]–[15]. Nowadays, GIS is the primary tool for promoting tourism in most countries. The Geographic Information System (GIS) is a computer-based system that allows users to access, save, learn, control, analyze, and present spatial information [16]–[18]. WebGIS is a geographical information system distributed across a networked computer environment and used to integrate, distribute, and communicate visual geographic information on the World Wide Web (WWW).

WebGIS is an application tool that integrates web design and web mapping [19]–[21]. GIS has been designed to be accessible online through WebGIS, facilitating more efficient

information access for users. Moreover, WebGIS can also improve server performance and is cheap, flexible, and highly practical [22]–[24]. Years of research and implementation efforts for GIS provide a promising approach to successful tourism systems [25]–[27]. WebGIS is a digital mapping that utilizes the Internet network. This medium of communication facilitates the distribution, publication, integration, and exchange of information in the form of text, digital maps, and travel functions of analysis and queries related to GIS over the Internet network.

Based on the description above, this study aims to identify and analyze the distribution of religious tourism in Nagari Batuhampar, Akabiluru District, and Lima Puluh Kota Regency using WebGIS technology. The development of WebGIS has shown consistent progress, along with the expansion of the internet and the advancement of hardware and software [28]–[30]. The significance of conducting this research arises from the need for more media as a resource for tourism promotion.

II. MATERIALS AND METHODS

Batuhampar is a Nagari located in the Akabiluru district in Lima Puluh Kota Regency, West Sumatra, Indonesia [31]. Geographically, this Nagari is bordered by Nagari Sariék Laweh to the north, and Nagari Koto Tengah Batuhampar to the south; to the west by Bukit Sulah, the steep part of Bukit Barisan ($\pm 500\text{m}$) acts as a dividing wall with the neighboring Nagari Padang Tarok. In contrast, to the east it is bordered by Nagari Durian Gadang, which was formerly one of the three “jorong” of Batuhampar. (The other two are Batuhampar and Koto Baru Batuhampar) (in Minangkabau cultural terminology, Jorong/Korong is the lowest level of customary administration that gathers people to live their daily lives as part of Minangkabau Culture, which then each jorong that has the same traditional and cultural characteristics will be gathered in one Nagari). Jorong Batuhampar is the largest and has been the main village for a long time.

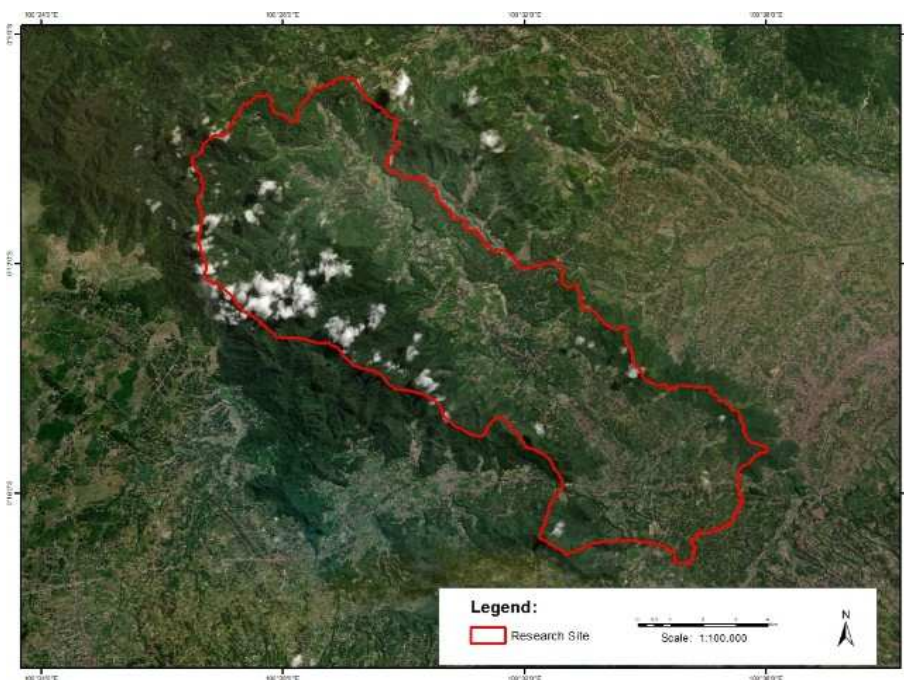


Fig. 1 The Research Location in Nagari Batuhampar, Lima Puluh Kota Regency

The type of research used in this study is descriptive survey research. Data collecting techniques include observation using GPS and documentation, interviews to obtain information for web development, and questionnaires. This tool is used to analyze system evaluations and online observations related to the effectiveness of the created website. The application used in this study is QGIS 3.32.5 Lima.

The development stages of WebGIS use a framework based on the waterfall method. The waterfall method is a systematic and sequential system for developing information systems. This development model is linear, systematic, and

sequential, from the early stages of system development, namely the planning stage, and continues to the final stage of system development, namely the maintenance stage [32]–[34]. The waterfall method has the following stages (Sommerville, 2011): (a) Requirements analysis and definition; (b) System and software design, (c) Implementation and unit testing; (d) Integration and system testing; (e) Operation and maintenance [35], [36]. In the Waterfall method, each phase's development must be completed before proceeding to the next, and it requires minimal resources and documentation.

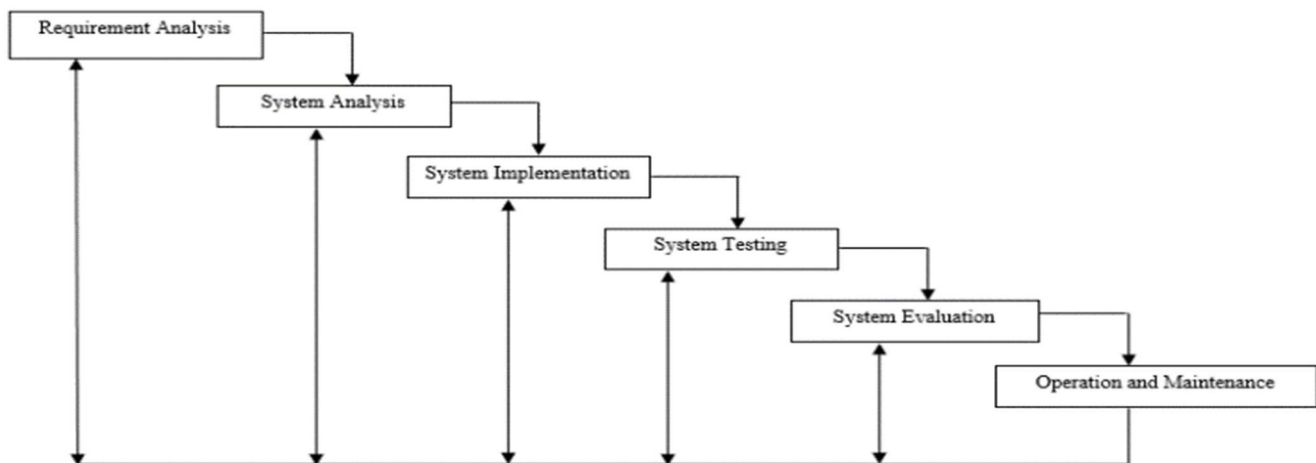


Fig. 2 Flow Chart of Waterfall Method

III. RESULTS AND DISCUSSION

A. The Distribution of Religious Tourism

Nagari Batuhampar offers natural attractiveness as a tourist destination. Moreover, it is supported by a strategic and easily accessible location and a comfortable and attractive location, making it simple for tourists to feel at ease while visiting Nagari Batuhampar. The effective management of tourism potential in the Batuhampar area requires the collective support and participation of all community stakeholders (according to an interview with walinagari, custom leader and community leader). In the Minangkabau realm, the construction leader of society consists of these three).

Nagari Batuhampar has the potential to transform into a tourist destination capable of attracting both domestic and international visitors, maximizing its unique tourism potential. Batuhampar village might also be used as a family tourist attraction, increasing job opportunities for the unemployed. Therefore, these opportunities, particularly religious tourism, may positively impact Nagari Batuhampar's development.



Fig. 3 (left to right) Romi Suhardi A.Md (Walinagari/head of Batuhampar), Mr. Zarwan Zed (Custom Leader), Ustadz Bujang (Ulama/Community Leader)

Based on the results of research and field surveys, religious tourism in Batuhampar District can be seen as a manifestation of the historical significance of Islamic heritage. These religious tours include the Al Manaar Batuhampar Islamic Boarding School, the Ar-Rahman Mosque Tower, the Islamic boarding school building, and the tomb sites. The buildings in the Islamic boarding school have historical architecture, making it attractive for tourists.

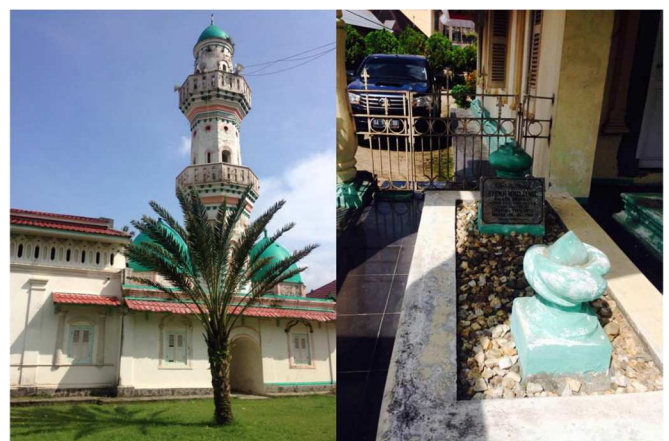


Fig. 4 The Ar-Rahman Islamic Boarding School (left) & The Tomb of Syekh Mohd. Jamil (father of national proclamation hero of Indonesia. Mohammad Hatta)

The al-Manaar Islamic Boarding School originated as a surau, or small mosque, which Sheikh Abdurrahman opened in 1824. He established a halaqah education system for teaching the Koran's qira'at (recitation). This surau became

well-known throughout the country due to his educational leadership. Many Siak people (students) came to Batuhampar to study with him. Minangkabai-Siak people from Aceh, Riau, Jambi, Bengkulu, and Central-Southern Sumatra come to Batuhampar to study the Koran.



Fig. 5 Al-Manaar Batuhampar Islamic Boarding School

Islamic boarding school authorities continue to try to maintain the quality of teaching and learning facilities to keep Al-Manaar Islamic boarding schools open. This is shown by the number of students enrolled in Al-Manaar Islamic Boarding School and the number of teachers. Besides, the Al-Manaar boarding school facilities are complete, including a two-story school building, dormitories, study rooms and their contents, sports facilities, and other amenities. Al-Manaar Islamic Boarding School continues to accommodate many students from various regions.

The Islamic Boarding School is introducing religious tourism to protect and sustain its existence. The Al-Manaar Batuhampar Surau and the Islamic boarding school complex have much potential for spiritual tourism. Despite their old age, towers and buildings have maintained magnificence for quite a long time. Another religious tourism opportunity to explore is grave pilgrimage activities to the graves of previous Sheikh leaders of Islamic Boarding Schools. Many far-away immigrants come to Batuhampar to pay their respects at the cemetery. Thousands of visitors come during fasting, Eid, or other big Islamic festivals, and they are not hesitant to come—the number of visitors who come to make the pilgrimage to the grave crowds the main route. Therefore, religious tourism can maintain Islamic traditions in the future.

B. Utilization of WebGIS for Visualization of Tourist Religious Objects

The utilization and development of WebGIS as a digital media to promote religious tourism in Batuhampar can

facilitate the distribution of information and serve as a connection between the user and the system through spatial data. WebGIS provides various advantages as a means of presenting information. WebGIS benefits include the simplicity of presenting geographic data using online media without needing GIS software, allowing it to be accessed by many different users. The WebGIS development model in this study follows the waterfall method. This model is based on the WebGIS development sequence and corrects and builds data with each other. [35].

This study used the waterfall method by using WebGIS to identify religious tourism objects in the research location. The waterfall method has several stages, which will be discussed one by one in previous research [37]–[39]. The waterfall model employs a systematic and sequential approach because a stage can only be executed once the preceding stages have been finalized.

1) *Analysis of Requirement.* The problem that occurs in the research location is the need for more information on the distribution of Web related to religious tourism. The website of the Nagari Batuhampar Government still needs to be more restricted, especially the website that displays information on the location of religious tourism. This lack of information has resulted in a low awareness of the broader community, limiting the optimal progress of industrial development in the area. The functional requirements for this system include: 1) The system can provide information about tourist destinations. 2) The system can present a map of tourist destinations' locations. 3) The system can present a description, address, coordinates, and images of the area. Hardware requirements like a laptop or computer are non-functional aspects in developing this system. Meanwhile, software requirements are Windows, QGIS, Visual Studio Code, Wampp Server, and Google Chrome.

2) *System Analysis.* The WebGIS system has been developed with a user-friendly interface to facilitate users' access to information and the location of religious tourism attractions in Nagari Batuhampar. The web system design includes the main website interface and menu options. The menu offers a variety of alternatives, such as the Nagari Batuhampar profile, location, and infrastructure facilities. When selecting an area, the background map can be modified to a vector view or satellite imagery.

- *System Implementation.*

GIS-based websites are developed using existing system designs. Furthermore, computer system security must be considered when developing WebGIS. This prevents unauthorized users from operating this WebGIS by restricting display editing that differs from the system design. Figure 6 shows a visual representation of the WebGIS that has been developed.

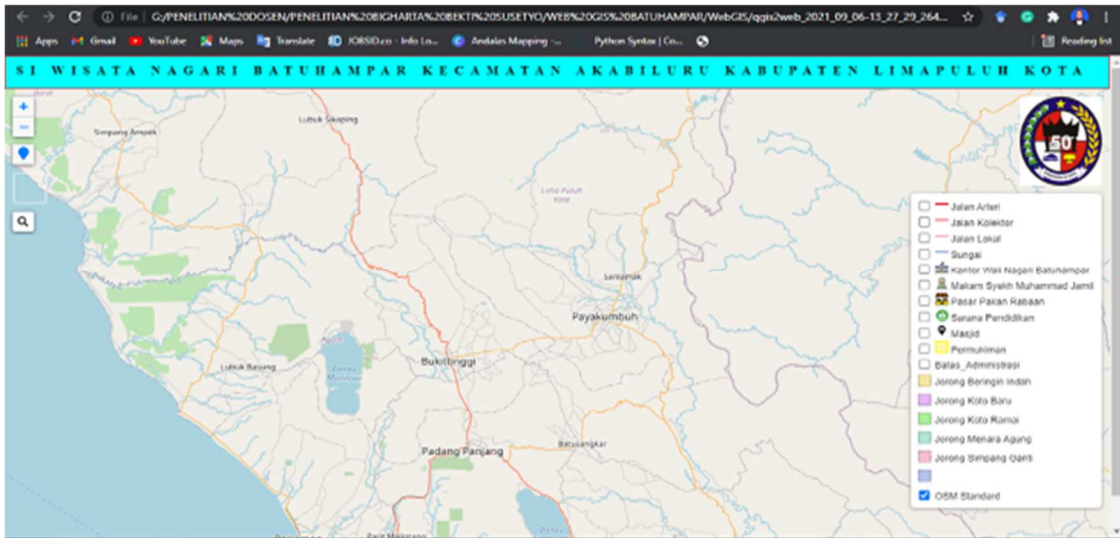


Fig. 6 The landing page of the website

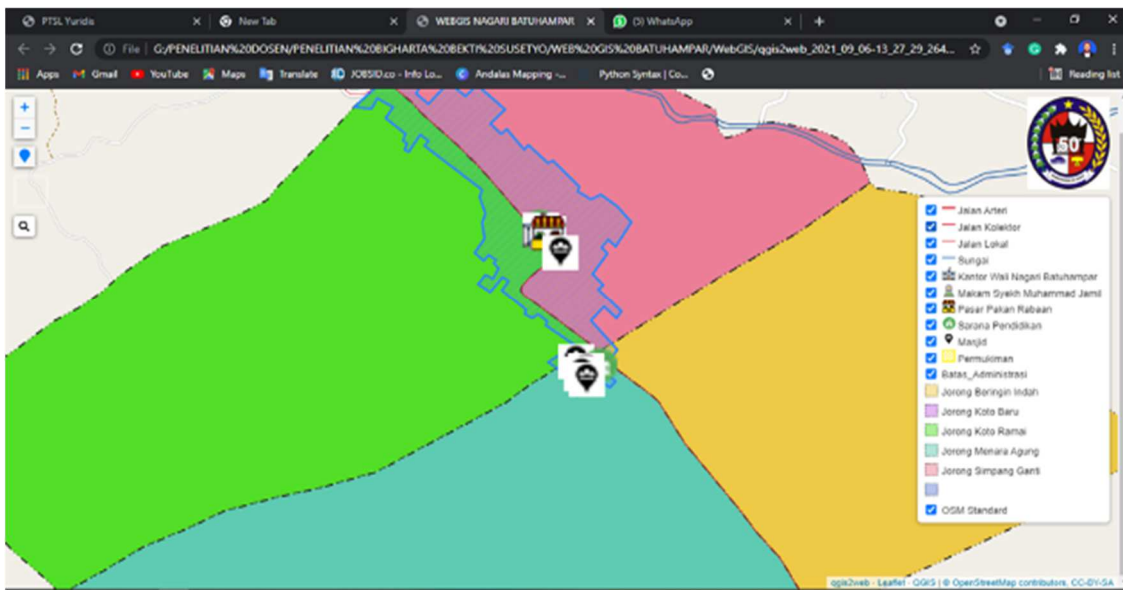


Fig. 7 Menu option for the facilities and infrastructure

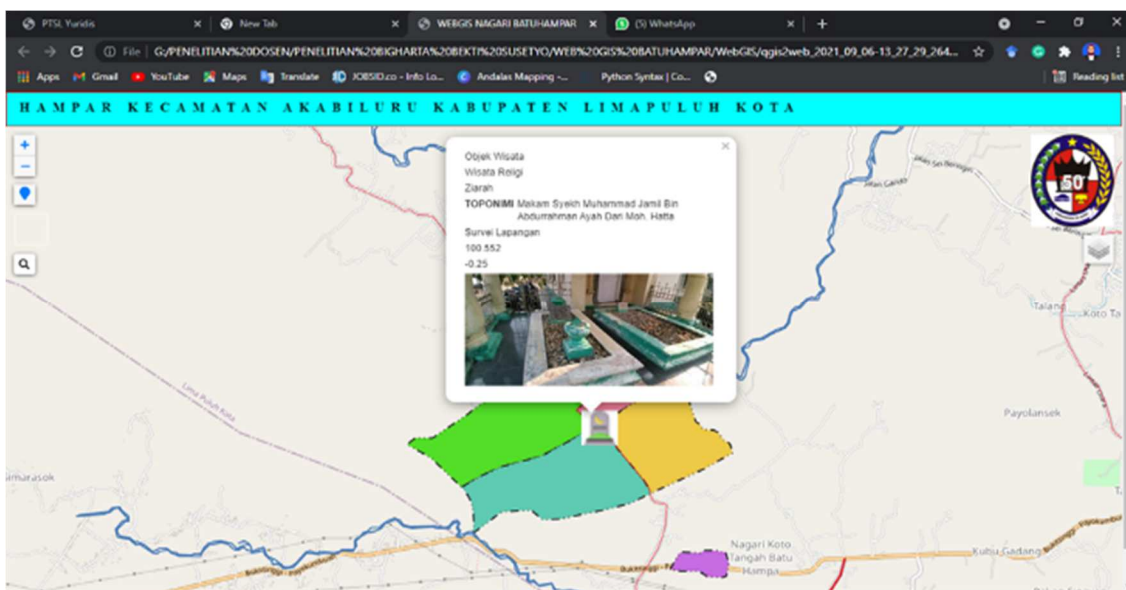


Fig. 8 The front page of the distribution of religious tourism and the detailed information

- *System testing/evaluation*

Evaluation is a systematic assessment process that includes the delivery of value, attributes, recognition, and introduction of problems and the availability of solutions for the issues identified. It can be concluded that evaluation is a planned activity to determine the condition of an object using instruments, and the results are compared to benchmarks to conclude. After the system has been implemented and tested, additional evaluation is conducted to determine which components must be fixed, improved, or replaced. The evaluation stage is crucial for the system's development to keep up with the changes that occur in digital visualization. This stage uses different instruments in each system built, following the designation and sections evaluated.

- *Operation and Maintenance.*

WebGIS is an innovation in spatial data visualization since it promotes user engagement with specific spatial data requests. Therefore, WebGIS development is focused on the needs of users who will be using spatial data for various purposes to build a particular spatial information system, and its accessibility can be achieved through an internet connection. Through the development of WebGIS, visitors will be more flexible in accessing religious tourism sites in Nagari Batuhampar because tourists can access WebGIS themselves through their devices.

The use of WebGIS in the tourism industry is an innovation that can help tourists because WebGIS will be needed by tourists who will participate in tourist activities anywhere. As can be seen from the WebGIS that we created, WebGIS can be accessed freely via the Internet by users who are equipped with directions and information about religious attractions in Nagari Batuhampar, such as place coordinates, names of tourist attractions, types of attractions, and photos of tourist attractions. Thus, visitors will have a preview of the attractions they will visit.

A GIS-based web operationalization has been designed and developed so that it can be utilized and administered by the government of Nagari Batuhampar. Regular tests are conducted in GIS web maintenance to ensure the proper functioning and management of the website. Maintenance activities may include eliminating unnecessary data and adding data and information to enhance the accuracy of the web system.

The initial step in developing a WebGIS model involves conducting a need analysis [40]–[42]. A needs analysis is conducted to fulfill the requirements of the information source for the recipient of the information through the online WebGIS platform. Mango et al. supported this finding. [43] who stated that they identified model requirements based on trade-offs between specific information and technology requirements to convey tourism information online. Then a system analysis is developed for a WebGIS model that suits the needs of tourists. The manager organizes the acquired information on the web map, customized to meet the specific requirements of tourists.

Furthermore, preparing the WebGIS system requires the use of georeferenced data. The selection of spatially georeferenced data to identify unique tourism resources in geographic space enables a spatial analysis on maps via

queries. Then, in preparing the system, 2 types of system user environments are needed: admin/expert user and non-expert user/recipient. This serves to separate the authority of each user to control the information that is submitted and received by WebGIS [44]. Only authorized parties, in this case, expert users, may add to and modify spatial data submitted by WebGIS.

WebGIS development uses HTML, CSS, Javascript, and PHP programming languages. Because HTML is the standard programming language for building websites, WebGIS is no exception. The difference between standard websites and WebGIS is that WebGIS emphasizes the use of geographic information for spatial data visualization that is understandable by general users for various purposes.

The process of building design and information that is text in the development of WebGIS, the process of building design and information, which is text, uses HTML and CSS so that the layout of WebGIS can be designed to be more interactive with user needs. Then, using Javascript and PHP programming languages, generate a button or menu in WebGIS. Javascript is used along with HTML and CSS to create the WebGIS front-end, and PHP is used to create web services and back-ends, as well as to make the features available in WebGIS usable [45]–[47].

Leaflet.js is then used to create web-based mapping applications on WebGIS. Leaflet.js is one of the open-source Javascript libraries used for web-integrated mapping application templates. A library that supports web-based mapping is required in the preparation of code in WebGIS development; Leaflet.js is the right library for WebGIS development because it provides an interactive base map and is connected to open-access satellite imagery providers such as Google Earth, Bing, Open Street Map, and others.

The spatial data must first be transformed from .shp format to .geojson format before it is imported into WebGIS because .geojson is the spatial data format supported in WebGIS development. Geojson is a data format for displaying geographic characteristics. The features included are lines, points, and areas. Geojson describes data in this format using JavaScript; therefore, it may be integrated with code used in WebGIS development to display spatial information on WebGIS itself.

There are several religious attractions in WebGIS for Nagari Batuhampar Tourism, including the 1929 Menara Mosque and the Tomb of Sheikh Muhammad Jamil Bin Abdurrahman, Father of Moh. Hatta, Al-Manaar Islamic Boarding School, and Jami Batuhampar Mosque. Tourists can find all the information they need on the Nagari Batuhampar WebGIS, including coordinates, names of tourist attractions, types of attractions, and documentation of these attractions.

Moreover, testing and evaluation of the system are carried out to determine the functionality of the WebGIS that has been built before operation and maintenance are performed. This is expected to optimize WebGIS's performance as a spatial data provider platform for tourism that is effective and user-friendly.

After the testing process has been carried out, WebGIS for Nagari Batuhampar tourism can be operated as a promotional medium for religious tourism objects in Nagari Batuhampar. The utilization of WebGIS is proper because tourists can search and explore specific information such as locations,

tourist facilities, accommodations, and much more about activities and attractions [48].

The waterfall method is considered as the most suitable model to utilize for conducting a software development process with a low level of risk and a long development duration. The waterfall method has the advantage of being more structured, which ensures that software quality is good and maintained. It is also more profitable from the user's perspective because they can plan and define needs from the beginning. The scheduling process becomes more apparent when each method can be determined with certainty. The development process for each stage can be seen with clarity by having a specific sequence. The waterfall model, on the other hand, requires a comprehensive documentation procedure to facilitate software maintenance.

Meanwhile, in the waterfall method, there are several factors that most people consider to be a weakness, specifically that this method needs to be more flexible, making it challenging to modify system requirements while the system development process is running. If there are errors in the processes or procedures from the previous stage, the development stage must start from the beginning again. This will take longer. Because the previous procedure has not been finished, the following process cannot run. Therefore, if there are problems in the user requirements specification process, the development process must start from the beginning. Consequently, it is right to claim that the software development process using the waterfall method is slow.

Another limitation of the waterfall method is that it requires a complete definition of software requirements from the start. However, only some users can meet this requirement. To avoid repeating stages, the user must provide all procedures, data, and reports needed, starting with the initial development stage. However, users frequently make requests during the middle stages of system development. Development must be restarted from the beginning with this method because development is customized to the user's design during the early stages. However, users cannot test the system before it is fully developed.

IV. CONCLUSION

WebGIS can be used to support regional development, including tourism. It is possible to map tourist attractions in Nagari Batuhampar. WebGIS may support the Nagari government in distributing information about tourist destinations. Users or the public can also virtually explore tourist destination objects in Nagari Batuhampar and can visit by following the road map.

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