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RESEARCH ARTICLE

INTERACTIVE DIGITAL MAPPING OF SENTUL-BOGOR TREKKING TOURISM DESTINATIONS TOWARD ONE STOP SENTUL TOURISM (OSST)

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ABSTRACT

Sentul trekking tourism in Bogor is becoming increasingly popular as it provides many attractive natural sights and is a safe option for tourists during and after the Covid-19 Pandemic. Nevertheless, access to information on the geographical description of tourism destinations is not available. In the context of tourist development, reliable, interactive, and fascinating geographical information regarding hiking routes and tourism objects is required. The purpose of this article is to discuss the development of an interactive digital map containing routes and areas of interest for the Sentul Bogor hiking tourist item and displaying multimedia content in the form of text, graphics, and images. This interactive digital map was created using a Geographical Information System (GIS) and includes all multimedia components such as images, text, and figures that are displayed dynamically. This article identifies six routes in Bogor's Sentul Region that are prioritized for presentation on an interactive digital map. The routes are divided into two levels: basic and intermediate. The basic level comprises the Leuwi Asih Waterfall Way, the Leuwi Hejo Waterfall Route, the Cibingbin Waterfall Route, the Goa Garonggang Waterfall Road, the Paniisan Hill Route, and the Ciburial Waterfall Route.

KEYWORDS

Geographical, hiking, tourism, dynamically, multimedia

1. INTRODUCTION

Tourism in Indonesia after the Covid-19 Pandemic has become the main target for development, including in the Bogor Regency area, West Java. During the pandemic, in 2020, in general, tourists in Bogor Regency significantly decreased from a total of 5,117,889 people, which only amounted to 60,552. In 2021, the number of visits rose to 6,455,954 people and began to show their enthusiasm and is targeted to reach 10 million people in 2023. Since the pandemic until now, nature tourism has become a popular tourist choice. The Sentul area, Bogor provides high opportunities as an outdoor tourist destination because there are many interesting natural tourist objects and have become alternative tourism since the pandemic until now. One type of tourism that has been popular until now is trekking tourism which is currently viral and is crowded with visitors because it offers a variety of very diverse natural tourist attractions, including waterfalls, protected forests, community forests, karst areas (caves), rice fields, plantations, hot springs (Dewi et al., 2022). Apart from nature tourism, local communities around tourist sites have great potential to be developed as new tourist attractions and provide alternative tourism activities in order to enrich the variety of trekking tourism (Dewi et al., 2022).

Now, the problems with trekking tourism are 1) There are still limited information services coming from social media and websites from tour managers 2) There are no websites from managers that present information spatially; 3) There is no system that integrates all tourist information services and their supports. Therefore, an outdoor tourism management company in the Sentul area, Bogor, PT. Cakar Langit

Indonesia, has the goal of developing tourism services by providing a spatial information system in the form of an interactive digital map based on a website and an application that integrates all supporting services for trekking tourism in Sentul, Bogor.

2. LITERATURE REVIEW

Several researchers have discussed trekking tourism with various perspectives, most of which lead to trekking activities outdoors or in nature. Tourism in general will find its saturation point, so that innovation in diversification efforts is sought after. Digitalization in tourism seems to be an inevitability that cannot be avoided. Therefore, this sub-chapter will discuss various literature related to these three matters.

2.1 Natural Trekking Tourism

Previous research stated that trekking is generally practiced in nature and in difficult terrain and climates, requiring special equipment, clothing and food. This tourism conveys connotations of risk, danger and wilderness (Gyimóthy and Mykletun, 2004; Buckley, 2006). In fact, trekking tours are often carried out in untouched and unknown areas, which are then included among the types of geotourism. The link between trekking and geotourism is that both are carried out in nature and provide learning and phenomena that describe the history of the earth (Newsome and Dowling, 2005). Trekking activities require special skills, especially when climbing in caves or old mining work, long hikes and taking risks (Schejbal, 2011; Rybár et al., 2012; Erfurt Cooper, 2011). More specifically trekking can also be done in the most remote areas divides trekking tourism into 2

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types, namely trekking in general, namely mountain trekking, otherwise known as classic trekking and other trekking, such as desert, tropical forest, glacial, arctic or river trekking (Gyimóthy and Mykletun, 2004; Rózycki and Dryglas, 2014). In Europe, trekking has traditionally been cultivated mainly in the Alps, as an activity that has many Routes, has scenic views and is an attractive tourism opportunity for the rest of the world.

The term trekking tourism is closely related to adventure tourism in nature. Public interest in this type of activity is increasing. Janowski, Gardiner & Kwek said that the concept offered in outdoor physical activity-based adventure tourism, ranging from light ones such as hiking, snorkeling and so on, to heavy adventures such as rock climbing, wilderness exploration and so on, in general fails to capture the essence of adventure travel (Janowski et al., 2021). Therefore a new conceptualization is needed that offers a more comprehensive and sophisticated understanding of adventure tourism activities (Janowski et al., 2021).

2.2 GIS-Based Spatial Data Processing

Geographic Information System (GIS) based mapping is mapping that is carried out based on a computer-based system designed to collect, manage, manipulate, analyze and display spatial information. The purpose and objective of using GIS is to create an effective and efficient work system and facilitate planning, monitoring, maintenance, development and assisting in decision making. Geographic Information System (GIS) is a system designed to work with spatially referenced data or geographic coordinates. Geographic information system is a form of information system that presents information in graphical form using maps as an interface. GIS is composed of the concept of several layers (layers) and relationships. The basic capabilities of GIS are integrating various database operations such as queries, analyzing them and displaying them in the form of mapping based on their geographical location (Prahasta, 2009; Cipta et al., 2022; Yanto, Rahmelina and Rahayu, 2020; Irwansyah, 2021; Suryana and Antara, 2021). The power of tourism development can be increased by applying geographic information systems to achieve sustainable tourism development (Ridwana and Himaya, 2020).

The data in GIS is the raw material that is produced by the Geographic Information System to produce information that describes the appearance of the earth's surface (real world). Types of geographic data in GIS consist of: a. Spatial data Spatial data is graphical data relating to locations, positions and areas at certain coordinates. In GIS spatial data can be represented in two formats, namely: 1. Vector data Vector data is the shape of the earth represented in a collection of lines (lines), areas or polygons (areas bounded by lines that start and end at the same point), point (point) and nodes (is the point of intersection between two lines). Vector data is defined by a two-dimensional (x, y) Cartesian coordinate system. 2. Raster data Raster data (or also known as grid cells) is data generated from remote sensing systems such as satellite imagery or aerial photography. In raster data, geographical objects are represented as grid cell structures called pixels (Figure elements). b. Non-spatial data (attributes) Non-spatial data (attributes) describe the spatial characteristics of geographical objects such as color, texture and other information. Non-spatial data is data that stores information about the value or quantity of graphical data (Donya et al., 2020; Anwar and Makruf, 2019; Yoga et al., 2019; Sasong et al., 2018).

2.3 Interactive Digital Map of Tourist Destinations

Utilization of digital mapping with geographic information system

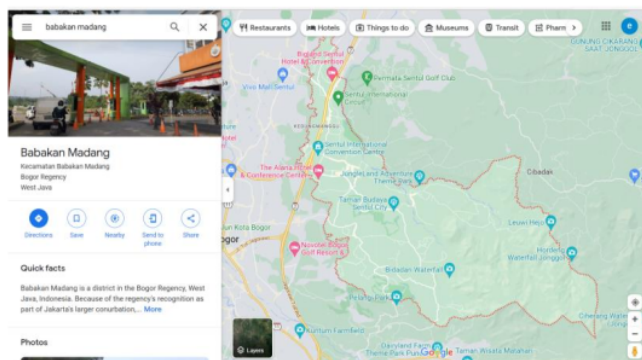


Figure 1: Research Location

technology has been widely used in regional research and development. There are those who use it for disaster studies regarding the spatial process of city preservation, various infographic purposes, preparing visualization data for the spread of Covid-19, which boils down to government recommendations for utilizing geospatial technology in various planning activities (Nirwansyah, 2019; Kerski, 2020; Bramasta, 2014; Windsor et al., 2020).

An interactive digital map is a two-dimensional representation of a three-dimensional space. A map is a traditional representation (in miniature) of physical elements (natural and man-made) of a portion or the entire earth's surface on a flat surface at a specific scale. Basically, the map is a visual aid. Through these props, a map maker wants to convey his ideas to others. The ideas in question are matters related to their position in space; by presenting them in the form of a map, it is hoped that the recipient of the idea can quickly and easily understand or get an overview of what is presented through his eyes (Sufaidah and Hafidhuddin, 2019).

Interactive maps are a development of digital maps. The various advantages of digital maps are customized again according to the user's wishes, so that a map is formed that not only displays spatial information for an area but also provides textual information with a display and mapping function that are well integrated in one map. Interactive maps pamper users with various conveniences and attractive views, as well as the interaction function between users with excellent maps. The form of this interaction is in the form of tools in an interactive map that are tailored to user needs.

In general, these tools consist of zooming, searching pan, and some editing functions. Interactive maps (Interactive Map) open space for ordinary users to be able to understand maps more easily, with a fairly attractive interface. The interest of ordinary users in using interactive maps to describe the spatial data of an area makes the competition for mapping software manufacturers more competitive, so that the functions of the maps themselves become more developed in line with the rapid development of technology (Saputro et al., 2021; Citra and Sarmita, 2019; Nursanty et al., 2022).

3. RESEARCH METHOD

This study uses a qualitative approach involving survey research techniques, interviews, field notes and documentation. Primary data was obtained by conducting surveys to research locations, recording phenomena that occurred and documenting objects. Secondary data, obtained by observation and interviews with tour managers and local guides. While the results of observations and findings in the field were analyzed using a qualitative description method and using the help of ArcGIS software by visualizing data, in the form of spatial data and descriptions. Thus, a comprehensive Figure is obtained in the form of graphic-attribute data and descriptions of the Sentul, Bogor trekking route and tourism spots.

3.1 Research Location

The research location is an area known as Sentul which is in Bogor Regency. The name Sentul is actually not the name of the research location, but because the name that is most attached to it is Sentul, all parts of the location are referred to as the Sentul Region. Even though the research area is in the Babakan Madang District, which is located in the eastern part of Bogor Regency. According to the analysis of spatial data released by the Regional Planning and Development Agency for Regional Development Planning Agency of Bogor Regency (Figure 1).

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Babakan Madang District covers an area of approximately 9181 hectares, stretching between 6°30' - 6°39' South Latitude and 106°50'-106°58' BT with geographical boundaries as follows: North side: Citeureup District South side: Megamendung District East side: Sukamakmur District West side: Sukaraja District Administratively, Babakan Madang District includes 9 villages, namely Desa Babakan Madang, Bojongkoneng, Cijayanti, Cipembuan, Citaringgul, Kadumanggu, Karang Tengah, Sentul, and Sumur Batu. Administrative Area of Each Village in Babakan Madang District No. Desa Luasan Ha 1 Babakan Madang 328,178 2 Bojongkoneng 1,884,795 3 Cijayanti 1,684,178 4 Cipembuan 250,159 5 Citaringgul 362,574 6 Kadumanggu 497,102 7 Karangtengah 3,554,845 8 SENTUL 359,192 9, Bappeda Kab. Bogor.

3.2 Data and Research Equipment

The data used in this study are in the form of: a. Data on the distribution of trekking routes that have been carried out; b. Field Survey Data; c. One unit of Acer brand computer with A16 Ryzen 52500 U Processor specifications Radeon Vega Graphics (R) Core (tm) i5-2450 M CPU @ 2.50 GHZ, 8 GB Memory; Operating System: Microsoft Windows 10 and the software used includes: 1) ArcGIS version 10.5 as software 2) Word processing and spreadsheet software (MS Word and MS Excel) for preparing reports and tabular data processing; 3) Global Positioning System (GPS) brand Garmin, used as an aid in determining direction or position in the field; And; 4) Canon camera to record important objects in the field.

3.3 Research Stage

Broadly speaking, the process in the following research is divided into 2 stages, namely:

1. Mapping Trekking Routes Using GIS. This stage consists of a survey using GPSmap 76CSx equipment. This GPS is a GPS with a navigation type that will be used to record travel tracks, record coordinates and measure altitude. When used for tracking basically GPS will record the coordinates and altitude of every point we have passed. From these points the GPS will connect them with a line. The recording interval of these points varies depending on the settings used. GPS will record every turn that we pass so that sometimes the interval between one point is only about 1 meter
- a. Preparation phase. The preparatory stage includes identifying problems with the object of study and reviewing the literature related to the scope of the study.
- b. Data Retrieval Process. At the stage of the data collection process in the form of spatial and non-spatial data such as the coordinates of tourist sites taken using GPS, photos of tourist sites, and other non-spatial data taken through observation and interviews with related agencies or communities.
- c. Data processing. At this stage of the data management process, namely by inputting the data coordinates of tourist locations into

the ArcGIS 10.5 software, then creating a database that will be equipped with non-spatial data such as names, types, tourist attractions etc.

- d. Data visualization process. At the data visualization stage, namely after getting the coordinates of each location and database, then carrying out the map layout process by displaying each tourist location point on the map to show the position of the tourist location on the map so that the public in general and tourists in particular can easily identify the location - Existing tourist sites.
2. Website-based Interactive Digital Map Development. An existing website or site is built to display information in the form of maps, text data and photos or a combination of all of them.

4. FINDINGS AND DISCUSSION

4.1 ArcGIS-based Track Mapping and Spot Trekking

Interactive digital mapping can be a powerful tool for promoting tourism destinations, especially for outdoor activities such as trekking. To create an interactive digital map of Sentul-Bogor trekking tourism destinations, follow these steps: 1) Collect data: Start by gathering data on the trekking routes, tourism destinations, and other relevant information. This data can include GPS coordinates, photos, descriptions of the trekking trails, and information about nearby attractions and facilities; 2) Choose a platform: There are several digital mapping platforms available, such as Google Maps, Mapbox, and ArcGIS. Choose a platform that is easy to use and has the features you need; 3) Create the map: Use the data you collected to create a map that shows the trekking routes and tourism destinations. You can add markers, labels, and other features to make the map more informative and interactive; 4) Add multimedia content: Enhance the map by adding multimedia content such as photos and videos. This can give users a better idea of what they can expect to see and experience when they visit the tourism destinations; 5) Test and refine: Test the map to make sure it is user-friendly and accurate. Refine the map as needed based on user feedback; 6) Promote the map: Once the map is ready, promote it on social media and other relevant channels to attract visitors to the Sentul-Bogor area. Consider partnering with local tourism organizations to reach a wider audience.

Based on the data exploration carried out, there are 36 Routes available with 6 of the most visited and prioritized Routes for making interactive digital maps. The Route consists of 2, namely the basic Route and the middle Route. The basic route consists of the Leuwi Asih Route, Cibingbing Route, Leuwihejo Route, while the middle route consists of the Ciburial Route, the Goa Garonggang Route and the Paniisan Route with each character belonging to each Route as shown in Figure 2. The two levels differ in terms of distance, steepness and challenges offered. The basic level tends to have relatively shorter travel distances, is sloping, has an open view and has close access to settlements. Meanwhile, the middle level has a longer distance, steeper terrain and usually enters a higher area, such as a forest area (Figure 3).

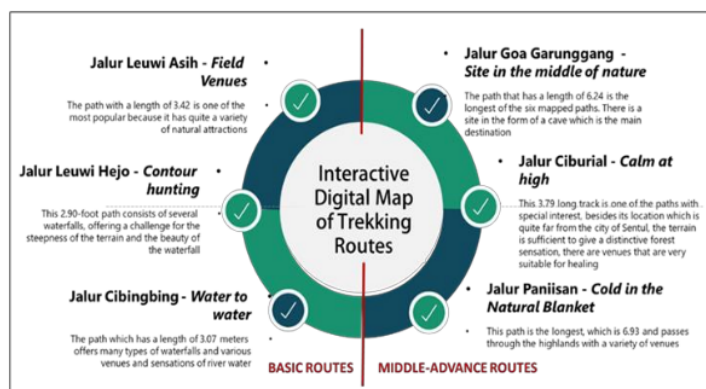


Figure 2: Selected Routes along with Characters and Themes

At the data visualization stage in the form of coordinate points obtained from each location and database, then the map layout process is carried out by displaying each tourist location point that forms a Route on the map to show the position of the tourist location on the map so that users, both tour managers, tour guides tourists and other communities can easily identify existing tourist sites. Route and spot mapping is carried out by means of a toponymy survey using Android software to take X and Y

coordinates on the field, then they will be included on the map. The coordinate points that have been taken are then entered into ArcGIS and then digitized into the base map to obtain correction values, and as a reference for making further decisions in making map applications. The following table (Table 1) shows the results of a Toponymy survey with a Mobile Topographer in the field with a sample on one of the trekking routes, namely the Curug Ciburial Route.

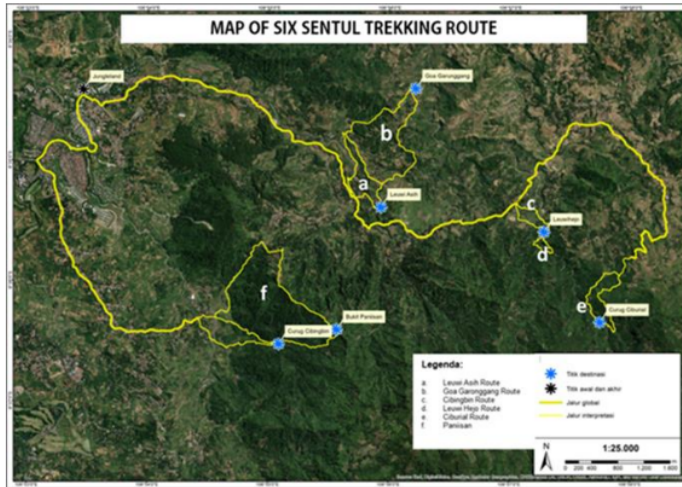


Figure 3: Six Priority Trekking Routes for Making Interactive Digital Maps

Table 1: The results of a Toponymy survey with a Mobile Topographer of Curug Ciburial Route

Kode	Kode GPS	Judul interpretasi	Elevasi	Koordinat X	Koordinat Y
A.1	17	Starting point	781	106° 58' 0,066" E	6° 35' 47,494" S
A.2	18	T-junction	771	106° 57' 54,554" E	6° 35' 56,612" S
A.3	19	View of Mount Puta	759	106° 57' 48,938" E	6° 35' 55,781" S
A.4	20	T-junction	766	106° 57' 45,425" E	6° 35' 58,610" S
A.5	21	View of Cisadon Hill	737	106° 57' 39,946" E	6° 36' 4,392" S
A.6	23	Ciherang River	684	106° 57' 40,255" E	6° 36' 14,472" S
A.7	24	Curug Lesung	687	106° 57' 41,188" E	6° 36' 16,283" S
A.8	25	Curug Ciburial	702	106° 57' 44,752" E	6° 36' 20,002" S
A.9	26	Curug Kembar	725	106° 57' 48,884" E	6° 36' 21,946" S
A.10	27	Rest Area	757	106° 57' 50,990" E	6° 36' 24,466" S
A.11	28	Curug Hordeng	761	106° 57' 52,092" E	6° 36' 24,433" S
A.12	29	Photo Spot	801	106° 57' 50,152" E	6° 36' 18,961" S
A.13	30	Photo Spot	832	106° 57' 43,715" E	6° 36' 7,085" S
A.14	31	Photo Spot	828	106° 57' 43,898" E	6° 36' 5,803" S
A.15	32	T-junction	804	106° 57' 45,986" E	6° 36' 3,874" S
A.16	33	Bamboo Forest	788	106° 57' 49,939" E	6° 36' 4,072" S
A.17	34	Endpoint	796	106° 57' 59,522" E	6° 35' 47,778" S

The results of the Routemapping consist of 4 types of maps (Figure 4). The map is very useful for tourism managers, namely PT. Cakar Langit Indonesia as material to provide information to tourists and trekking tour guides. Routes that have so far only been presented in the form of narratives, this map can provide more precise and accurate visual information. Travelers will get a complete spatial, so they can estimate all the risks of the trip.

1. 2D map. Maps which are often called flat maps or planimetric maps are flat and made on a flat surface such as cloth, paper or other media. However, in this case, the resulting map is a two-dimensional map that is produced digitally as a result of

processing with GIS. This map depicts Routes and tourist destination spots that can only be seen in two dimensions without visible contours.

2. 3D map. This map is described or created by adopting the applicable provisions of objects in three dimensions. Existing information is displayed in a three-dimensional form and in accordance with the real conditions and circumstances of the place and location. This 3-dimensional map will be very useful for tourists and trekking activity guides in providing a complete spatial Figure 4.



Figure 4: D Interactive Map

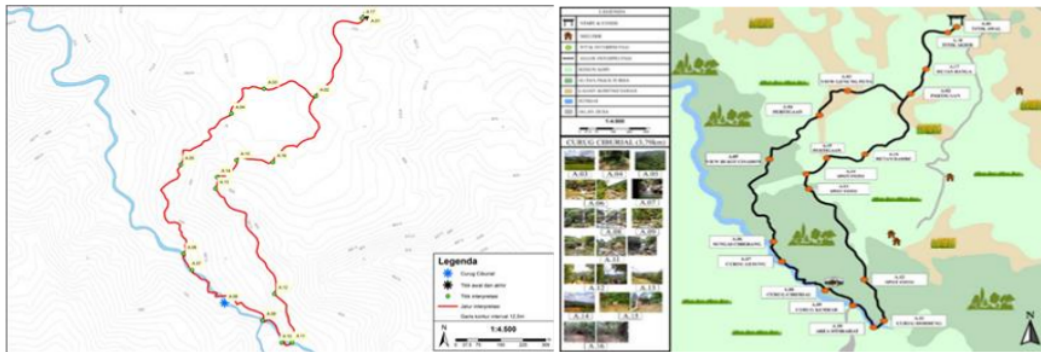


Figure 5: D Interactive Map

3. Contour map. Contour map as a type of map that produces imaginary lines on an area or area on the map that connects and shows several points on the map that have the same height. Contour lines are known as tranches, elevation lines, or horizontal elevation lines. This line then shows the movement or development of the ups and downs of a soil condition. These contour lines certainly function to show the condition of the trekking route with the ups and downs of the ground surface or the topography of the area. The contour line will be a marker of elevation or elevation angle at spots on the trekking Route, a marker for whether or not the relief is in accordance with its original shape, a marker for whether there is a slope on the track, a marker for the slope angle of a slope on the track, a marker for calculating area and the volume of a dam,

determines the Route canal that has a certain angle of inclination and determines whether or not there are two points on the land that have the same height and are visible to each other.

4. Interactive Maps designed to build on websites. Space for ordinary users to be able to understand the map more easily, with a fairly attractive interface. Ordinary users' interest in using interactive maps to describe spatial data of an area has made the competition for mapping software manufacturers more competitive, so that the functions of the maps themselves have become more developed in line with the rapid development of technology. Interactive maps are the development of digital maps.



4.2 Interactive Map Development on the Website

Website development is the process of creating and building websites, starting from designing the user interface to the programming of the website's functionality. Website development involves several stages, including: 1) Planning: This involves determining the purpose of the website, the target audience, and the features and functionalities required; 2) Design: This involves creating the layout and visual elements of the website, including the color scheme, graphics, and typography; 3)

Content creation: This involves developing and creating the website's content, such as text, images, and videos; 4) Development: This involves programming the website's functionality and features, such as database integration, forms, and e-commerce capabilities; 5) Testing: This involves testing the website's performance, usability, and functionality to ensure that it works properly; 6) Launch: This involves deploying the website to the live server and making it available to the public; 7) Maintenance: This involves updating and maintaining the website to ensure that it remains functional, secure, and up-to-date with the latest technology and trends. Website development can be done using various programming languages and platforms, including HTML, CSS, JavaScript, PHP, and content management systems like WordPress, Drupal, and Joomla.

The trekking tourism website where you can build interactive digital maps can be seen at the link <https://www.cakarlangitindonesia.co.id/>. On the

website there are menu options Home, Location Options, Sentul Canyoning, Caving, Camping, About Us and the Hiking & Trekking menu which will build an interactive digital map (Figure 5).

On the Hiking & Trekking menu there is information about several choices of trekking tour packages consisting of Basic, Middle and Advance Packages. In the package's selection menu, the digital map is included. Tourists who want to choose a package will be given information in the form of an interactive digital map that contains Routes, spot points and photos of destination descriptions (Figure 6).

4.3 Development of One Stop Sentul Tourism (OSST) Based Tourist Route

Tourism cannot continue if various innovations are not carried out. The innovation of making interactive digital maps is not enough to guarantee its continuation. Therefore, it is necessary to find a solution on how the map can be developed. An interactive digital map of Sentul-Bogor trekking tourism destinations can help promote the area and encourage visitors to explore all that it has to offer. The map can be used as part of a larger initiative to create a One Stop Sentul Tourism (OSST) portal that provides information on all the area's tourism offerings. The Routes on the visualized map only provide information about natural destinations, such as waterfalls, rice fields, hills, hot springs and so on. In fact, there is still a lot of potential that can be explored in order to enrich the destination. Local communities can become new objects and attractions to enrich

trekking routes. Tourist attraction from the community in the form of local products or village activities can be developed, such as serving welcome drinks from local coffee, rice planting activities with local farmers, learning to breed and milk cows and so on.

Tourism support facilities in the form of transportation and accommodation from local communities can also be empowered to support trekking tourism. Local transportation in the form of pick-ups or motorcycle taxis can help on routes that cannot be traversed by private

vehicles. Home stays owned by the community can also be promoted for trekking tourists who want to stay overnight and enjoy the village atmosphere. These tourism support facilities originating from the local community need to be integrated into an application called One Stop Sentul Tourism (OSST). This application can later serve various information as well as reservations and transactions for tourists who want to use trekking tour services. In the end, local people are not only spectators, but can also experience greater benefits from trekking tourism activities (Figure 7).

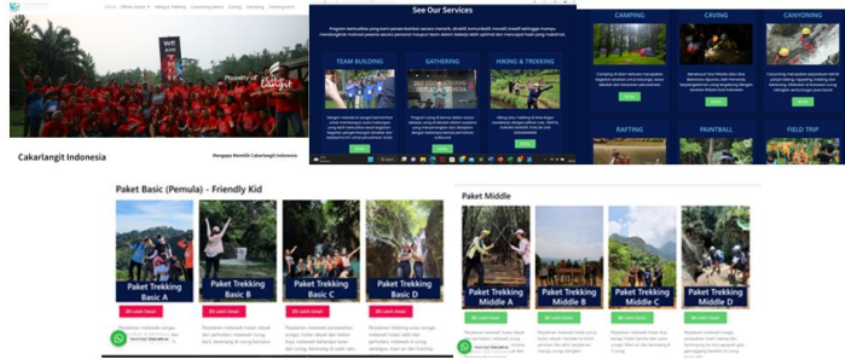


Figure 6: Tourism Website and Service PT. Cakar Langit Indonesia

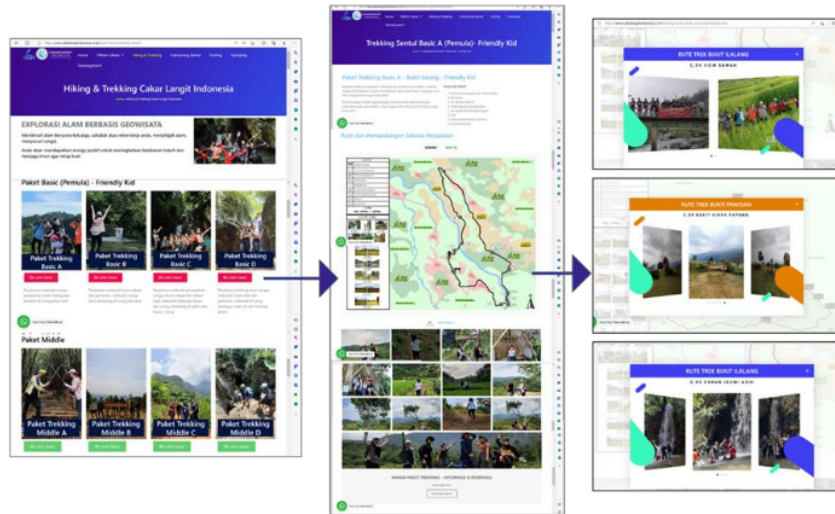


Figure 7: Interactive Digital Map in the Website



Figure 8: OSST-based tourism development

5. CONCLUSION

Interactive digital maps on trekking tours Sentul, Bogor are prioritized on the most popular and visited routes. The mapped Route is divided into 2 levels, namely basic and middle with each character. The resulting digital maps consist of 4 types, namely 2-dimensional maps, 3-dimensional maps, contour maps and interactive maps which will be included in the tourism management website, namely PT. Cakar Langit Indonesia. It is hoped that these maps can be utilized by tourists either individually, in groups or as corporations as spatial information to be considered before making a trekking trip. This Interactive Digital Map is recommended as a basis for the development of further trekking tourism services towards one-stop integrated services with a local community empowerment approach.

LIMITATION AND FURTHER RESEARCH

This interactive digital map only limits the area to 6 selected Routes with a geographic information system based mapping method. The interactive digital map is also only presented on the website owned by the tourism manager. It is hoped that in the future, this interactive digital map can be developed with more advanced and up-to-date technology according to the needs of the community.

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