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Development of a Web Mapping System for Tourism Attractive Places in Bintulu, Sarawak

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Abstract. Tourism is one of the main sectors that has hugely contributed to Bintulu's economy by generating income from locals and foreign tourists that come to Bintulu for vacations. The rapid growth of digital technology has been affecting the tourism sector by making it easier for tourists to gain information about tourist attractions by computer or smartphone. This study was conducted to implement the knowledge and techniques from GIS and cartographic techniques to develop an electronic mapping system of tourism information in Bintulu. This proposed system was produced to support the usage of the Windows operating system for computers or laptops and the Android operating system that is compatible with the smartphone. This system maps system offered navigation functions in helping route users to locations or destinations. Developing a tourism information mapping system could help increase the integrity and accuracy of the data, especially the locations of the attraction places. Selected respondents have also satisfied with the functions proposed in the system.
Keywords: Attractive places, Bintulu Sarawak, GIS, tourism, web mapping, information management.

1 Introduction

Tourism is one of the major industries that has significantly contributed to Malaysia's economic growth. According to Bernama (2017), tourism is Malaysia's third-largest source of income behind manufacturing and palm oil. Tourism has been among the first to make the most of new technologies and innovations. New technologies have significantly impacted the overall tourism sector and, more specifically, tourist destinations, promoting themselves and reaching out to potential visitors (Argyropoulou et al. 2011). Traveling for tourism typically involves going somewhere the tourist does not normally

actually live or work (Richmond & Keller, 2003). Tourism activity is traveling and staying in places outside for no more than 12 years for leisure, business, or other purposes.

As reported by the Bintulu Development Authority (2018), many tourist destinations in Bintulu are unknown outside the town. Bintulu is known as a place for 'making a living. Although it is not the leading tourist destination in Sarawak, the local authorities such as Sarawak Tourism Board and Bintulu Development Authority are now making a lot of efforts to make Bintulu tourist heaven. Ismawi Ishak (2021), as the Chairman of the Board stated that Bintulu is in the progress of developing the tourist industry by developing a lot of programs and events to attract tourists. This situation led to the COVID-19 pandemic, the tourism industry was growing but saw a decline when the deadly virus spread worldwide. Therefore, as a pioneer, we see the need for the Bintulu tourism industry to be revived and mobilized with the joint efforts of all parties, agencies, and the private sector.

The attractive places in Bintulu are sometimes found in a rural areas with the beauty of flora and fauna. Bintulu has various attractions: building attractions, natural attractions, events, and heritage attractions. With a mapping system, tourism quickly gets online mapping without spending too much to buy. Tourists can explore the place that they have not been to yet. Besides, tourists can go to the place by themself without help from others by using this web mapping system. Nowadays, almost everyone uses a smartphone to discover attractive places, especially tourists. The development of more informative and stiller interactive web-based mapping tourism information can benefit from the results of this study.

Maps play a vital role in acquiring spatial information about travel destinations because travelers have limited spatial knowledge of the visited environment. Maps are generally recognized as the best components used throughout the complete tourism experience, from pre-holiday trip planning to the actual vacation to post-trip analysis and holiday recollection (Richmond & Keller, 2003). Since most of the data associated with tourism are spatial data, GIS technology appears as an innovative approach that tourist destinations can use. It became an excellent component for travel and tourism due to its capacity to analyze and show spatial and non-spatial data as interactive maps (Markos, 2012).

Additionally, GIS is combined with a few other technologies, including the internet, virtual reality, and multimedia, to give alternative levels of usefulness and accessibility (Drummond and French, 2008). Web GIS has become a well-liked method of data sharing and visualization as Web technologies and GIS have grown significantly and are widely used (Tan, 2003). The creating, implementing, generating, and presenting maps on the World Wide Web by combining the benefits of both GIS and the Internet is known as web GIS (Markos, 2012).

Web-based GIS applications have recently become the first choice in promoting tourism in most countries (Markos, 2012). Companies hire these applications as a machine process to set up a high-performance web system for tourism attractions, services, and facilities to promote and serve the requirements and desires of its tourists. In order to create an attractive and involving website that also provides information about tourist destinations and activities, a well-developed design with screen maps is essential and must be created. This study has created a web-based system by hoping that it can in-

crease visitors' interest in what Bintulu has to offer in terms of the tourism sector. Therefore, the study aims to develop a GIS-based system to make it easier for tourists to find attractive places in Bintulu, Sarawak. The study's objectives are: i. to study the user requirement of the proposed system, ii. to develop the proposed system based on the user requirement, and iii. to evaluate the practicality of the proposed system based on the selected respondents.

2 Literature Review

2.1 Tourism Attraction Places in Bintulu Sarawak

Sarawak is in northeast Borneo Island and is the largest among 13 states in Malaysia. Bintulu is one of the divisions or cities in Sarawak. Bintulu is located 610 kilometers northeast of Kuching, 216 kilometers northeast Sibu, and 200 kilometers southwest of Miri. It covers 12,166.2 square kilometers and is the third largest division after Kapit and Miri. Geographically, the town is located halfway between Kota Kinabalu and Kuching. A great industrial center is Bintulu. The petroleum and natural gas sectors are the backbone of the economy. Bintulu is thought to have 85 percent of Sarawak's known natural gas reserves. A tourist attraction is a location of interest they want to visit, such as natural, historical, cultural, entertainment, healthy, adventure and sport. In Sarawak, many people consider attractions significant to the travel process. Tourist attractions provide activities and experiences at the destination and a way to track the signs of tourism consumption. They are frequently the reason for traveling to a specific location. (Richards, 2002).

Tourism is defined as the short-term, temporary movement of people to places other than their usual places of residence, employment, and related activities. Tourism is an industry that significantly impacts a country's economy and social environment since it helps develop other industries. It includes activities, facilities, industry, and facilities that provide a travel experience such as eating, drinking establishment, entertainment, historical and cultural events, shopping, and other activities services accessible to visitors who are away from home (Fadahunsi, 2011). There are two types of tourism: international and domestic, based on the visit's purpose. International tourism occurs when the tourist visits another country, which will be called international tourism. Domestic travel refers to a person who travels domestically and is doing so within their own country. Since no official travel documents or immediate procedures, such as required health checks and foreign exchange, are required, domestic travel is straightforward.

Tourism may be divided into some categories based on the reason for travel. Cultural tourism satisfies cultural interests by including trips to ancient monuments and historical or religious sites. Sport or adventure is trips taken by tourists with a view to hiking and driving off-road and others. Recreational tourism takes a tourist from everyday life routines such as spending time at the river, hills, and sea beaches. Convention Tourism is referred to people that travel within a country or overseas related to their business, interest, or profession. Health Tourists travel for medical treatment and visit locations with curative potentials, such as spa yoga, hot spring, and others (Niekerk Solms, 2010).

2.2 Development of Web Mapping System and Web-Based for Tourism

Tourism usually must know all the places they want to visit, but sometimes they have limited spatial knowledge and the vital thing is to map a guide there to the travel destination. Maps play an essential part in how we find, understand, and communicate information about the world around us, which helps to highlight the attraction of tourist locations. Maps are valuable components for understanding spatial information and developing images of space and location. Besides, the best service in the tourism business and the tourist map must be created. Tourists map importance that allows all tourists to find the attraction place. Tourist maps are well-known for their importance in identifying and finding tourist attractions and their importance in effectively and adequately managing tourism resources.

In line with the International Cartographic Association (2021), mapping is related to cartography, which is the study that examines, creates, and distributes maps. Another aspect of cartography is map representation, which means that mapping itself is a type of cartography. The development of a web mapping system divides into two maps which are static and dynamic maps. Static maps are typically view-only maps made only once and are frequently manual. Typically, the maps are static images with no interactivity. In contrast, dynamic maps occur when a web page is browsed, and dynamic maps are generated and sent on demand, allowing for the display of real-time information such as current weather conditions, traffic conditions, or election results. These maps are essential for the development web mapping system as conducted by local researchers in Malaysia (Abdul Basir & Abdul Rasam, 2019; Abdul Halim & Abdul Rasam, 2021)

Web mapping is known as online mapping. Web-based mapping is creating and offering maps on the World Wide Web so that users can browse and search for spatial data, such as locations and routes. Web-based mapping was used for this study to identify tourist destinations. Due to the news in technology, cartography was costly and only available to a select few businesses and institutions. However, with fast internet connections and advanced web development techniques, geographical data can now be provided and transferred across the internet at a low cost, allowing anyone to integrate and display a map on a website. (Näslund, 2007). Web mapping has been practically used worldwide in many fields (Omar et al., 2021; Rasam et al., 2021; Othman et al., 2020) especially in promoting a tourism hotspots in particular areas (Halim et al., 2018; Mohd Hasmizi et al., 2020; Sha'aban, 2021).

The waterfall model system development life cycle (SDLC) is the waterfall method used for system development. SDLC model is a traditional model used in the life cycle of a system to be developed linearly and sequentially (Afnarius et al., 2020) because the model develops transitions from one state to the next in a downward motion, it is known as a waterfall model. The output of one phase is used as the input for the following phase in this model, which is broken up into different phases. There is no overlap between phases, and each phase must be finished before the next one begins. This study uses SDLC which is the waterfall method. This development includes analysis, design, code, and test. In the end, this study evaluates the proposed system's practicality based on the selected respondents.

3 Methodology

This study used SDLC, a waterfall model for creating a web mapping system for tourism through 4 key phases. As represented in Figure 1. A preliminary study was conducted to cover the initial section of this destination. The preliminary study at this stage includes choosing a variety of comfortable equipment and software to process the existing free cartographic data and study area. The Bintulu Division of Sarawak, Malaysia, is the location of the study area. Geographically, the town lies halfway between Kota Kinabalu and Kuching. An important industrial centre is Bintulu. There are many websites for attractive places in Bintulu. These websites would help users better understand how they work and how they can benefit from them.

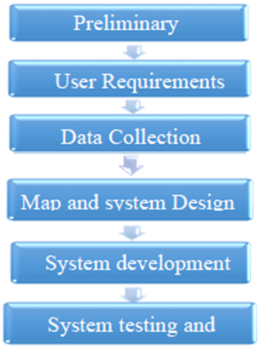

Figure 1: Study's Flowchart

Based on previous studies of the Bintulu Tourism web system, many factors have been focused on this research, including website design, especially the homepage design, the types of tourism listed on the website pages, button functions, text, tourism maps, and multimedia elements. The multimedia components consists of text, graphics, a gallery, and video. Thus, it was determined whether these components are present in the websites or not. Most of these websites use Google Maps to display the locations of attractive places. Because they only display a location's location using existing Google Map symbols, these maps lack creativity.

The website map interactivity analysis that available interactive element used on that tourism information. The three main components of a helpful map are zoom, pan, and review usually present on websites. These three components are basic features that give website tourists an excellent user experience. The cartographic components of the existing tourism websites. The title, legend, north arrow, scale, and symbology of the map are the five elements that would go into determining whether a map is accurate. The "symbols" marks on the table indicated that the element was part of the map on that website. Where blank space indicates that there are no elements on the map. Overall, it could be said that the element of spatial and cartography are not entirely implemented in the existing systems.

Users' requirement was the first objective of this study which is to study the user requirements of tourism in Bintulu. This step was conducted with 40 students as main respondents from January 2022 to June 2022. This step was essential to know the vital

information about this study. The research provided a questionnaire for the respondent. A questionnaire is a research tool that involves a summary of investigations to obtain data from a respondent. This questionnaire contained and divided into four sections which are section A (Respondents Background), section B (Tourism information system that has been used in Bintulu), and section c (Respondent opinions on tourism system). For data collection, the Primary method is using questioner about user requirements of tourism in Bintulu and testing the proper system based on selected respondents, while the secondary method is about the place attractive in Bintulu. The secondary data from google sources of the thematic info, such as Bintulu's restaurant destinations, were also obtained to design the system.

Storyboard Design of the web designing process was created for system design and development, including the navigation design, interaction control, and screen events. The design of the storyboard was also based on the survey's results, representing the respondents' opinions. The importance of the storyboard design that took the respondents' ideas on board can be seen in its contribution to developing a system that can optimize the user experience and satisfy users with system performance. The system design allowed users to interact with web mapping by controlling the web with zoom and drag (pan) and searching in the browser. The first step in the creation system was to prepare the storyboard design and follow to do the map design.

Figure 2 illustrates the home page layout, including the home buttons, introduction, tourist attractions, engaging, and contact us. These storyboards were created using the AutoCAD 2018 software. It was essential to organize the tourism category before beginning the map-design process.There are six different types of tourism data. To design the symbols for these various tourist attractions and activities, they must be assigned based on their categories of characteristics. ArcMap Windows software was used to create the map before export to Adobe Illustration 2022. The points that represent the place of tourism attraction. There were six categories of tourism and 30 places of tourism attraction in Bintulu. GIS software such as ArcMap to produce the map on tourism in Bintulu. Before starting design, the map proposed categories such as beach, culture and heritages, flea market, food, hiking and jogging, and nature and adventure.

Figure 2: Storyboard Design of Home Page

In system development, the hub ArcGIS was utilised properly. The system becomes more interesting when a multimedia element is included, such as zoom and drag (pan), attach video, gallery, and video (Figure 3).

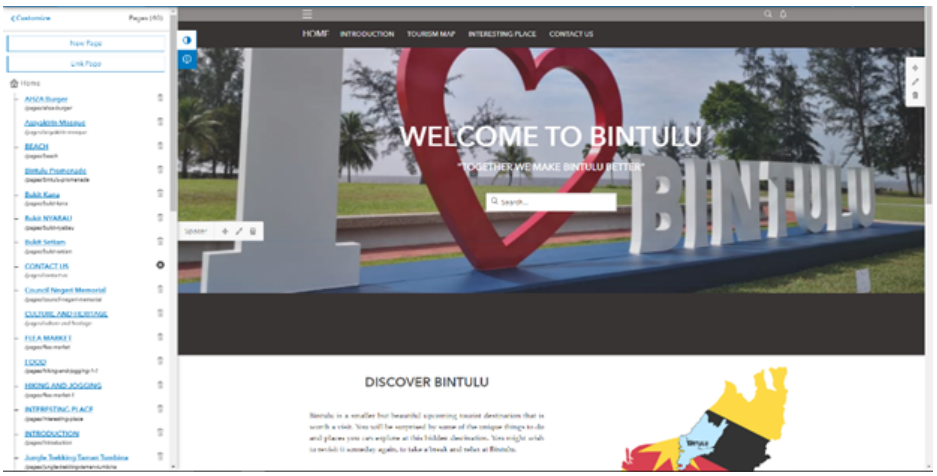

Figure 3: System Using Hub ArcGIS

In system testing and evaluation, the prototype needs to test the web mapping system for attractive tourism places and the system works correctly and smoothly. This test by the respondent through the questioner. The respondent was to test the proper system based on several aspects. The opinion and comments from respondents were recorded for future improvements. The questionnaire also used to test the practicality of the web-based system for tourism attractive places in Bintulu, Sarawak. There were two sections: Section A Respondents Background, and section B Respondents Satisfaction Level.

4 Result and Discussion

4.1 The Users Requirements for the Proposed System

The section is conducted to apply to the user requirement and develop the system according to user requirements. This system was created using a design approach in which user needs were determined through the distribution of questionnaires. A question has been constructed: the tourism website users, the user evaluates the tourism information system, and users' opinions on the proposed system. The respondent to the questionnaires was 39.7% for males and females, 60.3%, where teenagers and young adults (18-34 years old) comprise most users (83%) of the tourism information system.

Based on the user evaluation of the existing tourism information system, 92.1% of respondents have been to Bintulu, and some have used the journey guidance given by a system and website. Figure 4 displays the identified website names used to find tourist industry information. Users used four websites: TripAdvisor, Sarawak Tourism, Google, and Bintulu Development Authority. Most respondents stated that they frequently use Sarawak Tourism to get tourism information. Sarawak tourism information is usually provided in detail about Bintulu.

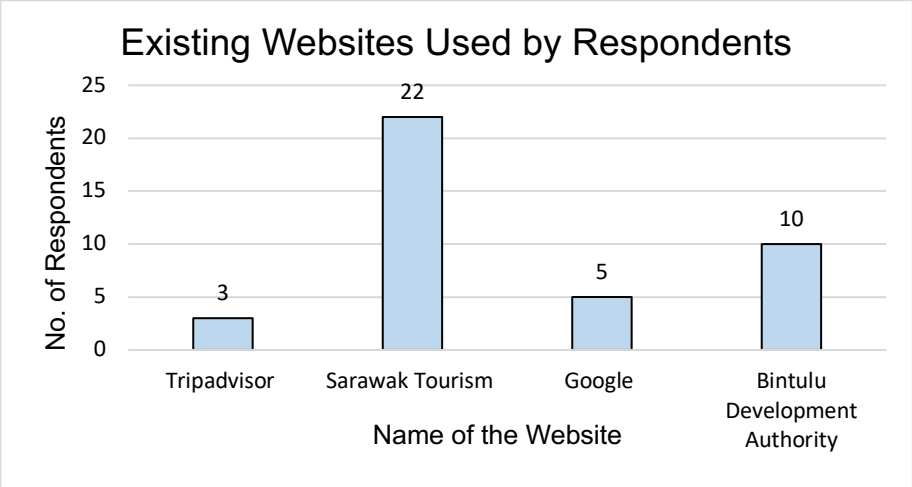

Figure 4: Existing Websites Used by Respondents

The evaluation of the respondent's previously used tourism information system is shown in Figure 5. There are five scales for this questionnaire which are wrong, poor, medium, sound, and excellent. The evaluation focuses on six aspects: map, user-friendly, interactivity, complete information, interesting multimedia element, easy to understand and enjoyable map, and others.

The first one is a map, 24 of the respondents said that the map is poor. Second, user-friendly 22 respondents said that their systems are not entirely friendly. Most respondents choose poor evaluation aspects of complete information, interesting multimedia elements, easy-to-understand and fascinating maps, and others that follow the medium for the scale. Other suggested contents by the respondents are shown in Figure 4. From this questionnaire, the previous system needs to improve because respondents mentioned that the map is difficult to understand or is entirely missing.

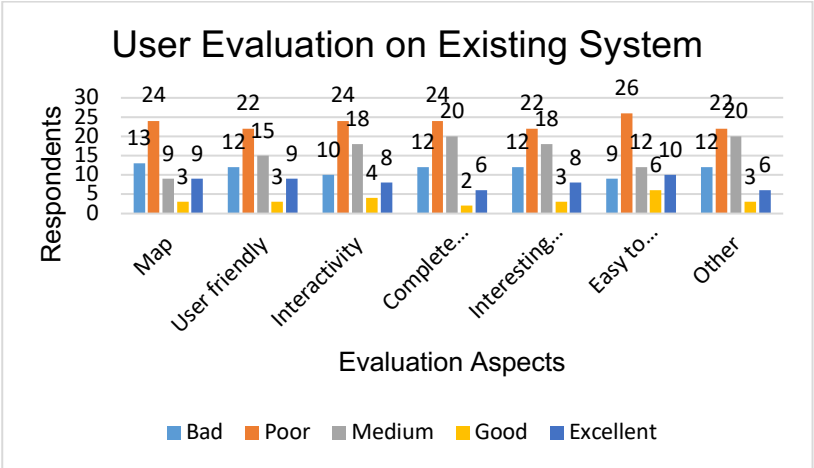

Figure 5: User Evaluation of Existing System

Therefore, based on the users' opinions on the proposed system, they agreed to develop a new system or improve the existing system by considering certain elements of a good tourism website. Figure 6 shows the user suggestion system for the development of a new system. The aspect of evaluation are speed, easy to use, interactivity and others. Most respondents are easy to use the system with 90.5% votes. Then, it is followed by the aspect speed which is 49.2% of respondents. Nowadays, the internet in every place has improved a lot. 46.0% of respondents. In terms of making the tourism information system more attractive and truly describing the information in a new system, said interactive should be included.

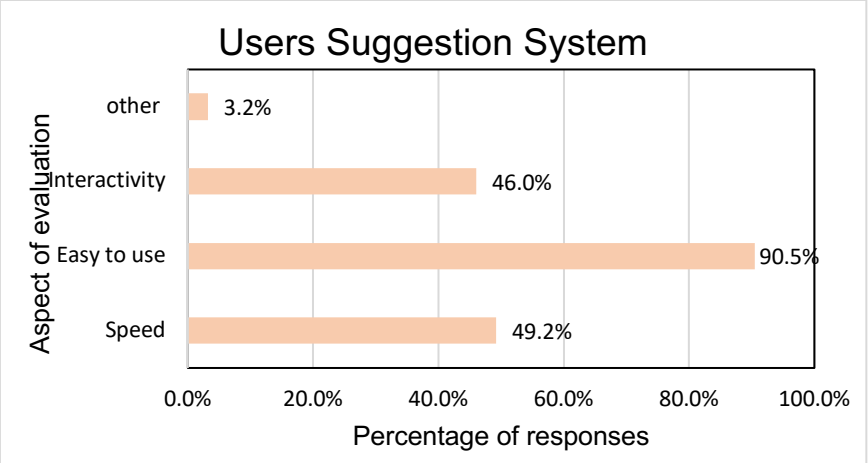

Figure 6: Criteria required to ensure that the system of tourism is effective for users

Additionally, the users are questioned regarding the suggested system functionality. The new system that will be developed will need ideas from respondents and the required content. Figure 7 demonstrates the number of content users suggest must be added to the new system. Food, nature, adventure, culture, and heritage are the four tourist destinations that respondents who answered more than 40 questions suggested. Most respondents suggested content is food then followed by nature. The respondents' feedback showed that the requested food, nature, adventure, culture and heritage are highly suggested in this system.

The information security perspective developed in this article reported issues involving corporate information sources, the needs of information users for corporate users, and the corporate guidelines that permeate the entire life of the organization. The variables involved in creating a safe behaviour for the information user and information security from the point of view of human resource management were briefly described. Thus, it was concluded that the importance of education and organizational learning in information security issues is fundamental. While information technology departments drive many information security initiatives, the real reasons for the failures continue to pervade the entire organization. People are everywhere, whether as users or as developers of information systems. It is up to them to watch out for organizational policies and guidelines designed to maintain security. It is up to the organization and its management to make such policies and guidelines known and value their adoption.

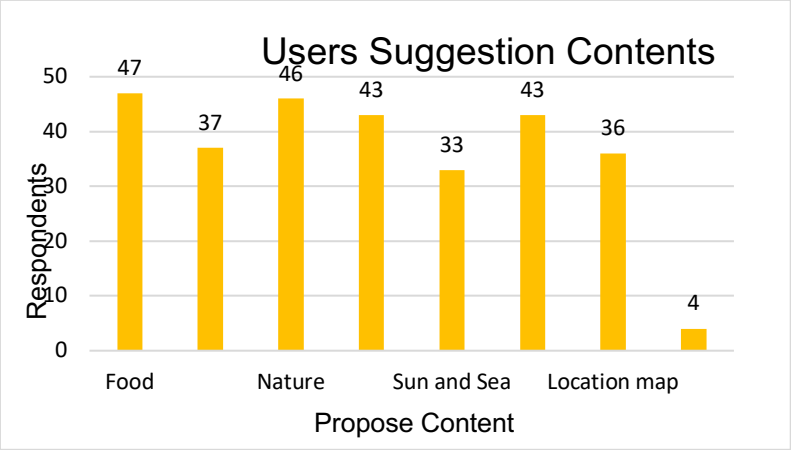

Figure 7: Users' Suggestions on the Tourism Information System Contents.

4.2 System Modules: Features and Functions

The flowchart of the system's modules and contents, created by considering the results of questionnaires asking users about their needs, is shown in Figure 8.

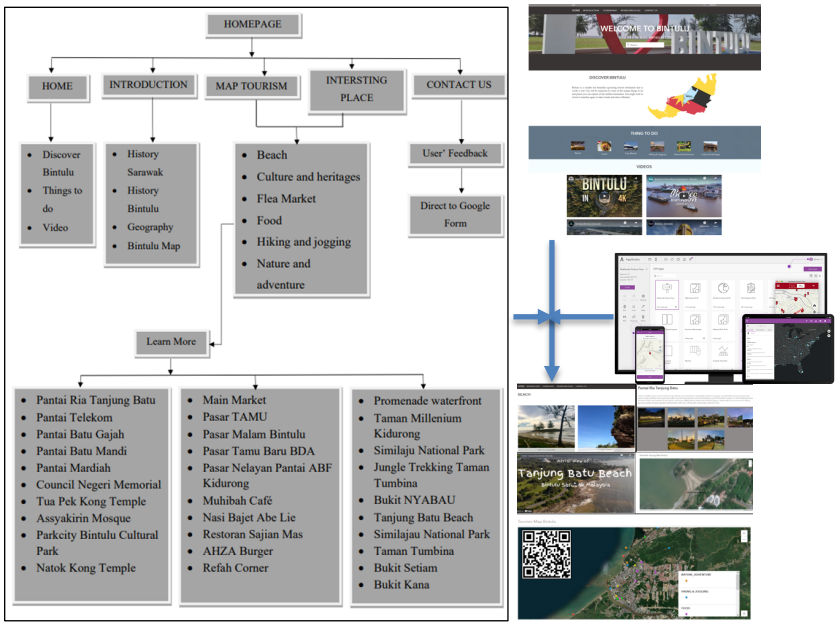

Figure 8: The System Modules Using ArcGIS AppStudio

This module contains general information and lists Bintulu's tourist attractions according to different tourism subsections. This exciting place module combines all six

tourism categories and 29 locations on one map. The subpage for Beach can be accessed by clicking the word by category, which will take users to the next page with more information. The map tourism map on the main page INTERESTING PLACE differs from the main page TOURISM MAP because this map combines all the places in one map with several main applications such as zooming, viewing, and a unique symbol representing a button. The last module is the button that contacts us linked to a google form. The responses will automatically store in Google form. This is the link and QR code system developed using ArcGIS Hub online. This makes tourist link to the system by using this QR code system. The link system is https://arcg.is/05XCX80.

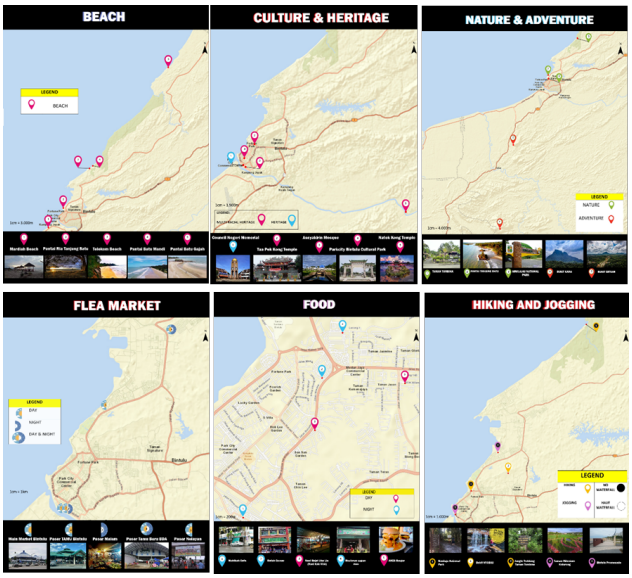

Figure 9: Types of Tourism Map in the System

4.3 System Testing and Evaluation

System testing is the last phase of the development of the Bintulu tourism information system to ensure that this project's three objectives are fully achieved based on the user's requirement, system testing and evaluation should be done with 5 Likert scales (Figure 10). All elements are being tested, including screen representation and presentation, GIS components, maps, travel data, interactivity, and multimedia components. The respondents are randomly chosen around Bintulu and others and 26 relevant returns are included in the evaluation. Most responses to system testing education background diploma, bachelor's degree, and masters. Besides, to identify and understand the profiles of the respondents, background information questions on their gender, city, working status and education background.

The system's first question to respondents is simple to use, and 17 respondents strongly agreed (5) that this system is simple to use and straightforward and simple to understand. At the same time, people agreed (4) this system functions. Regarding the element's attractive place in this system, 25 respondents agreed that (5 and 4) there are attractive places in Bintulu. The responses suggested the attractive places in Bintulu

such as beaches, adventure, nature, and others need to include as well. Similar to the result found in other function recommendations in the system, more than 90% of respondents agreed with the function in including the system having an excellent level of interactivity / can access to information. The system can be used in smartphones that quickly respond to the website. The system has also completed information and cartographic elements such as title, arrow, scale, and legends. There are six different tourism categories: beach, culture and heritage, flea market, food, hiking and jogging, and nature and adventure. Besides, every map consists of four or five places on one map. The map legend interface contains the detail on each meaning of the symbol base on the type. The multimedia components for that system are also completed which can help increase the users' attraction.

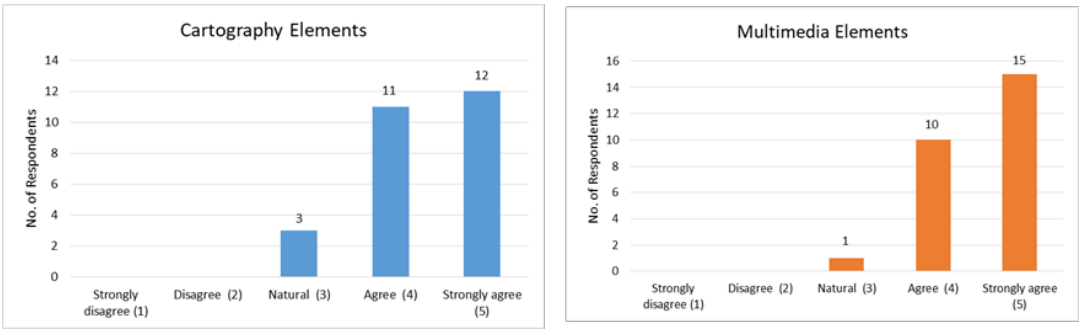

Figure 10: Evaluation of the proposed System on Cartography Multimedia Elements

5 Conclusion

This study has demonstrated the importance of developing the Bintulu tourism mapping and information system using cartographyor mapping tools such as Adobe Illustrator and ArcMap, WiX and ArcGIS Online. The critical finding from user requirements has shown that the respondents agreed with the development of this proposed system in the Bintulu, Sarawak. This system has several function modules that have been developed to provide users with spatial information that they can use to plan their vacations or holidays in the district. About 29 exciting places and activities in Bintulu are covered in detail in this system. 29 interesting places and activities are also covered in the system with the six categories for the tourism maps. The categories include beach, culture and heritage, flea market, food, hiking and jogging, and nature and adventure. This dynamic developed mapping system has much potential to be applied at other places in Sarawak. However, other more attractive places need to be considered in the future system. This mapping platform could assist the state of Sarawak in promoting its exciting places and activities as the leading tourist destination in Malaysia and World in parallel with the state's tourism theme "More to discover".

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