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# Development of E-Tourism System for the Bangka Islands Using the Extreme Programming Method Towards Digital Tourism

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**ABSTRACT**

Regional tourism often faces obstacles in providing fast, accurate, and easily accessible destination information to tourists. Many regions lack a digital platform capable of presenting information in an integrated manner, making it difficult for tourists to obtain an overview of tourist attractions, supporting facilities, and travel routes. This information accessibility problem affects the efficiency of tourism promotion and results in suboptimal implementation of digital transformation concepts. This study aims to develop and evaluate a E- Tourism application to improve the accessibility of tourism destination information and support digital transformation in the regional tourism sector. The system development was carried out using the Extreme Programming (XP) approach to ensure a fast iterative process, flexibility to respond to changing user needs, and software quality improvement in each testing cycle. Usability evaluation was conducted using the System Usability Scale (SUS) method involving 70 general user respondents. The test results show that the application obtained a SUS score of 75.74 in the acceptable category, indicating that the application is easy to use, clear, and aligned with tourism information needs.



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## 1. INTRODUCTION

Tourism is one of the development sectors that is currently the focus of the goverment because it plays an important role in supporting the national economy [1]. This sector not only contributes to increasing regional and national income, but also serves as a means of introducing Indonesia's natural wealth, culture, and local wisdom to the world [2,3]. Tourism provides opportunities for visitors to explore destinations and engage in various activities during their leisure time and vacations [4], offering them enjoyable and interesting experiences. Such tourism activities enhance visitor satisfaction and well-being [5]. As awareness of the enormous potential of tourism grows, the government continues to strive to deliver innovations to improve the quality of services and tourist experiences, one of which is through the use of digital technology. The rapid development of information and communication technology (ICT) in the last decade has brought about major changes in various fields, including tourism. This digital transformation not only makes it easier for tourists to find and access information, but also

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changes the way they interact with destination managers and local governments in enjoying a smarter and more connected travel experience.

Alongside digital transformation development, the concept of smart tourism plays an important role in the development of smart cities. Both share the same vision: to utilize advances in information and communication technology to improve the efficiency of public services, including tourism services. Information and communication technology are an important factor in establishing a smart city. As for tourism, information and communication technology currently plays a fundamental role in many services such as transportation, cultural activities, and entertainment.

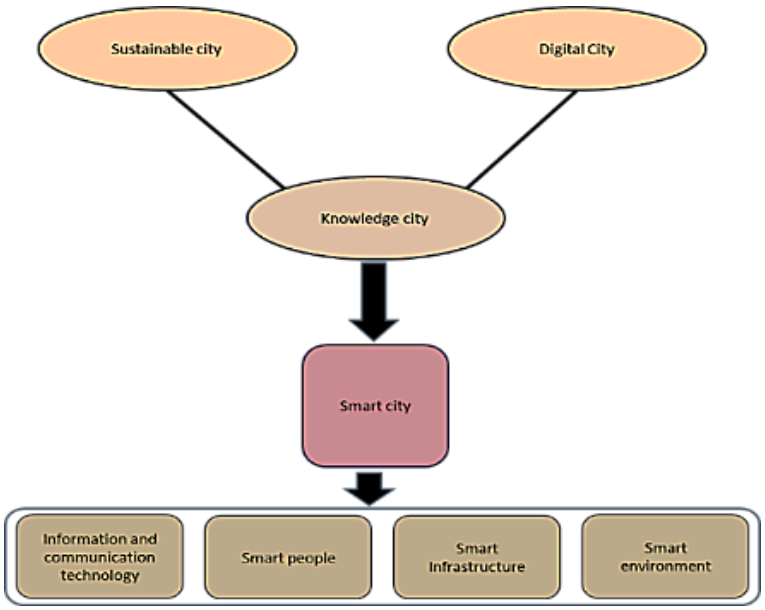


**Figure 1.**The relationship between smart cities and smart tourism [6]

Figure 1 illustrates the relationship between smart cities and smart tourism. Within the context of Smart Cities, Smart Tourism can be seen as a sectoral implementation of the Smart City concept. Smart Tourism uses the means of ICT, digital platform, and data analytics and combines them with smart/integrated infrastructure to enhance tourism services, improve visitor experience, and facilitate the management of tourism destinations. According to "2050—TOMORROW'S TOURISM" by Yeoman and Yu, technological advancements allow tourists to obtain information about tourism more quickly, precisely, and conveniently. This information can be acquired through a variety of user-friendly digital tools, exemplifying the key feature of the smart tourism concept: technology helps make the visitor experience more comfortable and practical [7]. The implementation of smart tourism also plays a role in increasing the competitiveness of destinations, strengthening regional tourism promotion, and encouraging the realization of sustainable tourism development. Therefore, the development of smart tourism-based applications is a strategic step toward realizing a smart tourism ecosystem that aligns with the vision of smart city development in Indonesia.

Bangka Island is part of Bangka Belitung Province, with the provincial capital, Pangkal Pinang, located on the island. The island is divided into four districts: West Bangka Regency, Central Bangka Regency, South Bangka Regency, and Bangka Regency [8]. Geographically, the Bangka Belitung Islands are bounded by the Bangka Strait to the west and the Karimata Strait to the east [8]. The Bangka Belitung Islands possess enormous potential and could become a promising destination for tourism development [9]. The region features beaches, natural attractions and religious tourism sites, making the Bangka Islands a promising destination for tourists. The strategic location of the Bangka Islands is already widely recognized by domestic and international tourists, providing numerous opportunities in the tourism sector. Beyond tourism, the economic and cultural development of local communities will also benefit positively [10] from the geographical location of the Bangka Belitung Islands, which offer interesting natural tourism potential, exotic beaches, and meaningful religious sites.

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While the use of information technology and the internet for tourism information dissemination is well-established in Indonesia, its adoption in Bangka Belitung remains limited among tourists. The use of internet technology for tourism promotion which facilitates tourist access to information anytime and anywhere. This concept, also known as E-Tourism can be utilized in developing information technology for the tourism industry, proving useful for promoting destinations, existing facilities, available accommodations, and transportation to tourist attractions [11]. Additionally, as digital services and data flows produced by online interactions allow for more intelligent, data-driven administration of visitor activities and destination operations, e-tourism is essential to the growth of smart tourism [12].

Currently, tourism promotion in Bangka Belitung has not fully embraced E-Tourism concepts. Tourists still frequently search for information on the internet from sources that may not be reliable, or they seek information through relatives or family members in Bangka Belitung to learn about natural tourist destinations, beach tourism, and religious tourism. At present, tourism promotion primarily relies on word-of-mouth recommendations and existing social media platforms. However, comprehensive tourist information covering all attractions in the Bangka Islands is not yet available. The analysis of the website owned by the Bangka Belitung Tourism Office reveals several obstacles in promoting tourist attractions, including incomplete information displays about destinations and facilities [13]. Route information to tourist attractions remains unclear, with the official website primarily featuring only photographs and basic descriptions. These limitations contribute to a relatively low level of tourist visits.

E-tourism platforms could be the primary tool for tourists in determining their destination choices [14]. With access to more specific information, tourists can search for attractions with greater confidence and satisfaction, while also viewing reviews from other tourists who have used e-tourism services. The presence of E-Tourism is expected to transform the Bangka Islands into a Digital Tourism Island. There are many software development methodologies for completing projects [15], one of which is the agile methodology. Agile methods are iterative and incremental, so user requirements are met by continuously providing partial and incomplete software. Any changes in client requirements can also be easily handled at each stage of development. These models have proven effective in dealing with constantly changing business environments. Agile methodologies have been gaining recognition in recent years due to their simplicity, flexibility, and suitability for today's software development needs [16]. The most widely used agile frameworks are Scrum and Extreme Programming.

Extreme Programming (XP) is one of the most influential Agile-based software development approaches, as it emphasizes an adaptive development process that focuses on quality and is responsive to changing requirements [17]. In [18], Extreme Programming emphasizes simplifying the development process by encouraging intensive communication between all team members and customers involved [19]. This direct collaboration enables the identification of solutions that are more accurate, efficient, and within budget. In addition, XP ensures rapid feedback through regular unit testing and integration testing, so that software quality can be monitored and continuously improved throughout the development process.

Researchers will develop Digital Tourism using the Extreme Programming development method. For tourists, this platform will provide essential information to help them determine which attractions to visit. This development is integral to information technology advancement and can serve as a primary application of IT in the tourism sector. The development of E-Tourism information technology using the Extreme Programming method is essential and necessary to serve as an effective tool for promoting natural attractions, beach tourism, and religious tourism in the Bangka Islands, thereby improving the availability and quality of tourism information. One form of E-tourism information technology utilization can be seen through website-based tourist platforms. Additionally, it can serve as an alternative medium to promote tourism widely through E-Tourism channels. The implementation of E-Tourism aims to enhance tourism sector development in the Bangka Islands. Fundamentally, the e-tourism concept represents one approach to applying information technology in the tourism industry. By utilizing E-tourism information technology, tourists can obtain comprehensive information on tourist destinations and receive personalized recommendations for their visits.

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## 2. RESEARCH METHOD

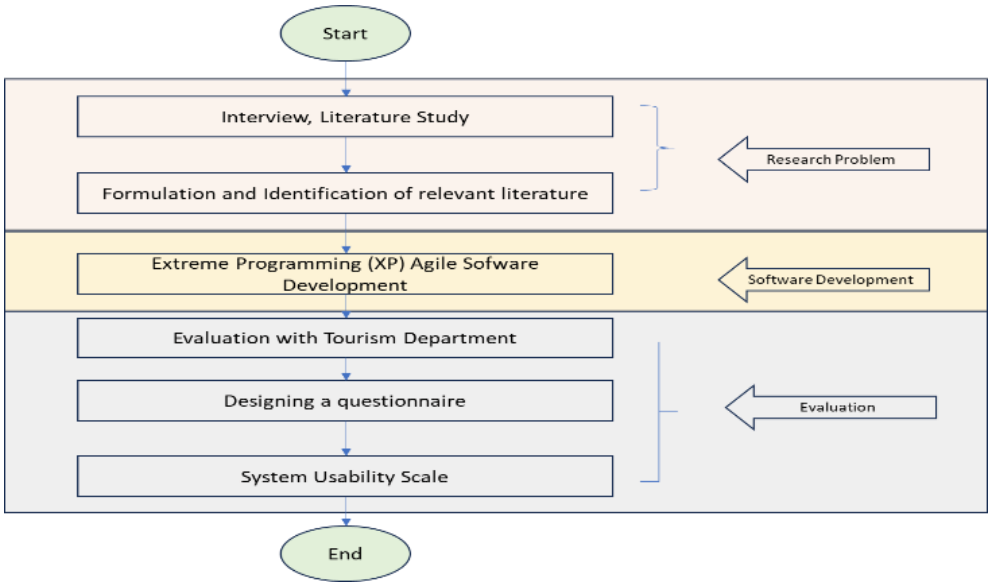


**Figure 2.**The research step

This research process was divided into several stages, as shown in Figure 2. The first stage was the collection of initial data and information, which was carried out through interviews and literature reviews. Interviews were conducted with the Pangkalpinang City Tourism Office to obtain data and information related to regional tourism activities and conditions. Interviews took the form of discussions and question-and-answer sessions during socialization activities at the Tourism Office. In addition, a literature study was conducted to collect references, secondary data, and supporting theories relevant to the research needs.

The second stage was software development, which was carried out based on the results of needs analysis and input from the Tourism Office as the main user. At this stage, the system was designed and implemented in accordance with the specified requirements.

The third stage was system evaluation and testing. The evaluation was conducted by the Tourism Office to assess the functionality and usefulness of the developed system. Next, a survey was conducted among the public using the System Usability Scale (SUS) method to measure the ease of use (usability) and user satisfaction with the resulting system.

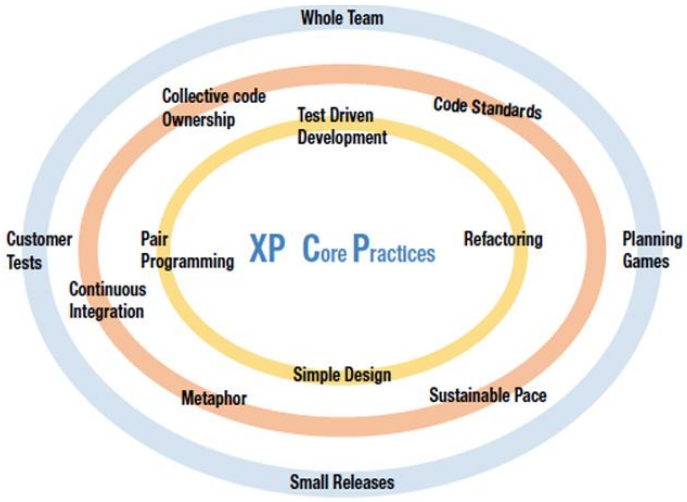


**Figure 3.** Extreme programming

The selected system development process was Extreme Programming (XP) Agile Software Development. Extreme Programming is an agile software development methodology [20]. This

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approach was chosen because it is suitable for addressing the identified problems. The software being developed is not highly complex and falls into the category of small-scale software that requires relatively short and iterative development cycles. Extreme Programming also helps improve software quality incrementally, encouraging collaborative project development in which programmers and customers are actively involved. During the software development process, customers can propose changes and updates as needed, as their understanding of the problem improves over time [21], making the work process more efficient. The diagram figure 3 illustrates the Core Practices of Extreme Programming (XP), an Agile software development methodology that emphasizes flexibility, collaboration, rapid feedback, and continuous improvement. At the center of the diagram are the XP Core Practices, which represent the fundamental technical and collaborative principles that guide the development process. Surrounding these core practices are additional supporting practices that ensure the method works effectively as an integrated system. This approach is divided into several activities. That is Planning, Design, Coding, and Testing.

The planning stage, as the first step in the Extreme Programming (XP) method, determines the direction and scope of system development. At this stage, data collection and analysis activities explore user requirements. The main objective is to provide the development team with a comprehensive understanding of the processes involved in selecting tourism categories. Through this stage, the team can measurably identify the functional and non-functional requirements of the system so that the developed software design can effectively support the organization's objectives. The results of this planning process include an overview of the system, a list of key features, and the core functionality of the application to be implemented. Thus, the planning stage not only forms the basis for system development but also ensures that each software component aligns with user needs and is capable of producing relevant and measurable outputs.

The second stage in the Extreme Programming (XP) method is the design phase. At this stage, the development team designs the system structure to serve as a guideline for realizing the user requirements identified in the previous stage. Although the design phase is often considered flexible or even postponable in practice, it plays an important role in this study as the conceptual foundation for system implementation. The design phase includes the architecture of the software, system workflow, user interface, and relationships between the main components of the application. With systematic documentation, subsequent development proceeds more efficiently and with greater focus. In addition, the results of this phase serve as a communication guide between the development team and users, ensuring that each party has a shared understanding of the structure and function of the system to be developed. Thus, the design phase ensures that the resulting application not only meets functional requirements but is also intuitive and accessible to end users.

The third phase in the Extreme Programming (XP) method is the coding phase. This phase is the core of software development, where developers translate the system design into executable program code. In this phase, developers focus on implementing key features in accordance with the specified requirements. The coding process in XP is carried out iteratively and collaboratively, allowing the team to make changes or improvements without restarting the entire development process. In addition, this phase includes the creation of test cases designed to verify the accuracy and reliability of the written code. After each piece of code successfully passes the testing stage, the results are gradually integrated into the system. This approach allows the development team to identify and fix errors early in the process. Thus, the coding stage not only focuses on writing code but also becomes a continuous process that supports software quality. This stage prepares the foundation for the next step, the testing phase to ensure that the system functions as expected.

The fourth stage is the testing phase, which is an essential component of the Extreme Programming (XP) approach. At this stage, verification and validation processes are carried out on the software components that have been developed to ensure that all system functions operate in accordance with the established requirements and specifications. The testing phase in XP is continuous, where each module or feature that has been developed is immediately tested using specialized tests designed based on user requirements. This approach allows the development team to quickly evaluate each change and ensure no regression disrupts existing system functions. In addition, the testing phase focuses on usability testing, which involves users directly to assess the ease, reliability, and effectiveness of the system in

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supporting their activities. The results of this testing process form the basis for further refinement of the system, both from technical and user experience perspectives. Thus, the testing phase not only serves as final validation but also as an iterative mechanism to ensure software quality and user satisfaction.

### 2.1. Functional Requirement Analysis


**Figure 4.** Use case diagram

Figure 4 shows the use case diagram for this study. It illustrates the interaction between actors and the system in developing digital tourism services, including the roles, activities, and relationships between users and features. The developed system has three main actors: User, Service Provider, and Admin. Each actor has different responsibilities, access rights, and interaction objectives, yet they are all interrelated in supporting the continuity of the digital tourism service process.

The User actor represents the end user of the application and interacts directly with its services. This actor can perform activities such as authentication (login, registration, and logout), browsing the list of services, and booking the desired service. Users also have access to service provider contact information for direct communication and can provide feedback on services to improve the quality of tourism offerings. These activities enable two-way interaction between users and service providers within the digital ecosystem.

The Service Provider actor provides services within the system. The main roles of this actor include verifying booking availability to ensure schedules align with available service capacity, as well as managing service content to update relevant information. In addition, service providers can view booking requests and review user feedback as evaluation material to improve the quality and relevance of the services offered. Service providers maintain control over the content and performance of their services within the system.

Meanwhile, the Admin is responsible for ensuring the continuity, validity, and consistency of the application's operations as the main system administrator. The Admin's main functions include adding new service provider accounts, managing menu content, and creating informative content such as tips and usage guides to educate and guide the users. Thus, the admin manages data and controls system operations between users and service providers.

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## 2.2. Activity Diagram

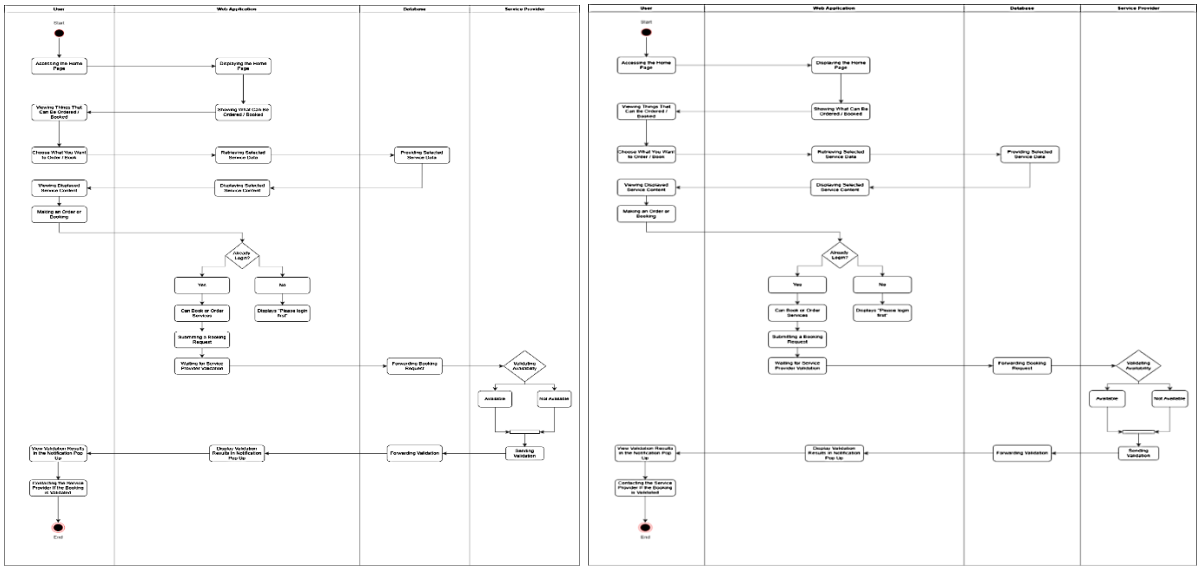

**Figure 5.** Activity Diagram

The Activity Diagram in Figure 5 describes the flow of activities and interactions between components in the Bangka Island Smart E-Tourism application system, reflecting the main business processes in booking tourism services. This diagram is designed to show the logical sequence of steps taken by the main actor (User) and how the system responds to each action systematically through the Web Application, Database, and Service Provider components.

The process begins when the user accesses the application's home page, after which the system displays the main homepage. Users can view the various travel services available for booking, and the system will display a list of available services. When the user selects one of the services they want to book, the system retrieves the selected service data from the database, which is provided by the service provider. Detailed information about the service is displayed to the user through the application interface.

Next, users can place a booking. At this stage, the system verifies the user's authentication status. If the user is already logged in, the system allows the booking process to continue. However, if the user has not logged in, the system displays a warning to log in first.

After the authentication process is successful, the user submits a booking request, which is then forwarded by the system to the service provider for validation. At this stage, the service provider validates the availability of the service. If the service is available, the service provider sends the validation results to the system, while if the service is unavailable, the system displays information that the service cannot be booked at the specified time.

After the validation results are received, the system displays the results in the form of a notification to the user. Users can view the booking validation results and contact the service provider directly if the booking has been validated. This process is the final stage of the service booking activity, which marks successful communication and transaction between the user and the service provider.

This Activity Diagram illustrates how the Smart Tourism system integrates user activities, system mechanisms, and service provider validation processes in a synchronized and structured manner. The model reflects workflow automation principles applied to tourism information systems. The model aims to improve process efficiency, reduce manual errors, and provide a more interactive and transparent user experience. The diagram helps developers and researchers understand the system's overall functional flow, providing a reference for ongoing implementation and evaluation.

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### 2.3. Class Diagram

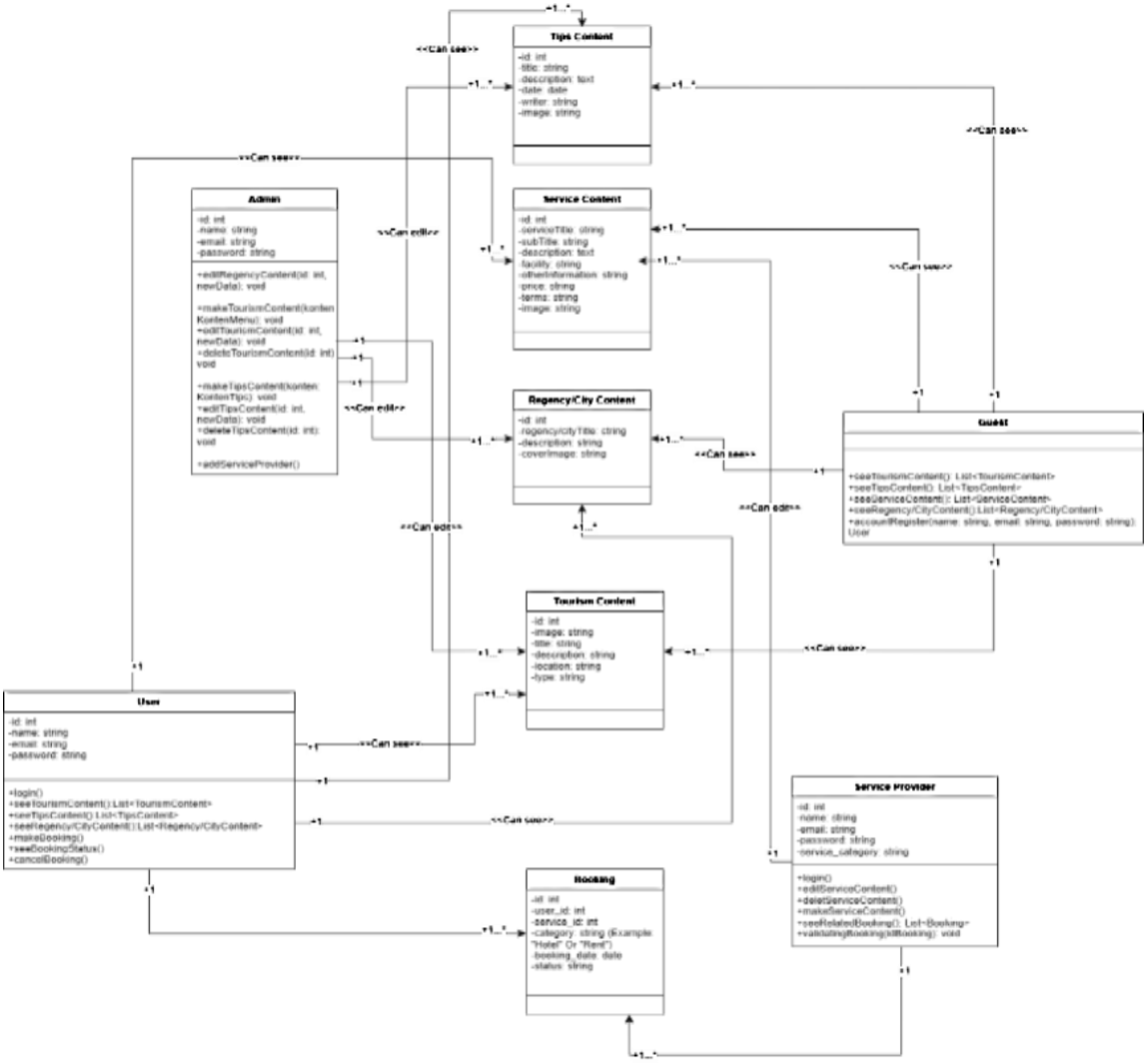


**Figure 6.** Class Diagram

The class diagram shown in Figure 6 describes the structure of the Bangka Island Smart Tourism system, showing the relationships between classes, attributes, and operations that support the overall functionality of the system. This diagram is a conceptual representation of the database design and application logic that supports the digital tourism information management process. The system consists of several main classes: Admin, User, Guest, Service Provider, Tourism Content, Service Content, Regency/City Content, Tips Content, and Booking. A more detailed explanation of Figure 6 can be seen in Table 1 below.

**Table 1.** Class diagram information

| No | Class | Information |
|---|---|---|
| 1 | Admin | Admins can edit content related to services, tourist destinations, cities/districts, and travel tips. |
| 2 | User | Registered system users who have the ability to view various available content and place service orders through the booking class. |
| 3 | Guest | Guests can only view basic information about destinations and travel services without the right to make reservations. |
| 4 | Service Provider | Tourism service providers who interact directly with the system to manage service availability and receive orders submitted by users. |
| 5 | Booking | The link between users and service providers, responsible for recording and validating booking activities carried out through the system. |

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## 3. RESULTS AND DISCUSSION

A web-based smart tourism application has been developed for Bangka Island. This smart tourism application facilitates tourist access to destination information, support services, and interactive features that enhance the tourist experience on Bangka Island.


**Figure 7.** Smart tourism web-based application interface

The web-based smart tourism interface is shown in Figure 7. The main page displays a hero banner featuring a typical Bangka Island beach scene, which serves as the main visual element to attract attention and establish an initial impression of the region's identity. Horizontal navigation is placed in the header section, allowing users to systematically access several categories including Home, Tourism, Tour Packages, Hotels, Rentals, and Contact.

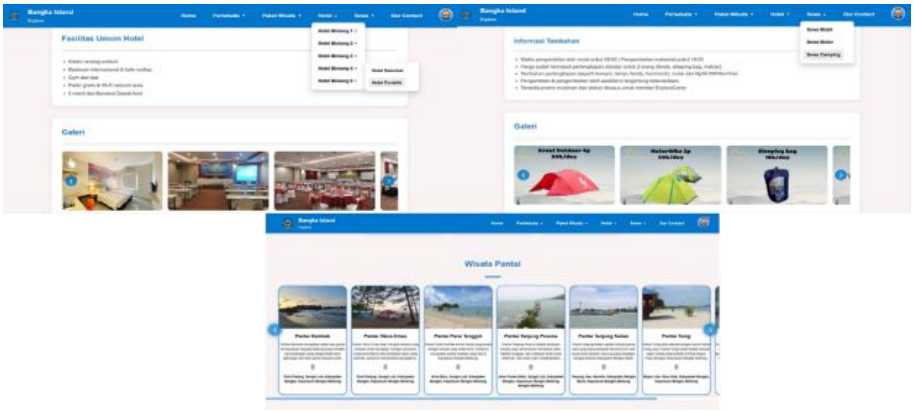


**Figure 8**. Smart Tourism web-based application information display

The information needed by users is shown in Figure 8. The hotel information page includes a list of general facilities such as swimming pool, international restaurant, fitness center, parking, and Wi-Fi. The information is presented in bullet list format, enabling users to quickly review available services. Additionally, a carousel-based gallery feature allows users to interactively view images of rooms, meeting facilities, and supporting facilities, thereby enhancing information delivery quality and supporting the decision-making process of potential travelers.

The rental services page displays additional information related to rental terms, including pickup times, equipment capacity, and price variations. This section features a gallery of equipment available for rent, such as tents, camping gear, and other outdoor equipment. Each gallery item is accompanied by an image and price description, enabling users to evaluate their options efficiently.

In the tourist destination information section, the system uses a card-based layout to display a list of beach attractions. Each card contains a destination photo, brief description, and administrative location, facilitating tourist browsing according to their preferences. The carousel feature in this section also supports a more dynamic exploration experience without overloading the main page display.

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**Figure 9.** User authentication page

Users can create accounts with the display shown in Figure 9. The user authentication page provides several access options: logging in with internal credentials, authentication using a Google account, and guest access mode. The purpose of this service is to increase user flexibility and comfort, as well as to implement the principle of inclusivity in a web-based public information system.

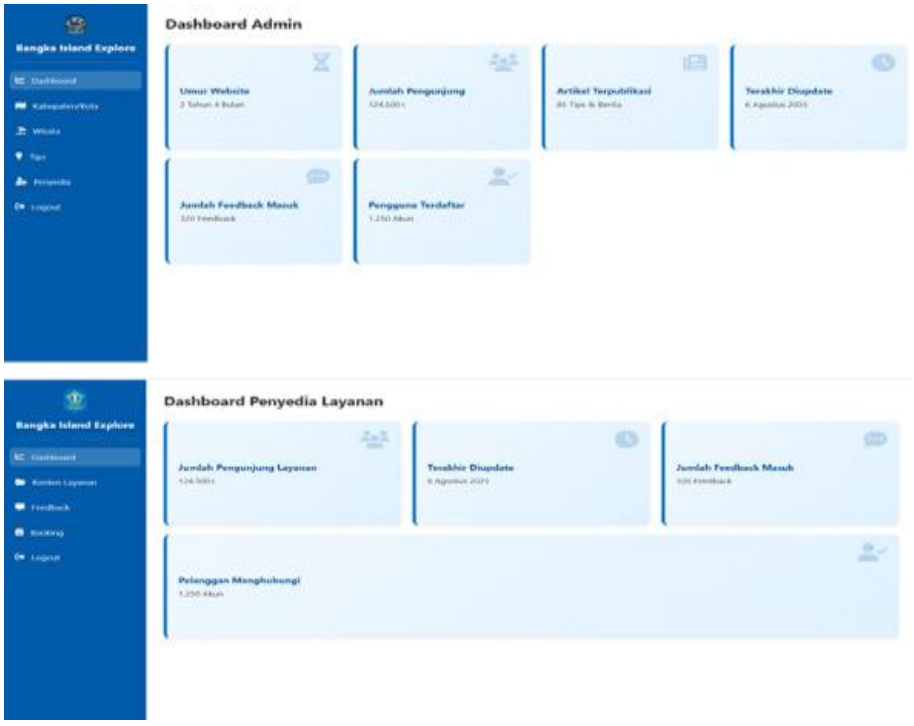


**Figure 10.** Smart Tourism web-based application information display

The next section shows the Admin Dashboard as shown Figure 10, which serves as a center for monitoring and managing the system's operational data. This dashboard presents key performance indicators including the website's operational age, number of visitors, number of articles published, amount of feedback received, and number of registered users. The presentation of data in information card format with concise layout and consistent visuals allows administrators to quickly evaluate system conditions and make more effective data-driven decisions.

Furthermore, the Service Provider Dashboard (e.g., hotels, rental providers, or tourism businesses) is also displayed as part of the application ecosystem. This dashboard provides relevant operational information for service providers, including the number of service visitors, the date of the last data update, the amount of customer feedback, and a list of customers who have contacted them. The provision of a dedicated dashboard for these stakeholders strengthens the system's function as a collaborative platform that supports data integration, service transparency, and the management of interactions between service providers and tourists.

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Based on the results of system development and testing, modeling in the Extreme Programming (XP) approach contributes significantly to the speed of system development iterations, flexibility in responding to user requirement changes, and improved software quality.

The XP method was implemented to actively engage relevant parties including the Pangkalpinang City Tourism Office, micro and macro MSME players, and visitors in every development stage. This resulted in a system that is more responsive to tourist needs, such as searching for tourist destinations, booking tourism services, and integrating maps with location-based local information (geo-tagging). The advantages of this approach can also be seen in the system's ability to provide smart recommendations for tourists using a search feature based on tourist interests and preferences.

### 3.1. Evaluating the Smart Tourism Application

The evaluation process in this study used the System Usability Scale (SUS) as a usability evaluation method. SUS was chosen because of its simplicity and high reliability, as proven by various previous studies. SUS produces quantitative scores that enable objective and comparative interpretation based on international acceptance categories. In line with the findings of Brooke [22], who introduced the SUS as a practical evaluation scale, as well as empirical reinforcement from Lewis and Sauro [23], this method has been proven to provide consistent, valid, and relevant usability indicators for assessing the comfort and ease of use of the developed smart tourism system.

The research participants in this study were general respondents who were potential users of the E-Tourism application. Respondents were asked to complete an online survey via Google Forms. All data collected focused on user perceptions and experiences regarding the use and implementation of the smart tourism system. A total of 70 respondents participated in this survey, and the data obtained was used as the basis for evaluating usability and analyzing user acceptance of the developed application.

SUS is presented in the form of a questionnaire containing 10 statements. Respondents provide scores using a Likert scale of 1–5, where Scale 1 = Strongly disagree, Scale 2 = Disagree, Scale 3 = Undecided, Scale 4 = Agree, and Scale 5 = Strongly agree, as shown in Table 2 below.

**Table 2.** Standard SUS

| No | Question | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | I plan to use this system again | | | | | |
| 2 | I find this system complicated to use | | | | | |
| 3 | I find this system easy to use | | | | | |
| 4 | I need help from others in using this system | | | | | |
| 5 | I feel that the features of this system are working properly | | | | | |
| 6 | I feel that there are many inconsistencies in this system | | | | | |
| 7 | I feel that others will quickly understand how to use this system | | | | | |
| 8 | I find this system confusing | | | | | |
| 9 | I feel that there are no obstacles in using this system | | | | | |
| 10 | I need to familiarize myself with this system first | | | | | |

Table 2 presents the questionnaire given to respondents. The questionnaire consists of 5 positive questions and 5 negative questions in accordance with the SUS standard. For questions 1, 3, 5, 7, and 9, the contribution score equals the scale position minus 1. Conversely, for questions 2, 4, 6, 8, and 10, the contribution score is calculated as 5 minus the scale position. The scores are then summed and multiplied by 2.5 to obtain the overall SUS score.

The SUS score is used as an important parameter for assessing the level of user acceptance of a system. A score below 68 indicates usability barriers, requiring in-depth analysis to identify and resolve problems. Conversely, a score above 68 indicates that the system meets basic usability standards, although minor improvements may still be considered to optimize user experience.

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The calculation results obtained a SUS score of 75.74, indicating that users consider the Smart Tourism application interface design to be acceptable, and that the system provides a user interface (UI) and user experience (UX) that adequately supports their needs in accessing tourism information and services.

### 3.2. Discussion

Equations The performance of this web-based smart tourism system is considered satisfactory, based on testing its responsiveness across various platforms, data security measures, and user experience. With interactive displays of tourist destination information, complete with reviews by previous tourists, multimedia galleries for each tourism category, and integration with social media and digital maps, this system can increase tourist engagement both before and during their trip to Bangka Island.

In terms of system sustainability, this system can generate significant opportunities for broader local tourism promotion, especially for lesser-known destinations that have great potential to be discovered. The digitization of tourism information will enable local stakeholders to expand the market reach of each tourist attraction while simultaneously promoting more effective destination management based on visitor data and tourist feedback.

However, several challenges still need to be addressed, including the limited digital infrastructure in remote areas of Bangka Island, the need for digital literacy among tourism stakeholders, and the requirement for ongoing training and assistance. Therefore, collaboration between academics, the Pangkalpinang Tourism Office, and tourism industry stakeholders is essential to ensure the sustainability and development of this system in the future.

Overall, the smart tourism system developed demonstrates that the application of the Extreme Programming (XP) software development method can accelerate the digital transformation of tourism on Bangka Island while simultaneously addressing the challenges of adapting to developments in information technology within the tourism economy sector.

## 4. CONCLUSION

The development of web-based Smart Tourism has been effective and able to meet the fundamental needs of users in obtaining digital tourism information. Based on usability evaluation using the System Usability Scale (SUS) method, the developed application scored 75.74, which is classified as acceptable, indicating that the quality of the user interface and user experience (UI/UX) was deemed adequate by the respondents. These findings confirm that the Smart Tourism application has succeeded in providing ease of use, clear navigation structure, and functionality relevant to user needs. Overall, this study confirms that the integration of the smart tourism concept through a web-based platform has significant potential in improving the accessibility of destination information and supporting digital transformation efforts in the regional tourism sector.

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