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Designing an Engaging Mangrove Ecotourism Website for Bontang Mangrove Park Using the RUP Method

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Abstract: Bontang Mangrove Park located in Kutai National Park, North Bontang District, Bontang City, serves as a prominent mangrove forest tourism destination. Despite its popularity, the park lacks an official website, relying solely on social media for information dissemination. This limitation restricts the park's ability to reach a broader audience and provide comprehensive details about its facilities, operational hours, and attractions. To address this issue, a dedicated website was developed to enhance the park's online presence and improve visitor accessibility to information. The website design and development followed the Rational Unified Process (RUP) methodology, an iterative and incremental approach to software development that ensures adaptability to changing functional requirements. Functionality testing was conducted using the Black-box method, while user satisfaction with the website's design and usability was assessed through a Likert-scale questionnaire distributed to 100 participants, indicating a positive reception with 74.03% of respondents rating the website favorably. This rating classifies the website as "Good" in terms of functionality and user experience, demonstrating its potential as a valuable tool for promoting mangrove ecotourism in Bontang Mangrove Park. The findings highlight the website's ability to improve accessibility, promote ecotourism, and engage visitors through digital means.

Index Terms: Ecotourism Promotion, Website Development, RUP Methodology, Mangrove Conservation, Online Tourism Platforms

1. Introduction

During holidays, one of the activities people engage in is traveling to tourist destinations. A tourist attraction or destination is a place or natural condition that has the appeal to become a vacation destination [1]. The destinations and types of vacations in Indonesia are numerous, and one of them among them is ecotourism. Ecotourism is a type of tourism that emphasizes the experience of visiting areas that are still natural and indirectly builds awareness about the

importance of environmental conservation and protecting natural resources. Enjoying and understanding nature under environmental protection rules is the main goal of this type of tourism [2].

One of the ecotourism destinations that are frequently visited is mangrove forest ecotourism, often commonly referred to as mangrove ecotourism. Mangrove forests are one of the vegetation groups along the coastline and play an important role in the ecological preservation of coastal areas and their surroundings [3,4]. These plants are also one of the four best ecosystems in the world [5,6].In addition to functioning as a protector against abrasion, mangrove forests also play an important role in maintaining the balance of coastal ecosystems, providing habitats for various species of flora and fauna, and serving as a source of livelihood for local communities that rely on the economic benefits and natural resources provided by the mangrove forests [7,8].

Moreover, mangroves can be used as an interesting tourist attraction, allowing visitors to enjoy the natural beauty and learn about the biodiversity within the mangrove ecosystem [9]. Bontang Mangrove Park, a prominent mangrove ecotourism destination in East Kalimantan, is situated within Kutai National Park, North Bontang District, Bontang City [10]. This tourist site is a coastal area planted with mangroves to prevent abrasion. In addition to benefiting the environment, also has aesthetic value, as it is managed by the Bontang Mangrove Park Organization. In addition to enjoying the mangrove forest, visitors can also plant mangroves directly and take photos, as this tourist destination has attractive photo spots.is the first mangrove area to be designated as ecotourism, making it a pioneer in the development of mangrove ecotourism in East Kalimantan [11,12]. However, as of the time this research was written, this ecotourism site does not yet have a website as a platform to provide information, expand networks to promote, and introduce this tourist destination online. In the rapidly developing context of ecotourism in Indonesia, there is a significant gap in terms of understanding the use of information technology, especially in the context of website development for natural tourism destinations like Bontang Mangrove Park [13].

This research aims to fill this knowledge gap by designing and developing an innovative and interactive website for MMP. The role of a website is considered very important in the tourism sector, as it supports the advancement of tourism as an information medium that ensures tourism promotion [13]. This is relevant to, as the number of visitors has continuously increased from November 2019 to January 2020. However, when the Covid-19 pandemic struck Indonesia, the number of visitors to declined significantly. Has started efforts to expand the reach and introduce the destination through social media, education game[14], etc. Although it has been active on various social media platforms, such as Facebook and Instagram, these efforts have still not been sufficient to optimize marketing potential and services to a wider audience.

Several approaches can be used in website development, including Waterfall, Agile, and the Rational Unified Process (RUP). The Waterfall method offers a structured and linear approach, making it suitable for projects with well-defined requirements from the beginning [15]. However, it lacks flexibility in adapting to changes during the development process. Meanwhile, the Agile methodology is highly flexible and responsive to evolving user needs but often lacks systematic documentation and can result in a less structured development process. Therefore, this study adopts the Rational Unified Process (RUP), which combines an iterative approach with a strong focus on use cases, allowing for gradual refinement while maintaining well-structured documentation.

RUP is a framework that emphasizes iteration, meaning small repetitive cycles, with each iteration resulting in system improvement. RUP provides a systematic approach to software development. With clear phases such as inception, elaboration, construction, and transition, RUP helps to structure a plan for website development. RUP prioritizes the involvement of stakeholders throughout the process [15,16]. The RUP methodology provides several advantages over other methods, including an iterative approach that enables continuous improvement throughout each development cycle and the active involvement of stakeholders in every phase of the project. By ensuring direct participation from the Bontang Mangrove Park management in each stage of website development, this methodology guarantees that the system aligns with their specific needs and expectations.

Development allows adjustments based on the feedback received. In the development of this website, the involvement of Bontang Mangrove Park ensures that the website built meets their expectations and needs. Therefore, the use of the RUP method is highly suitable for the development process of the Bontang Mangrove Park website. The result of this research is a website that can be used to promote Bontang Mangrove Park tourism to the public on a broader scale, facilitate access to information about the location, facilities, and available activities digitally, and is expected to increase the number of visits to this tourist destination.

2. Research Methodology

2.1 Framework IS Research

The IS Research Framework, introduced by Alan Richard Hevner, is a framework used in scientific activities to gain a deeper understanding of a specific problem. By using this framework, various facts and concepts necessary to understand the observed phenomena and develop solutions to solve existing problems can be collected. The scope of IS Research focuses on the interaction between humans, organizations, and technology. This concept is then implemented with the aim of improving the effectiveness and efficiency of the organization [17]. Fig. 1 shows the IS Research Framework used in this study. This framework highlights the interactions between people, organizations, and technology as key components to achieve efficiency and effectiveness.

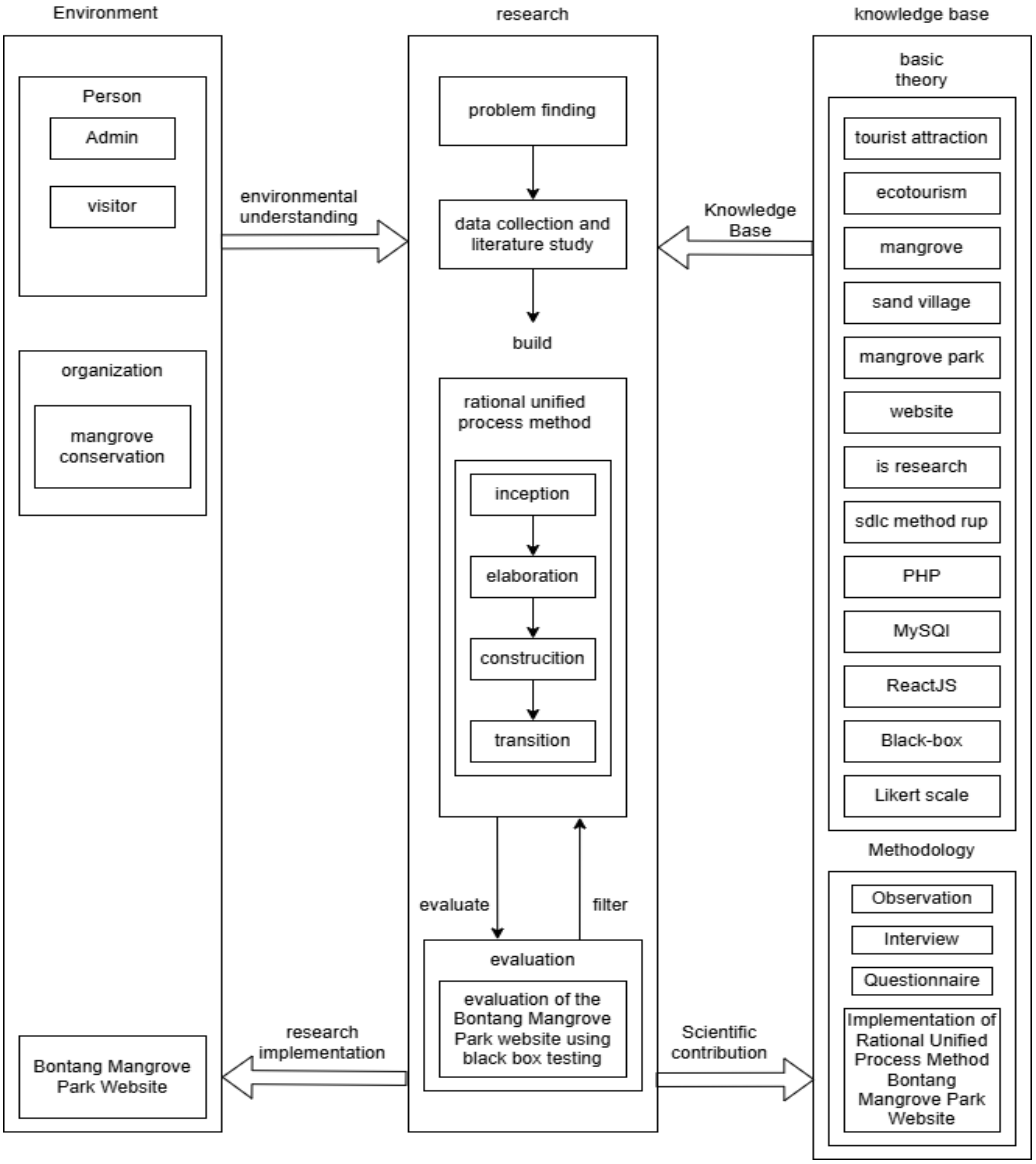


Fig. 1. IS Research Framework

Fig 1 is the framework for the research on the design of the Bontang Mangrove Park website, which illustrates the steps taken in this research. In the environment section, there are three elements involved. The first element is People. The second element is Organization, which is the object where the research is conducted. The third element is Technology, which is involved in this research. The technologies involved in this research are the programming languages JavaScript and PHP, as well as the Database Management System MySQL, the ReactJS library, and the Laravel framework. The research starts by identifying the problems at the tourist destination, which has experienced a decline in visitors due to the Covid-19 pandemic [18]. Although efforts were made to address these issues, they have not yielded significant results.

In an effort to help address these issues, this research focuses on the development of a website with the aim of supporting the recovery of visits to the site. Tourism and helping to provide information, then the next step will be data collection and literature study. Data collection is carried out through direct observation at, which is done to gather data related to the current conditions, facilities, and other important aspects. Then, a literature study is conducted to review journals, books, and previous research. After that, the development phase will proceed using the Rational Unified Process (RUP) method. The software development stages applying the Rational Unified Process (RUP) method are iterative. The phases consist of four phases: the Inception phase, which produces a business model, purpose documents, and use case models. The Elaboration phase focuses more on system analysis and design based on the models created earlier.

The Construction phase involves the creation of the system based on the designs that have been made, and the Transition phase is where the system is handed over to the users. The knowledge base for this research encompasses various elements, including tourist attractions, mangroves, Kutai National Park, Bontang Mangrove Park, website development, the SDLC Rational Unified Process methodology, PHP, JavaScript, MySQL, the ReactJS library, the

Laravel framework, and Black-box testing. The methods used to develop the knowledge base are through interviews, direct observation, and distributing questionnaires to 100 respondents. The respondents were randomly selected, consisting of potential visitors to Bontang Mangrove Park, with diverse backgrounds including students and local tourists. They were chosen because they are considered to represent potential website users and have basic knowledge of the information expected from the tourist site. After that, the evaluation phase of the developed website will be conducted.

The website evaluation is conducted using the Black-box testing method [19]. Black-box testing involves a series of steps to ensure that the functions and features of the website operate as intended without considering its internal implementation. This evaluation is carried out by involving stakeholders, and it is expected that they can provide in-depth perspectives on the evaluation results, so that policies or actions taken in response to the evaluation can be more targeted and sustainable. The stakeholders involved in this research are the Bontang Mangrove Park organization, the entity responsible for the management and conservation of.

2.2 Rational Unified Process (RUP)

The Rational Unified Process (RUP) method is a software development framework that emphasizes several important aspects. First, RUP places strong emphasis on use cases, which are used to determine the system's functionality from the user's perspective. Additionally, RUP also focuses on system architecture, which helps in designing the system's structure. Furthermore, the iterative and incremental approach is a key characteristic of RUP, allowing gradual improvements to the system. This approach allows system development to be carried out in stages, with each iteration improving and enriching the system further. The RUP methodology was chosen because it provides a clear structure for software development based on stakeholder requirements. Compared to Agile, which is highly flexible but lacks formal documentation, or Waterfall, which is rigid with stages that cannot be modified once started, RUP enables an iterative approach that is more suitable for this project. Table 1 shows a comparison of the methods.

Table 1. Response Category Analysis

Method	Advantages	Disadvantages	Reason Not Chosen
Waterfall	Clear structure, easy to understand	Not flexible to changes	The website requires iteration and periodic evaluation
Agile	Flexible, responsive to changes	Often lacks systematic documentation	Requires a more structured approach
RUP	Iterative, use case-driven, strong documentation	Requires deeper understanding for implementation	-

With this approach, each iteration of development aims to improve the quality and functionality of the system, while considering feedback and changes that may occur during the development process. This allows the project to adapt to changing requirements and ensures a result that better aligns with user expectations [20]. Fig. 2 shows, the RUP method, which consists of iterative and incremental stages: Inception, Elaboration, Construction, and Transition. Each stage involves specific processes to ensure the software meets user requirements.

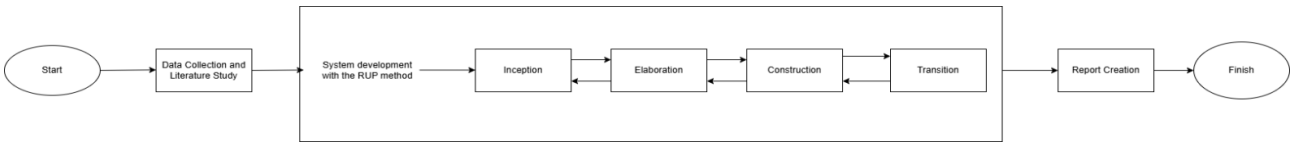


Fig. 2. Rational Unified Process

Fig 2 is the research flow conducted using the RUP method, the following are the steps that can be taken:

a) Field Study and Literature Study

In the field study, data is collected through direct observation and interviews with the Bontang Mangrove Park parties to identify issues and needs at the research site. Then, a literature study is conducted to provide the theoretical foundation for the research.

b) System development with the RUP method

The stages in system development using the RUP method are [21]:

1) Inception (beginning)
   This stage has several processes, including business process modeling conducted using Business Process Modelling and Notation (BPMN), Requirements (analysis of system functional requirements), analysis and design (creating system use cases), and testing.
2) Elaboration (planning)
   This stage has several processes, including Requirements (adding system requirements from the previous stage if necessary), analysis and design (use cases are created again if there are additions from the previous stage, and the creation of activity diagrams, sequence diagrams, class diagrams, and entity relationship diagrams),

interface design, and testing.

3) Construction (development)
4) This stage has several processes, including Implementation (creating the database and system development) and testing.
5) Transition (transition)
   At the transition stage, testing is conducted on the system interface to determine its alignment with user requirements.

2.3 Black-Box

Black-box is a software testing technique used to determine the functionality of an application. The main focus of Black-box testing is that the inputs align with the expected results. Black-box is also referred to as specification-based testing and behavior testing. This technique is called "Black-box" because, in this testing, the tester does not need to know the internal code implementation of the application [19].

2.4 Skala Likert

The Likert scale is a method of measuring a person's opinion using a questionnaire to determine the attitude scale toward a particular object. This scale is named after Rensis Likert, a famous psychologist from the United States, who created the tool to measure public attitudes in 1932 [22]. The Likert scale is the most commonly used measurement scale in Indonesia in the form of a rating scale or more commonly known as the Likert model instrument. It is relatively easy to create, and respondents also find it easy to respond. The formula used to determine the score category on the Likert scale can be seen in (1).

$$TS = \mathrm{T} \times \mathrm{Pn} \tag{1}$$

Description (1)
TS= Total Score
T= Total number of respondents who selected
Pn= The score value for each answer.
Y= The highest Likert score x number of respondents x total question.
For determining the percentage index for each category, it can be seen in equation (2):

$$\text{Formula Index } \% = (\mathrm{TS}/\mathrm{Y}) \times (100) \tag{2}$$

Then, a recalculation is done to obtain the value interval. The determination of the percentage index interval for each category choice uses the formula in equation (3):

$$\mathrm{I} = 100/\text{Number of Answer Choices} \tag{3}$$
$$\mathrm{I} = 100/5 = 20$$

Based on the result from the value interval formula in Equation 3, it is known that the value interval for each answer is 20. The following is the score interpretation based on the value interval:

Very Poor= 0% - 19.99%
Poor= 20% - 39.99%
Fair= 40% - 59.99%
Good= 60% - 79.99%
Very Good = 80% - 100%

2.5 Business Modelling

Business Modeling provides a highly useful visual representation of a series of business processes and interactions among the elements involved in them. In this diagram, there are a set of symbols and connecting lines that represent the steps and relationships between business processes [23-25]. The diagram starts with a main activity representing the starting point of the business process and continues through a series of steps and interactions that end when all related activities have been completed. Fig. 3 shows, the Business Process Model and Notation (BPMN) for Bontang Mangrove Park, which serves as the foundation for activities on the website.

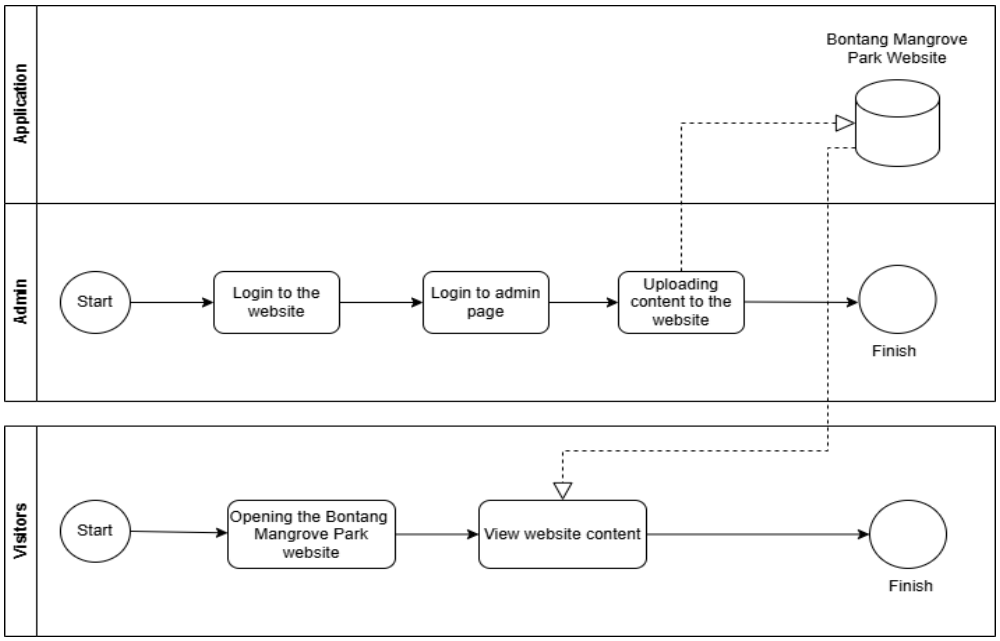
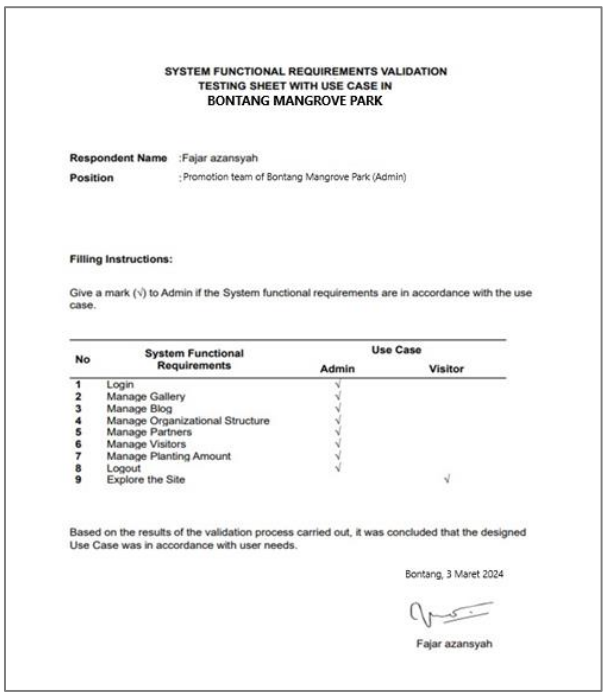


Fig. 3. BPMN Bontang Mangrove Park

This business process model serves as the foundation for all activities that take place on the Bontang Mangrove Park website. The process begins when the admin logs into the system using the provided credentials. Once successfully logged in, the admin is directed to the admin page, where they can manage site content. On the admin page, the admin has the ability to upload various types of content, such as articles, images, or videos, which will be displayed to site visitors. After the content is uploaded, site visitors can then access and browse the content based on their interests or needs, providing them with a beneficial and informative user experience.

2.6 Requirement

To gain a deeper understanding of the system requirements for the website to be developed, an in-depth interview was conducted with the Chairman of Bontang Mangrove Park. This interview process involved a thorough discussion regarding the specific and detailed needs for the website being developed. The results of the interview were then recorded and analyzed to serve as considerations and the main guide in the planning and development of a system that aligns with the needs and goals of Bontang Mangrove Park. Below is Fig. 4 shows, which contains the system requirements specifications.



SYSTEM FUNCTIONAL REQUIREMENTS VALIDATION TESTING SHEET WITH USE CASE IN BONTANG MANGROVE PARK

Respondent Name :Fajar azansyah
Position : Promotion team of Bontang Mangrove Park (Admin)

Filling Instructions:

Give a mark (√) to Admin if the System functional requirements are in accordance with the use case.

No	System Functional Requirements	Use Case	
		Admin	Visitor
1	Login	√	
2	Manage Gallery	√	
3	Manage Blog	√	
4	Manage Organizational Structure	√	
5	Manage Partners	√	
6	Manage Visitors	√	
7	Manage Planting Amount	√	
8	Logout	√	
9	Explore the Site		√

Based on the results of the validation process carried out, it was concluded that the designed Use Case was in accordance with user needs.

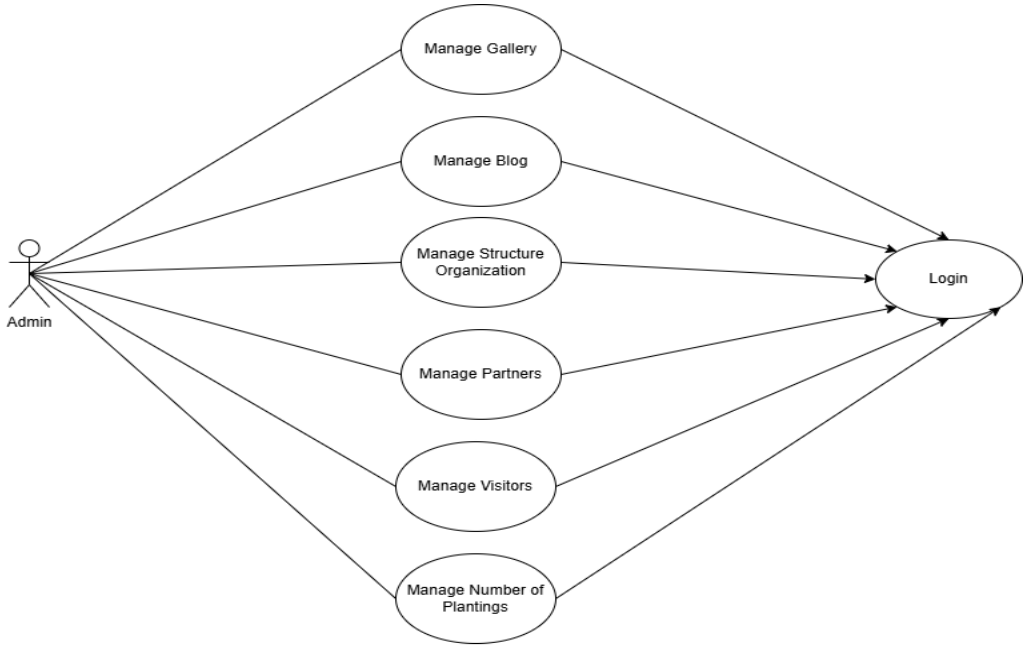
Bontang, 3 Maret 2024

Fajar azansyah

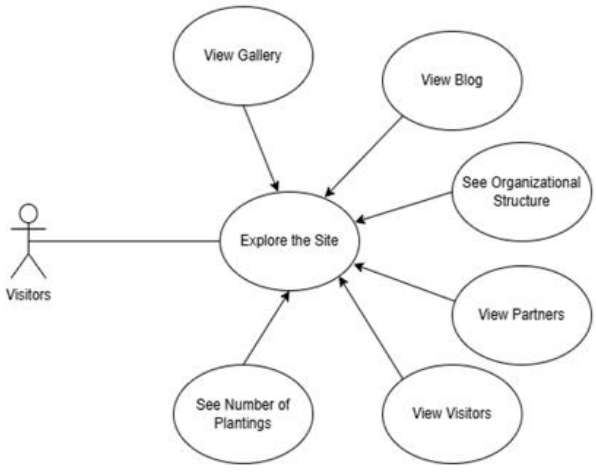
Fig. 4. Requirement Website

2.7 Use-case Diagram

A Use-case Diagram is a visual tool that helps illustrate the interaction between actors, which can be users or other systems, and the main functionalities provided by the system. In the context of the Model, there are two main actors involved: the admin, who is responsible for the administration and management of the system, and the visitors, who are the end users of the system [26]. Fig. 5 explains common use-case scenarios involving these two actors, ranging from the registration and account management process by the admin to the access and usage of various features and information by visitors, such as information about the location, facilities, or activities available at the Mangrove Park. Fig. 5 illustrates the Use-Case Diagrams for the system, divided into two parts: Fig. 5 (a) shows the interaction between the admins and the system, highlighting functionalities such as managing content, handling user inquiries, and generating reports, while Fig. 5 (b) shows depict the interaction for visitors, showcasing their ability to browse information, submit inquiries, and provide feedback. These diagrams collectively demonstrate the system's dual focus on administrative efficiency and user engagement.



(a)



(b)

Fig. 5. Use Case diagram Admin (a), Use Case diagram Visitors (b)

The website is designed for two types of users: admins and visitors. Admins require a login to manage the website. Website management includes features such as managing the gallery, managing the blog, managing the organizational structure, managing partners, managing visitors, and managing the number of plantings. Visitors can use the "explore the site" function, which includes several sub-functions. These sub-functions include features like viewing the gallery, viewing the blog, viewing the organizational structure, viewing partners, viewing visitors, and viewing the number of plantings. Visitors do not need to log in to use these features.

2.8 Activity Diagram

An Activity Diagram provides a visual representation of the various activities and processes carried out within a specific system or application. This diagram consists of various symbols and arrows to illustrate the flow of activities on the website [27,28]. The activity begins when the user accesses the system, then the user decides whether to become an admin or a visitor, and the process flow continues based on the role selected by the user. Fig. 6 shows, the general Activity Diagram for the system, describing the flow of activities based on the roles of admins and visitors.

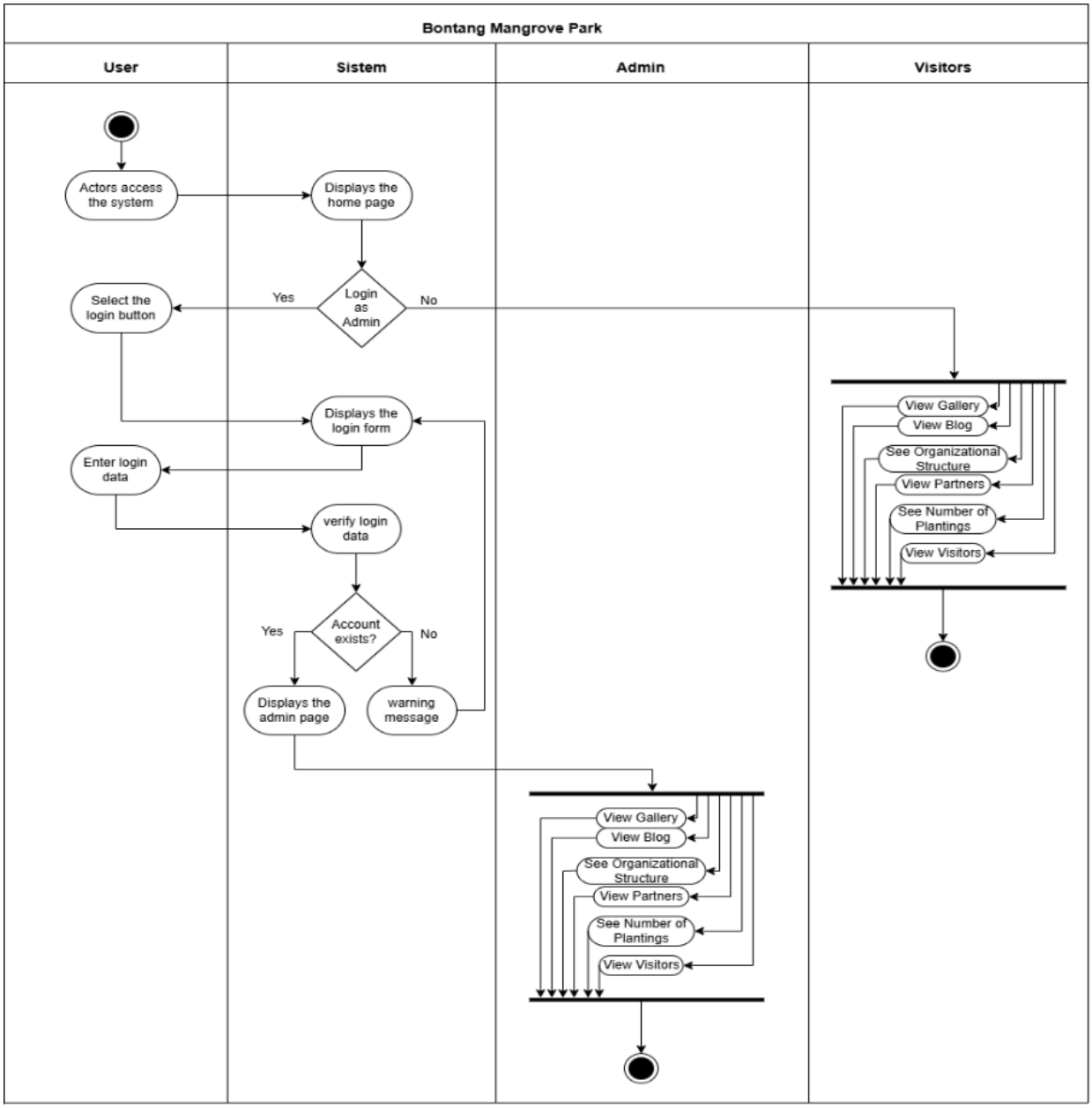


Fig. 6. Activity Diagram

2.9 Architecture System

System architecture in website development is a technical framework that guides the organization and interaction between components within the website. This system architecture also defines the basic structure and elements of the system and explains how the system will interact with each other [29,30]. In the Bontang Mangrove Park website's system architecture, there is a Data Management component that functions to insert and retrieve data from the Database, and a Knowledge Base Management component that gathers data such as Blogs, Galleries, etc. The admin can input and view data, while visitors can view the data uploaded by the admin. From this system architecture, it can be concluded that admins and visitors do not interact directly. Fig. 7 shows, the system architecture of the Bontang Mangrove Park website.

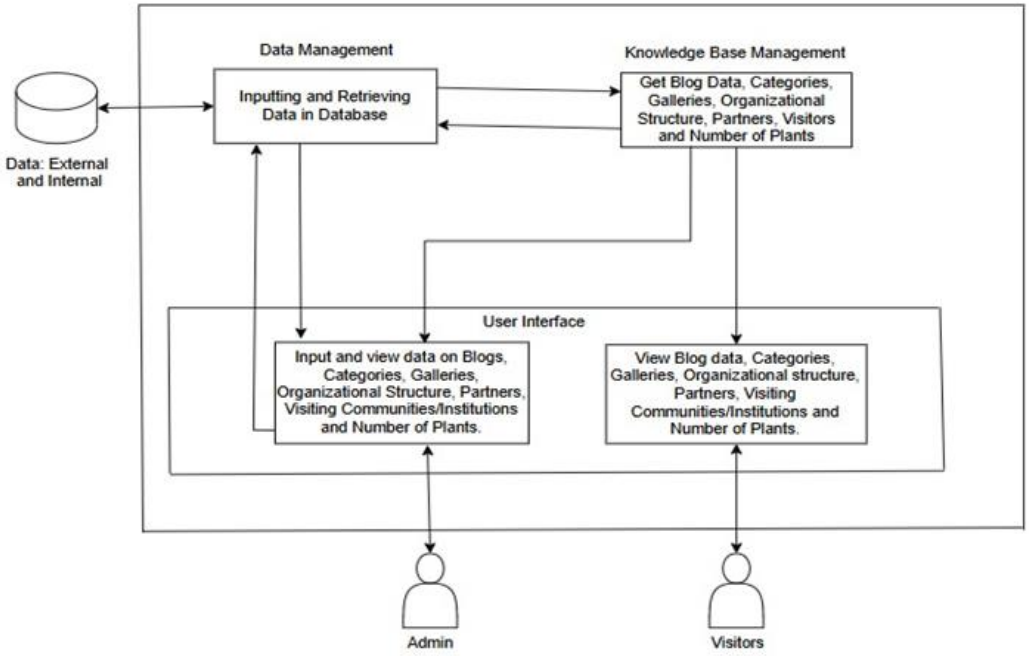


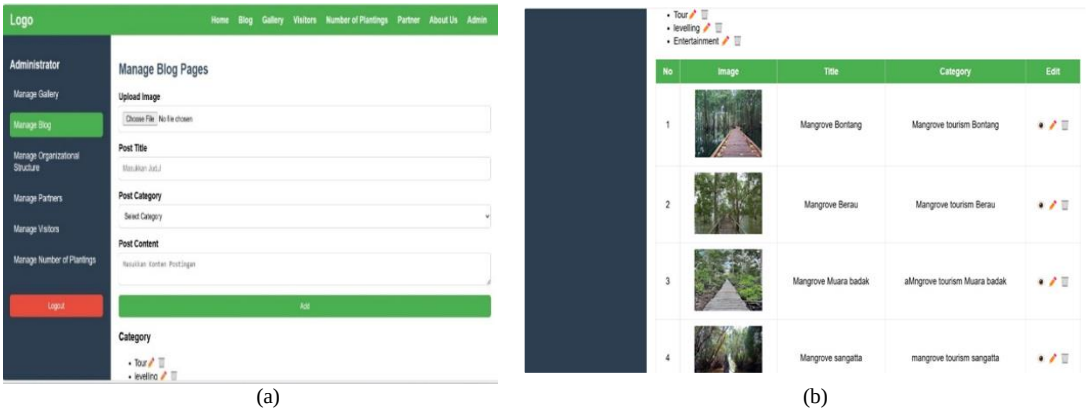
Fig. 7. Architecture System

3. Results and Discussion

3.1 Interface Design

The interface design is based on discussions and collaboration with the Bontang Mangrove Park. The involvement of the in the interface design process is intended to gather direct input from them regarding user preferences and the primary objectives of the application to ensure an optimal user experience. Therefore, the interface design is not solely based on the developer's desires but also reflects the collaboration and strong understanding between the developers and.

Fig. 8 illustrates the interface design for the Blog Management feature. Fig. 8 (a) shows, the form interface that enables administrators to upload posts, specify titles, select categories, and add content, ensuring an intuitive and user-friendly experience for managing blog content. Fig. 8 (b) shows, the post management view, displaying the uploaded posts along with their titles, categories, and editing options to streamline administrative tasks effectively.



(a) (b)

Fig. 8. Interface Design for blog management (a), Interface Design for post management (b)

The interface in Fig 8 represents the page intended for administrators to manage the blog. Administrators can upload posts to the website through this page. Fig. 9 shows, the interface design for the Blog Management feature, enabling administer manage images effectively.

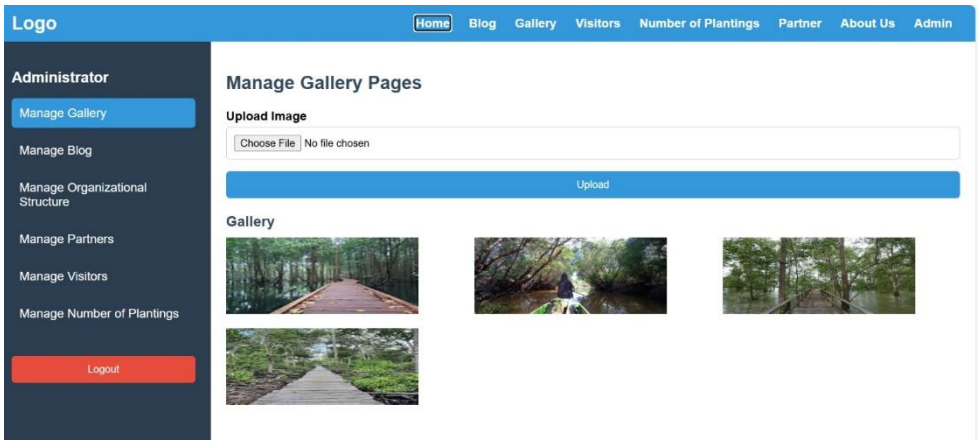


Fig. 9. Interface Design for Gallery Management

With the interface design shown in Figure 9, it is expected that users will gain a clear understanding of the management page to be developed. This interface design aims to enable users to interact easily with the gallery management features, making image management more practical. Additionally, it assists developers in implementing the interface on the gallery management page.

3.2 Interface Implementation

Implementation of the interface for the Blog Management feature. Administrators can upload photos by clicking the Upload Image button (optional) and add categories using the Add button. They can then enter a title in the Title field, select a category in the corresponding field, and input the content in the Content field. Implementation of the interface for the Gallery Management feature, including the Add Photo functionality. Administrators can click the Upload Image button to select a photo and then press the Upload button to upload it.

3.3 Interface Testing

By directly involving users, this phase aims to gather feedback from them, enabling improvements to ensure the developed website achieves a high level of satisfaction. The satisfaction level is measured using the Likert scale. The Likert scale is a measurement tool used to assess levels of agreement or opinion.

Respondents were asked to indicate their level of agreement or disagreement by selecting from the options provided. Below are the questions used in the testing process:

1) The website is easy to access and operate.
2) The website responds quickly and simply.
3) Navigation between pages is smooth.
4) The website operates without errors.
5) The website displays photos effectively.
6) The website effectively displays posts, tables, and information.
7) The website has a good color combination.
8) The website features a responsive design, adapting to various devices.
9) The website displays fonts (letters, numbers, and special symbols), icons, and images well.
10) The website maintains overall visual consistency.
11) The overall appearance of the website is satisfactory.

The testing was measured using the Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Through interface testing conducted via an online questionnaire completed by 100 respondents, user feedback on the implemented interface was gathered. The results obtained are as follows:

a) Determining the total score

$$\text{Total Score} = T \times Pn$$

Explanation:
T = Total number of respondents selecting each answer.
Pn = Score value for each answer.

Below are the score values (Pn) for each answer choice. The Likert scale results show that the website achieved a "Good" rating of 74.03%, based on user feedback. The detailed analysis is shown in Table 2.

Table 2. Response Category Analysis

Category	Score	Frequency	Total Score
Strongly Agree	5	230	1150
Agree	4	470	1880
Neutral	3	244	732
Disagree	2	154	308
Strongly Disagree	1	2	2
$\Sigma Total Score$			4072

b) Determine the value Y

Y = Highest score × number of respondents × number of questions.
$Y = 5 \times 100 \times 11 = 5500$

After obtaining the final score, the final calculation is carried out as follows:
$= \Sigma \text{ Total score} / Y \times 100\%$
$= 4072 / 5500 \times 100\%$
$= 74.03\%$

Based on the calculation using the Likert scale, the value of 74.03% falls within the interval categorized as "Good".

4. Conclusion

The development and design of the Bontang Mangrove Park website using the Rational Unified Process methodology demonstrates that the system operates effectively after undergoing functional testing through the Black-box method, involving the Bontang Mangrove Park stakeholders. The interface evaluation, which utilized an online questionnaire filled out by 100 respondents, showed that 74.03% of the respondents rated the system in the "Good" category. Therefore, it can be concluded that the RUP methodology is an effective approach for system development. Future research should include larger-scale evaluations of performance metrics such as website load times and security. Additionally, it is recommended that future studies measure the number of visitor engagements over a specific period to assess the website's impact on tourism growth. Incorporating stakeholder feedback more explicitly can further optimize the website's effectiveness as a promotional and educational platform.

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