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Development of a Web-Based Information System to Support Marine Product Data Management at the Aceh Department of Marine Affairs and Fisheries

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ABSTRACT

Accurate marine product data management is essential to support policy formulation, transparency, and institutional efficiency in regional fisheries governance. However, many provincial institutions still rely on semi-manual systems, leading to inefficiency and data inconsistency. This study aims to design and develop a structured web-based information system to manage marine product data at the Aceh Department of Marine Affairs and Fisheries. The system was developed using the Waterfall model due to its suitability for well-defined institutional requirements. Functional and non-functional requirements were explicitly classified. The architecture applies a three-layer structure (presentation, application, and database layer) with role-based access control and server-side validation mechanisms. Black-box testing covering 53 scenarios resulted in 100% functional validity. Performance testing shows an average response time of 1.2 seconds under normal load. A satisfaction survey involving 15 staff members yielded an average score of 4.42/5 with Cronbach's Alpha of 0.87, indicating high reliability. The system significantly improves reporting efficiency, reduces manual errors, and enhances transparency. However, scalability and advanced interoperability remain areas for future improvement.

I. Introduction

The marine and fisheries sector plays a strategic role in Indonesia's economic development [1]. Effective management of marine product data is essential to support evidence-based policymaking and public accountability.

Previous studies have examined marine resource management [2] and the implementation of electronic-based government systems (SPBE) [3]. Several web-based systems have been developed for institutional management [4], [7], yet many remain limited to single-module functionality without integrated transparency and performance validation mechanisms.

Research in Jurnal Inovasi Teknologi dan Rekayasa also demonstrates structured system development approaches. Yunial and Fauzi [9] designed an Android-based guestbook management system with structured validation, while Yanik [10] applied spatial autocorrelation analysis to workforce distribution. However, these studies do not specifically address integrated marine product governance systems that combine administrative data processing, public transparency modules, and empirical performance validation.

International e-government research highlights the importance of transparency, interoperability, and governance-based system architecture [11], [12]. Nevertheless, provincial-scale marine data systems integrating structured development methodology with empirical evaluation remain limited.

II. Research Method

This study employed a software engineering approach with a qualitative descriptive method [1], [6]. This approach was used to analyze user needs, understand existing data management processes, and describe the development of a web-based marine product data management information system based on actual institutional conditions [2], [7]. The qualitative descriptive method allowed the researcher to obtain a comprehensive understanding of system requirements through observation, documentation, and analysis of administrative activities related to marine data management processes [1], [8]. The research was conducted through the following stages:

A. Requirement Analysis

This stage focused on identifying both functional and non-functional requirements of the marine product data management information system, including data processing needs, system performance, usability, and data security requirements to support institutional administrative activities [2], [4], [7]. Requirement analysis was carried out to ensure that the developed system aligns with user needs and organizational workflows within the Department of Marine Affairs and Fisheries [10]. Functional requirements identified include data input, data editing, data deletion, public information access, and report generation. Non-functional requirements include system security, access control, data validation, and responsive user interface design.

B. System Design

The system design was developed using Unified Modeling Language (UML) to model system functionality and workflows. UML diagrams used in this study included use case diagrams to describe interactions between users and the system, as well as activity diagrams to illustrate the sequence of business processes and data flow within the marine product data management system [4], [8], [9]. The use case diagram defines two main actors: administrator and public user. The administrator is responsible for managing data, while the public user can only access published information. The activity diagram describes the workflow of login authentication, data processing, database transactions, and information presentation.

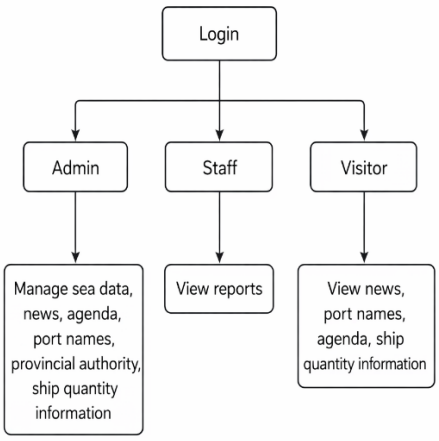

Fig. 1. Diagram Use Case

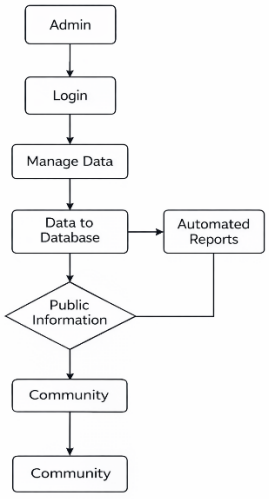

Fig. 2. Activity Diagram

C. System Implementation

The system was implemented as a web-based application using PHP as the programming language and MySQL as the database management system. Bootstrap framework was utilized to support responsive interface design. This implementation aimed to produce a system that is flexible, easy to maintain, and capable of supporting marine data management activities within the institution [4], [7].

The system architecture follows a structured separation between user interface, business logic, and database processing to improve maintainability and data security.

D. System Testing

System testing was conducted using the Black Box Testing method to evaluate system functionality based on input and output conformity without considering the internal program structure. This testing ensured that all system features operated according to user requirements and minimized potential errors during system operation [3], [5].

A total of 53 testing scenarios were executed, covering login authentication, data management processes, public access, and report generation features. [5].

III. Results and Discussion

The result of this study is a web-based marine product data management information system that is used by administrators to manage institutional data and provide public information services [4], [7]. The system provides several main features, such as:

- Marine product data management
- Vessel data management
- Port data management
- Public information display
- Automatic report generation

A. System Development Results

Application implementation is a stage in which the system has been fully developed and equipped with functional features and user interfaces based on the results of system analysis and design. At this stage, the system is applied to support administrative activities related to marine product data management within the institution [4].

1. System Dashboard Page

This page displays a summary of marine product data information, including total recorded marine products, number of registered vessels, number of ports, and recent updates in real time.

Fig 3. Main Dashboard Interface

2. Marine Product Data Page

This page is used to manage marine product master data, such as product name, category, production quantity, date of entry, associated vessel, and port information. Administrators can add, edit, delete, and view detailed marine product records through this interface.

Fig 4. Marine Product Data Page Display

3. *Vessel Data Page*

This page functions to manage vessel information, including vessel name, registration number, capacity, and operational status. The data recorded on this page supports integration between marine product records and vessel sources to ensure traceability.

No	Nama Pelabuhan	Lokasi	Jumlah Kapal (Unit)					
			<5 GT	5–10 GT	10–20 GT	20–30 GT	30–60 GT	>60 GT
1	PPS Kutaraja Lampulo	Banda Aceh	180	140	95	70	45	18
2	PPN Idi	Aceh Timur	130	100	65	40	22	6
3	PPI Pusong	Lhoksemawe	120	85	50	28	15	2
4	PPI Meureudu	Pidie Jaya	90	60	35	18	8	0
5	PPI Peudada	Bireun	85	55	30	15	6	0

Fig 5. Vessel Data Page Display

4. *Port Data Page*

This page is used to manage port-related information, including port name, location, and operational details. The integration of port data with marine product information strengthens transparency and data governance mechanisms in public institutions

No	Nama Pelabuhan	Lokasi	Produksi Ikan Dominan (kg)	Harga (Rp/kg)	Bulan/Tahun
1	PP Lambada Lhok	Aceh Besar	0 4.100.000 kg	Rp 18.500	2023-01-01
2	PP Ie Meulee	Sabang	0 2.650.000 kg	Rp 35.000	2023-01-01
3	PP Pante Raja	Pidie Jaya	0 2.980.000 kg	Rp 17.500	2023-01-01

Fig 6. Port Data Page Display

B. Aplication Testing

System testing was carried out using the Black Box Testing approach, which emphasizes evaluation of system functionality by examining the relationship between input data and output produced without analyzing the internal program structure. This testing process was intended to verify that every feature of the Web-Based Marine Product Data Management Information System functions properly and meets specified user requirements

Table 1. The results of Black Box Testing are presented in

ID	Test Description	Input	Espected Output	Test Results	Status
1	Login with correct username and password	Username: admin, Password: admin123	Successfully enter the dashboard	Successfully logged in	Valid
2	Login with incorrect password	admin / wrong password	Error message appears	Error message appears	Valid
3	Login without input	All fields empty	Required field validation appears	Validation message appears	Valid
4	Admin adds agenda with complete data	Title, date, activity description	Agenda data is saved and displayed in the admin agenda list.	As expected	Valid
5	Admin adds agenda without filling the date field	Date field empty	System displays message “Data cannot be empty”	As expected	Valid
6	Admin edits an existing agenda	Change activity description	Agenda data is successfully updated and saved	As expected	Valid
7	Admin deletes a specific agenda	Click delete button	Agenda is successfully removed from the list	As expected	Valid
8	Admin views the list of all agendas	Agenda list page	Data is displayed in order based on date	As expected	Valid
9	Public user opens the agenda page on the website	URL: /agenda	System displays a list of activities with date and description	As expected	Valid
10	Public user attempts to edit agenda data	No edit form available	System does not provide edit or delete access	As expected	Valid
11	Public user accesses an agenda deleted by admin	Agenda data has been deleted	Data no longer appears on the public page	As expected	Valid
12	Public user accesses a new agenda added by admin	Latest agenda	Agenda appears automatically without login	As expected	Valid

ID	Test Description	Input	Espected Output	Test Results	Status
13	Public user opens the website from a mobile device	Responsive display	Agenda is displayed properly and responsively on small screens	As expected	Valid
14	Admin adds new news data with complete information	Title, content, date, image	News is saved and displayed on the admin news page	As expected	Valid
15	Admin adds news without filling required fields	Title field empty	System rejects input and displays “Data cannot be empty”	As expected	Valid
16	Admin edits existing news	Change news content	News data is updated and saved correctly	As expected	Valid
17	Admin deletes specific news	Click delete button	News is successfully removed from the list	As expected	Valid
18	Admin views the news list	News list page	All news data is displayed according to date order	As expected	Valid
19	Public user opens the news page on the website	URL: /news	System displays the latest news list	As expected	Valid
20	Public user opens detailed news	Click news title	System displays complete news content with date and image	As expected	Valid
21	Public user attempts to delete or edit news	No edit/delete button	System only displays data without edit access	As expected	Valid
22	Public user accesses news deleted by admin	Data already deleted	News does not appear on the public page	As expected	Valid
23	Public user opens news from a mobile device	Responsive display	News appears neatly and is easy to read on small screens	As expected	Valid
24	Admin adds marine production data with complete information	Fish type, production amount, location, date	Data is saved and displayed in the marine production list	As expected	Valid

ID	Test Description	Input	Espected Output	Test Results	Status
25	Admin adds data without filling required fields	Production amount empty	System displays message “Data cannot be empty”	As expected	Valid
26	Admin edits existing marine production data	Change production amount	Data is updated and saved correctly	As expected	Valid
27	Admin deletes one marine production record	Click delete button	Data is removed from the list	As expected	Valid
28	Admin views marine production data list	Data list page	All data is displayed in the latest order	As expected	Valid
29	Public user opens marine production page	URL: / marine-production	System displays the latest marine production data list	As expected	Valid
30	Public user opens detailed marine production data	Click fish type name	System displays complete information (type, amount, location, date)	As expected	Valid
31	Public user attempts to add or modify marine production data	No input form	System does not provide access to edit or add data	As expected	Valid
32	Public user views data from a mobile device	Responsive display	Data appears neatly and can be easily scrolled	As expected	Valid
33	Public user accesses deleted marine production data	Data deleted from database	Data no longer appears on the public page	As expected	Valid
34	Admin adds new port data with complete information	Name, location, authority status	Data is saved and displayed in the port list	As expected	Valid
35	Admin adds data without port name	Name field empty	System rejects input and displays “Data cannot be empty””	As expected	Valid
36	Admin edits existing port data	Change port location	Data is successfully updated and saved in the database	As expected	Valid
37	Admin deletes a port record	Click delete button	Data is removed from the list	As expected	Valid

ID	Test Description	Input	Espected Output	Test Results	Status
38	Admin views all port data	Port list page	Data is displayed completely in order	As expected	Valid
39	Public user opens port page on website	URL: /port	System displays a list of ports with names and locations	As expected	Valid
40	Public user opens detailed port information	Click port name	System displays port details (name, location, authority status)	As expected	Valid
41	Public user attempts to add or modify port data	No input form	System does not provide access	As expected	Valid
42	Public user views port information from mobile device	Responsive display	Data appears properly on small screens	As expected	Valid
43	Public user accesses a port deleted by admin	Data deleted from database	Data no longer appears on the public page	As expected	Valid
44	Admin adds ship data with complete information	Ship name, type, capacity, location	Data is saved and displayed in the ship list	As expected	Valid
45	Admin adds ship data without name	Name field empty	System displays message “Data cannot be empty”	As expected	Valid
46	Admin updates existing ship data	Change ship capacity	Data is successfully updated and saved	As expected	Valid
47	Admin deletes ship data	Click delete button	Data is removed from the list	As expected	Valid
48	Admin views ship list	Ship list page	All ship data is displayed completely in order	As expected	Valid
49	Public user opens ship information page	URL: / number-of-ships	System displays the ship list according to the latest data	As expected	Valid
50	Public user opens ship details	Click ship name	System displays ship details (name, type, capacity, location)	As expected	Valid

ID	Test Description	Input	Espected Output	Test Results	Status
51	Public user attempts to modify or add ship data	No input form	System does not provide edit or add access	As expected	Valid
52	Public user views data via mobile device	Responsive display	Data appears neatly and can be easily scrolled	As expected	Valid
53	Public user accesses ship data deleted by admin	Data already deleted	Data no longer appears on the public page	As expected	Valid

Based on the Black Box Testing results, all system functions operate as expected. The system successfully validates input data, prevents duplicate entries, manages relational data integrity, and generates reports accurately.

Compared to the previous manual data management process, this web-based system improves efficiency in data recording, reduces human error, and enables faster retrieval of marine product information. Administrators can monitor data conditions in real time and generate reports automatically when needed.

These findings are consistent with previous studies stating that web-based information systems significantly improve administrative efficiency, transparency, and data accuracy in institutional environments [3], [6], [7].

IV. Conclusion

The study demonstrates that the web-based marine product data management information system developed in this research is capable of resolving data management issues encountered at the Department of Marine Affairs and Fisheries. The implementation of the system streamlines the recording and processing of marine product data, enhances the accuracy and consistency of institutional data, and shortens the time required to generate periodic reports.

In addition, the use of this system contributes to more efficient administrative activities and supports managerial decision-making by providing marine product information that is accurate, structured, and up to date. Consequently, the web-based marine product data management information system can be utilized as an effective solution for government institutions to improve data governance, transparency, and overall operational performance.

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