



Management Information System for Maimun Palace Tourism Using Web Engineering and FAST Methods

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Abstract– This study aims to design and implement an event reservation and payment system to support tourism services at Istana Maimun, Medan. The system was developed to simplify the process of event booking, payment, and management for both users and administrators. The development method adopted was a web-based approach using the Laravel framework and MySQL database. System testing was carried out using the black-box method, focusing on functional requirements such as event creation, reservation processing, and payment confirmation. The testing scenarios included valid and invalid inputs to evaluate the system's ability to handle different cases. The results showed that all core functionalities performed as expected, with correct status updates and validation messages. The payment module successfully processed transactions and displayed accurate order details, including transaction amounts and unique order IDs. In addition, the system effectively prevented duplicate payments and ensured data consistency between reservations and payment records. Based on these findings, the system is considered functionally ready for production use. It can improve operational efficiency and user experience in managing event reservations at Istana Maimun. Future development may focus on integrating additional features such as online ticket verification and mobile application support.

Keywords: Event Reservation System, Tourism Services, Laravel Framework, Black-box Testing, Payment Processing.

1. INTRODUCTION

Tourism is one of the most significant sectors contributing to economic growth, cultural preservation, and community development in many regions across the world. In Indonesia, cultural heritage sites serve not only as historical symbols but also as major tourist attractions that stimulate local economies [1][2]. Istana Maimun, located in Medan, North Sumatra, stands as one of the most prominent landmarks representing the cultural heritage of the Malay Deli Sultanate [3][4]. As a historical palace with a unique blend of Malay, Islamic, and European architectural influences, it attracts a substantial number of domestic and international visitors each year [5][6]. Effective management of such a high-profile tourism destination is crucial to ensure visitor satisfaction, operational efficiency, and sustainable heritage preservation. In recent years, the digital transformation of tourism management systems has become an essential strategy for improving operational efficiency and enhancing visitor experiences [7][8]. The shift from manual to digital-based management allows stakeholders to collect, store, and analyze data in real time, facilitating more informed decision-making processes. For historical sites like Istana Maimun, this transformation is even more critical, as it enables the integration of cultural promotion, visitor services, and administrative tasks into a centralized platform. Despite its popularity, the management of Istana Maimun still faces challenges in maintaining efficiency in ticketing, visitor data recording, promotional activities, and event coordination [9][10].

Manual management processes are often prone to delays, human errors, and limited accessibility of information. For example, visitor registration and ticketing handled through physical documentation can cause long queues and administrative inefficiencies, especially during peak tourism seasons. Additionally, the lack of a centralized information system may hinder effective coordination among management staff, ultimately impacting the quality of service provided to visitors. These limitations highlight the urgent need for an integrated information management system tailored specifically to the operational needs of Istana Maimun.

To address these challenges, the development of a web-based information management system offers an innovative solution. A web-based platform enables centralized data management, accessibility from multiple devices, and the integration of different operational functions into one coherent system. Furthermore, it supports scalability, allowing the addition of new features and modules without major overhauls to the existing infrastructure. This approach not only streamlines internal management processes but also improves transparency and accountability in decision-making [11][12].

The development of such a system requires a structured and systematic methodology to ensure that the resulting product meets both functional and non-functional requirements. The growing demand for responsive, interactive, and data-driven web systems has encouraged developers to apply structured methods in their creation [13][14][15][16]. In this study, the Web Engineering methodology is adopted to guide the development process through well-defined stages, from requirement analysis to deployment [17]. Web Engineering emphasizes a disciplined approach to web application development, ensuring maintainability, scalability, and usability. It is particularly suitable for projects that involve complex, multi-user systems such as tourism management platforms [18].

In addition, the Framework for the Application of Systems Thinking (FAST) is applied to the analysis and design phase to ensure that the system is built upon a clear understanding of user needs, organizational goals, and operational workflows. FAST provides a comprehensive framework for identifying problems, analyzing requirements, and proposing solutions that align with strategic objectives [19]. The combination of Web Engineering and FAST allows the



development process to be both technically rigorous and responsive to the actual context of tourism management at Istana Maimun.

This research aims to design and implement a web-based information management system for Istana Maimun that integrates ticketing, visitor data management, promotional content, and reporting functions into a unified platform. The system is expected to address existing inefficiencies, reduce manual workloads, and improve the overall visitor experience. Furthermore, the platform will enable management to make data-driven decisions, thereby supporting sustainable tourism and heritage conservation.

The outcome of this study is expected to provide both practical and academic contributions. Practically, it will serve as a digital solution that can be implemented by Istana Maimun management to enhance operational performance. Academically, it will demonstrate the applicability of Web Engineering and FAST methodologies in the development of cultural tourism management systems. The findings and implementation process can also serve as a reference for other heritage sites in Indonesia or similar contexts worldwide that aim to modernize their management systems through digital transformation.

2. RESEARCH METHODOLOGY

2.1 Research Stages

This research was conducted at the Sultanate of Deli, specifically at Istana Maimun, located at Jl. Brigjen Katamso No.66, Aur, Medan Maimun District, Medan City, North Sumatra Province, Indonesia. The palace serves as both a historical landmark and a major cultural tourism destination, making it a suitable case study for the development of a tourism management information system.

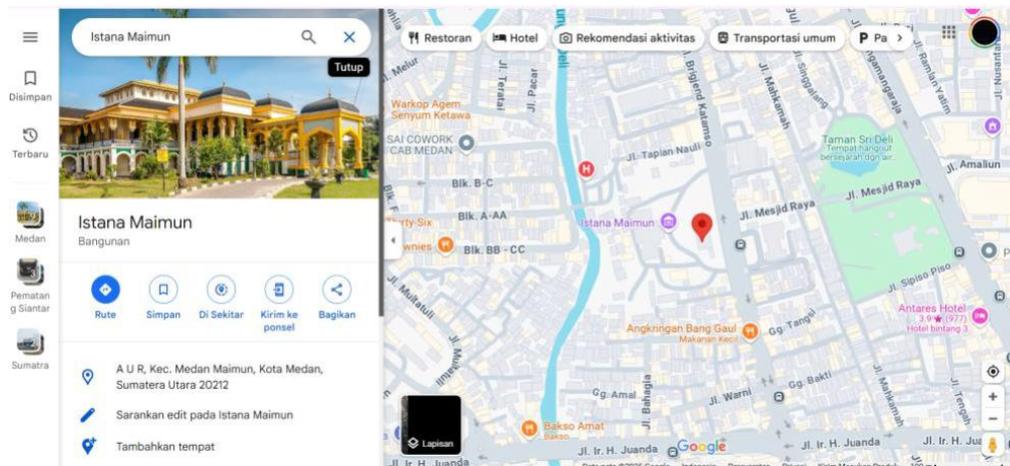


Fig 1. Research Location

The research stages were designed to ensure a structured and systematic process from problem identification to the delivery of the final solution. The main stages of the research are as follows:

1. Needs Identification. At this stage, the existing management processes at Istana Maimun were observed and documented to identify operational challenges. Interviews and informal discussions were conducted with staff members to gather initial insights into administrative workflows, ticketing processes, visitor management, and promotional activities.
2. Literature Review. A comprehensive review of related literature was carried out to identify existing research and best practices in tourism management systems, particularly for cultural heritage sites. This stage also involved studying the principles of Web Engineering and the Framework for the Application of Systems Thinking (FAST), as well as analyzing relevant case studies that could serve as references for system design and implementation.
3. Requirements Analysis. Based on the findings from the needs identification and literature review, both functional and non-functional requirements of the system were formulated.
4. System Design. The system design stage involved creating the architecture, data models, and user interface prototypes.
5. Implementation. In this stage, the system was developed based on the previously defined design specifications. The development process followed the Web Engineering methodology, using web-based technologies to ensure platform independence and ease of deployment.
6. Testing. The implemented system underwent functional testing to verify that all modules performed according to the specified requirements.



7. Conclusion. The final stage involved evaluating the overall performance of the system, summarizing the research findings, and formulating conclusions.

2.2 Web Engineering Method

The development of the tourism management information system for Istana Maimun was guided by the principles of Web Engineering. Web Engineering is a systematic and disciplined approach to the development of high-quality web-based applications, focusing on methodologies, tools, and techniques that ensure maintainability, scalability, and usability. This approach is particularly relevant for complex, multi-user systems such as tourism management platforms, which require robust functionality, efficient data handling, and a user-friendly interface.

Web Engineering treats web application development as a full software engineering process, moving beyond traditional website creation by emphasizing structured analysis, design, implementation, testing, and maintenance. In the context of this study, Web Engineering provided a clear roadmap for transforming the identified needs at Istana Maimun into a functional and reliable system.

The Web Engineering process adopted in this research consisted of the following stages:

1. Customer Communication and Requirements Elicitation. This stage involved direct interaction with stakeholders, particularly the management and staff of Istana Maimun, to gather detailed requirements.
2. Planning. A development plan was formulated, outlining the system's scope, resources, timeline, and responsibilities.
3. Modeling. The modeling stage involved creating abstract representations of the system's functionality, data structures, and interactions.
4. Construction. During the construction stage, the system was implemented using appropriate web technologies. This included developing the back-end functionalities for data processing and storage, as well as front-end components to provide a responsive and user-friendly interface.
5. Deployment. Once the construction phase was completed, the system was deployed in the operational environment of Istana Maimun. Deployment included the migration of necessary data, configuration of the server environment, and training sessions for staff members to ensure they could effectively use the system.
6. Maintenance and Evolution. After deployment, the system entered a maintenance phase to fix potential bugs, update content, and introduce new features in response to user feedback and technological advancements.

2.3 FAST Method

In addition to Web Engineering, this research employed the Framework for the Application of Systems Thinking (FAST) to guide the early phases of system development, particularly in problem analysis and requirements definition. FAST is a structured methodology that focuses on understanding a system as an integrated whole, identifying its problems, analyzing user needs, and proposing solutions that are both technically feasible and aligned with organizational objectives. This method is highly suitable for projects where complex processes and multiple stakeholders are involved, as in the case of tourism management at Istana Maimun.

FAST emphasizes systematic analysis before moving into design and implementation. It ensures that developers and stakeholders share a common understanding of the problems to be solved and the functionalities required. In this study, FAST was applied primarily during the requirements analysis and system modeling phases to ensure that the resulting design was fully responsive to operational needs. The FAST methodology as applied in this research consisted of the following stages:

1. Scope Definition. The project scope was defined based on observations, interviews, and discussions with Istana Maimun's management. The boundaries of the system were established to focus on ticketing, visitor data management, promotional content, and reporting, while excluding unrelated administrative functions.
2. Problem Analysis. Current management practices were analyzed to identify inefficiencies, such as the reliance on manual ticketing processes, delays in generating visitor reports, and difficulties in promoting events to a wider audience.
3. Requirements Analysis. Detailed functional and non-functional requirements were documented. Functional requirements specified what the system should do such as registering visitors, processing ticket sales, and generating reports.
4. Logical Design. A conceptual model of the system was created without yet specifying implementation technologies. This included defining entities, data flows, process flows, and user interactions. Use case diagrams, activity diagrams, and sequence diagrams were prepared during this stage to visualize the intended system behavior.
5. Decision Analysis. Several technical options were evaluated for system development, including different web technologies, database solutions, and hosting options. The selection was based on criteria such as cost, performance, scalability, and ease of maintenance.

2.4 Integration of Methods

The integration of the FAST methodology and Web Engineering in this research was designed to leverage the strengths of both approaches while ensuring a smooth and efficient development process. While FAST provided a structured





framework for understanding operational problems and defining precise system requirements, Web Engineering offered a disciplined pathway for transforming those requirements into a functional, high-quality web-based application.

The research process began with FAST to ensure that the system was conceptually sound and aligned with the needs of Istana Maimun's management. The Scope Definition and Problem Analysis stages in FAST helped to clearly identify the system's boundaries and the root causes of inefficiencies. Requirements Analysis and Logical Design established a solid foundation by producing well-documented functional specifications and visual models, such as UML diagrams, without being tied to a specific technology. Decision Analysis then guided the selection of the most suitable technical stack for the system.

Once the analysis and conceptual design were complete, the process transitioned into Web Engineering, which focused on translating the approved specifications into an operational system. The Customer Communication and Requirements Elicitation stage of Web Engineering built directly upon the requirements identified in FAST, ensuring consistency between analysis and implementation. The Planning, Modeling, Construction, and Deployment stages of Web Engineering then provided a step-by-step approach to building and delivering the system, while Maintenance and Evolution ensured its long-term sustainability. The advantage of combining these two methods lies in their complementary nature:

1. FAST excels in the early phases, ensuring that the system's purpose, scope, and design are well thought out before any coding begins.
2. Web Engineering excels in the later phases, ensuring that the implementation follows best practices, is well-structured, and results in a maintainable and scalable application.

3. RESULT AND DISCUSSION

3.1 Overview of the Developed System

The developed system is a web-based tourism management information platform designed to support the operational needs of Istana Maimun, a historic landmark and cultural heritage site in Medan, North Sumatra. Its primary goal is to provide an integrated solution for managing events, reservations, guided tours, tourist attraction information, and reporting processes. By digitizing these core functions, the system enhances operational efficiency, minimizes manual errors, and improves service quality for both visitors and administrative staff.

The system was developed using the Laravel framework, a modern PHP-based web application framework known for its scalability, security, and modular architecture. Laravel's built-in MVC (Model-View-Controller) pattern allowed the development team to maintain a clear separation between data, application logic, and presentation, ensuring better maintainability and future extensibility. The database layer is powered by MySQL, providing reliable and structured data storage, while the front-end leverages Blade templates combined with HTML5, CSS3, and JavaScript to deliver a responsive and user-friendly interface.

Functionally, the system consists of five main modules:

1. Event Module – Enables administrators to create, manage, and publish event details such as cultural performances, exhibitions, or seasonal promotions, ensuring visitors remain informed and engaged.
2. Reservation Module – Handles visitor reservations for tickets, guided tours, or group bookings, integrating real-time availability checks and confirmation features.
3. Tour Module – Supports the scheduling and management of guided tours, including tour guide assignments and participant tracking.
4. Tourist Attraction Module – Provides comprehensive information about various attractions within Istana Maimun, enhancing visitor knowledge and experience.
5. Report Module – Generates statistical and financial reports on visitor numbers, ticket sales, event participation, and other performance indicators for managerial decision-making.

3.2 System Design

The system design phase serves as the blueprint for the development of the Istana Maimun Tourism Management Information System. It transforms the results of the requirements analysis into a structured representation that guides the implementation process. The design process integrates functional modeling, behavioral modeling, and interaction modeling to ensure that the system's architecture, workflows, and data interactions fully meet the needs identified during the analysis stage.

In this research, the system design focuses on three key modeling approaches: Use Case Diagrams, Activity Diagrams, and Sequence Diagrams. The Use Case Diagram illustrates the functional scope of the system, defining how various actors—such as administrators, ticketing staff, tour guides, and visitors—interact with the five main modules: event management, reservation handling, tour scheduling, tourist attraction information, and reporting. This diagram serves as a high-level view of the system's functional requirements, ensuring clarity of roles and responsibilities.

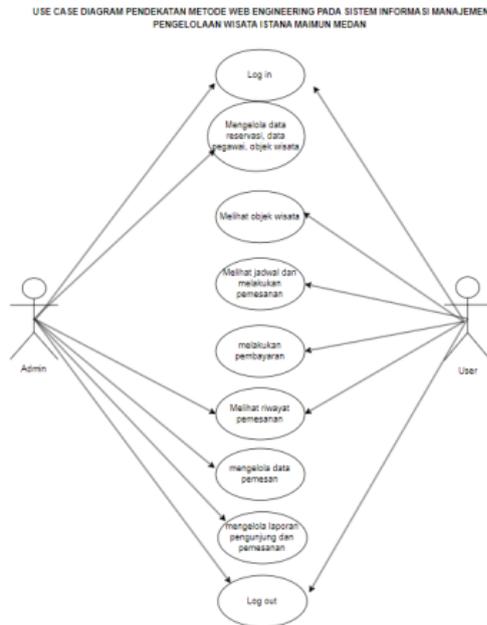


Fig 2. Use Case Diagram

In the Use Case Diagram for the Istana Maimun Tourism Management Information System, two primary actors are identified: the Administrator and the User (visitor). The diagram illustrates how each actor interacts with the system's core functions. The Administrator has full control over system operations, including logging in, managing reservation data, events, tours, and tourist attractions, as well as updating schedules and processing bookings. Administrators can also manage payment records, monitor booking histories, and generate visitor and reservation reports for analytical purposes. This ensures the smooth operation of the tourism management process and provides valuable insights for decision-making. The User, on the other hand, interacts with the system primarily for information retrieval and service utilization. Users can view details about tourist attractions, check event schedules, make reservations, process payments, and review their booking history. The inclusion of the payment process and reservation history access within the user's scope enhances their autonomy and improves service efficiency.

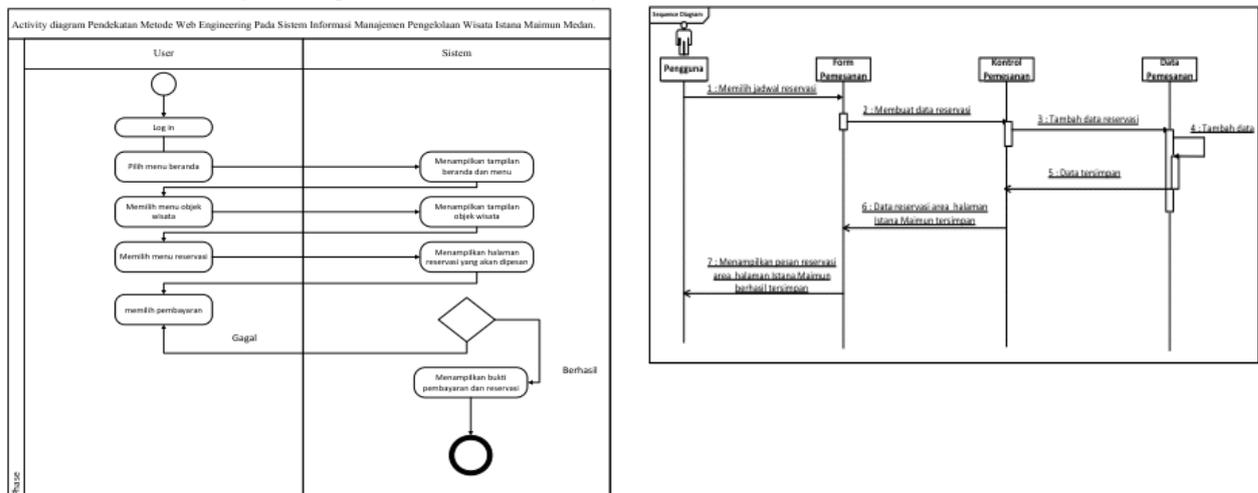


Fig 3. Activity and Sequence Diagram

The Activity Diagram for the reservation and ticketing process outlines the sequential flow of actions between the User and the System in facilitating ticket purchases for Istana Maimun. The diagram is divided into two swimlanes, clearly distinguishing user actions from system responses. The process begins when the user logs into the system and selects the homepage menu. The system responds by displaying the homepage interface and navigation menu. The user then selects the desired tourist attraction, prompting the system to display detailed information about that attraction. Once the user chooses the reservation menu, the system presents the reservation form or page. At this stage, the user proceeds to the payment process. A decision node determines whether the payment is successful or not. If the payment fails, the process

terminates without confirmation. If successful, the system generates and displays proof of payment along with reservation details, marking the completion of the transaction.

3.3 System Testing and Evaluation

System testing and evaluation are essential phases in the development of the Istana Maimun Tourism Management Information System to ensure that the implemented features function according to the predefined requirements. The primary objective of the testing process is to identify and resolve any functional discrepancies before system deployment, thus guaranteeing reliability and user satisfaction. The testing procedure employed the Black Box Testing method, which evaluates the system’s functionality based on user inputs and expected outputs, without examining the internal code structure. Testing was primarily conducted on three core modules—Event, Reservation, and Payment—to ensure that the system’s most critical functions perform reliably under various usage scenarios. For the Event Module, the primary focus was on verifying the ability of administrators to create, update, and delete event information, as well as the accurate display of event details to users. The testing confirmed that all event-related data, including titles, descriptions, schedules, and images, were processed and displayed correctly without data loss or formatting errors.

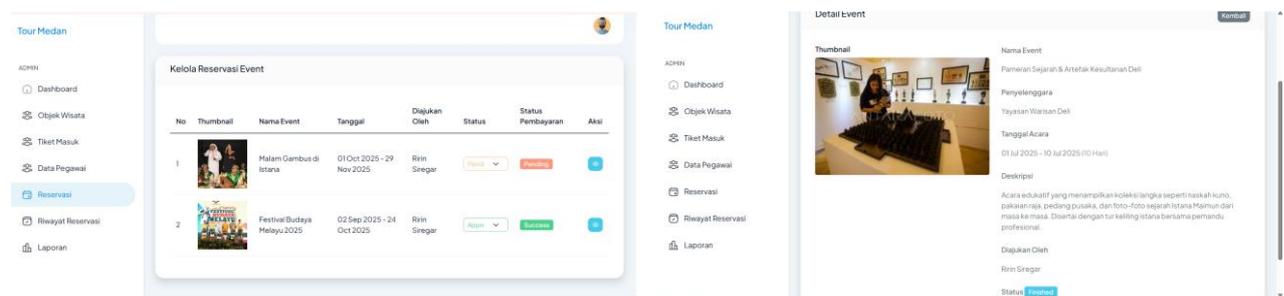


Fig 4. Event Module Testing

The testing of the event module focused on verifying the functionality for creating, managing, and viewing event information. In the event management interface (Fig. 4), administrators can view a list of scheduled events, including event thumbnails, titles, dates, proposers, approval status, and payment status. The system allows administrators to approve or reject event proposals and update payment statuses dynamically. In the event detail view (Fig. 4), comprehensive information about a specific event is displayed, including its title, organizer, schedule, description, and current status. The detailed view enables users to assess the relevance and readiness of an event before participating or promoting it. Testing confirmed that all fields were correctly retrieved from the database and displayed without formatting errors. Furthermore, updates to event status (e.g., Pending, Approved, Finished) were accurately reflected in real-time, ensuring consistency between database records and user interface output.

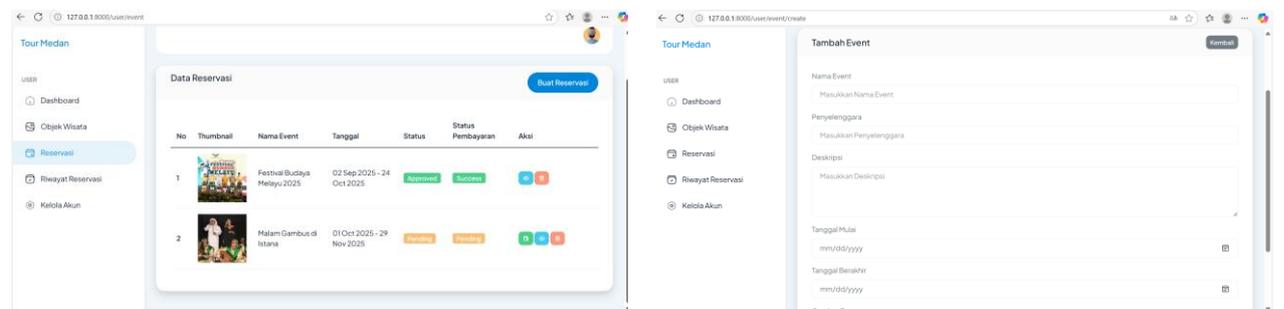


Fig 5. Reservation Module Testing

Testing of the reservation module from the user’s side was carried out to ensure that the ticket booking process for events runs smoothly, from creating a reservation to updating the payment status. The module interface displays a list of events booked by the user along with key information such as the event name, event dates, approval status, and payment status. Users can create new reservations through a form containing event details such as the name, organizer, description, start date, end date, and event image upload. The test results show that the system successfully processes reservations, updates statuses according to the approval and payment progress, and stores newly input event data without significant issues.

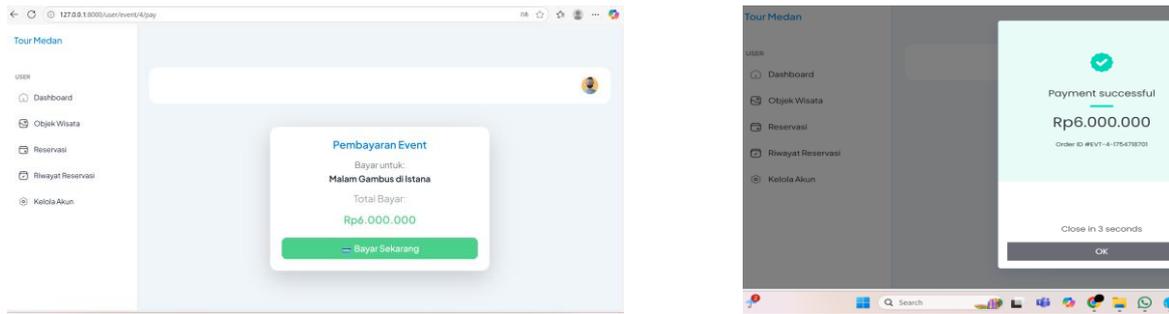


Fig 6. Payment Module Testing

The payment module was tested to ensure that transactions for event reservations can be processed successfully. The test scenario involved selecting an event with a pending payment status, initiating the payment process, and confirming the transaction. As shown in the first screenshot, the system displays the event details, including the event name, total payment amount, and a “Pay Now” button. After the user initiates payment, the second screenshot confirms that the payment was processed successfully, showing the transaction amount, order ID, and a success notification. This test verifies that the payment module is functioning correctly, allowing users to complete transactions seamlessly and receive immediate confirmation of their payment status.

3.4 Discussion

The system testing focused on the three main modules of the application: Event, Reservation, and Payment. The objective was to verify that each module performed according to functional requirements and provided a smooth, error-free user experience.

1. Event Module. The Event module allowed users to view and add event details. The input form included fields for the event name, organizer, description, start date, end date, and event image. During testing, the system successfully validated input and stored event data, indicating correct implementation of the event creation process.
2. Reservation Module. The Reservation module enabled users to book events and track their reservation status. The tested scenario demonstrated that users could view event details, check approval status, and see payment progress. The display of status labels (e.g., *Approved*, *Pending*, *Success*) was clear and informative, making it easy for users to monitor their reservations.
3. Payment Module. The Payment module was tested to ensure the system could process payments accurately and securely. Users were able to proceed from a pending reservation to a completed payment with immediate confirmation. The transaction feedback screen provided order details and payment success notifications, which enhances user confidence in the system’s reliability.

Overall, the integration between modules worked seamlessly. A reservation initiated in the Reservation module could be paid for in the Payment module, with statuses updating appropriately across the system. This confirms that the modules are well-connected and meet the intended functional specifications.

Tabel 1. BlackBox Testing Results

No	Module	Test Case Description	Test Steps	Expected Result	Actual Result	Status
1	Event	Add new event with valid data	Fill in event name, organizer, description, start date, end date, upload image, click "Save"	Event is saved and displayed in event list	Event successfully saved and displayed	Pass
2	Event	Add new event with missing required field	Leave event name blank, fill other fields, click "Save"	System shows validation error message for missing event name	Error message displayed	Pass
3	Reservation	View reservation list	Navigate to "Reservation" menu	System displays all reserved events with status and payment info	Reservation list displayed correctly	Pass



4	Reservation	Make a reservation for an available event	Select an event, click "Reserve"	Reservation is created with status "Pending"	Reservation created successfully	Pass
5	Reservation	View reservation details	Click the "View" button in reservation list	System displays detailed reservation information	Details displayed correctly	Pass
6	Payment	Pay for a reservation with "Pending" status	Select a pending reservation, click "Pay Now", confirm payment	Payment processed, status updated to "Success"	Payment successful and status updated	Pass
7	Payment	Attempt to pay for an already paid reservation	Select a reservation with status "Success", click "Pay Now"	System blocks payment and shows notification	Payment blocked with notification	Pass
8	Payment	Verify payment confirmation screen	Complete payment process	System displays payment success page with order ID and amount	Confirmation page displayed correctly	Pass

4. CONCLUSION

Based on the black-box testing conducted on the main modules of the Tourism Management Information System, namely Event, Reservation, and Payment, all tested functionalities performed as expected. The test results indicated that the system successfully handled event management, reservation creation, and payment processing without critical errors. Validation mechanisms worked correctly, ensuring that incomplete or invalid inputs were appropriately flagged with error messages. In the payment module, the system accurately processed transactions, updated reservation statuses, and displayed confirmation details, including the payment amount and order ID. Moreover, attempts to make duplicate payments were effectively blocked, demonstrating the reliability of the implemented control logic. Overall, the testing outcomes confirm that the developed system meets the functional requirements and is ready for deployment in a production environment to support event reservations and ticketing for the Istana Maimun tourist attraction.

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