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Design and Development of a Web-Based Inventory Application at the Central Bureau of Statistics of Riau Province

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Abstract
This study aims to design and develop a web-based inventory application at the Central Bureau of Statistics (BPS) of Riau Province to overcome the limitations of the existing system. The current inventory system is limited in accessibility, lacks real-time updates, fails to record asset mutation history, and does not provide a dashboard visualization of asset conditions. The research uses a Research and Development (R&D) method with a prototype approach. The system is developed using Laravel 11 for backend services and ReactJS 18.2.0 for the frontend interface. Functional testing achieved a 100% success rate, demonstrating that all system features perform as expected. Additionally, the application scored high in compatibility and portability across platforms, with good ratings for reliability, security, and maintainability based on SonarQube assessments. The developed inventory application enhances transparency, accountability, and efficiency in managing organizational assets at BPS Riau Province.
Keywords: Inventory Application, Web-Based System, ISO 25010, Prototype

INTRODUCTION

The Central Bureau of Statistics (Badan Pusat Statistik or BPS) is a non-ministerial government institution in Indonesia that reports directly to the President. Formerly known as the Central Statistics Bureau (Biro Pusat Statistik), it was restructured under Law No. 16 of 1997 on Statistics, which replaced previous statistical legislation. As mandated by law, BPS is responsible for administering core statistical operations, coordinating statistical activities nationally, and fostering statistical capacity building across institutions. In addition to its primary mandate, BPS Riau Province also holds responsibility for managing office facilities, including inventory management. The inventory system at BPS Riau is divided by asset types and their designated custodians: Information and Communication Technology (ICT) assets, such as computers and access points, are managed by the Integration of Data Processing and Statistical Dissemination (IPDS) Division, while non-ICT items such as office furniture are overseen by the General Affairs Division. Despite this structured division of responsibility, the current inventory management system exhibits several weaknesses. As identified through interviews with Mr. Agus Wardiman, the main inventory data officer at BPS Riau, an ideal inventory system should be online, accessible, integrative, real-time, and updatable. However, the current system falls short of these criteria. It restricts access only to inventory administrators, does not allow real-time data entry or updates, lacks an audit trail for asset transfers, and fails to provide an analytical dashboard that summarizes the asset status in graphical form. These deficiencies hinder transparency, accountability, and efficient decision-making. For instance, the inability to track the history of asset mutations (changes in ownership or location) reduces oversight and complicates audits. Moreover, the lack of visualization impairs users' ability to quickly assess inventory health across categories and conditions. Previous studies have attempted to address similar issues in different contexts. Prayogi et al.

(2021) developed a web-based inventory system for a vocational high school that allowed data input and updates anytime and anywhere. However, their system lacked visual features such as item photos or condition graphs. Another study by Nurhadi and Ridwan (2022) at PT. Fastrata Buana added features such as exporting data to XLS format but still lacked condition-based visuals. Annisa et al. (2023) made further progress by including item images and condition updates but failed to integrate graphical summaries.

These studies provide useful insights but still leave gaps in functionality that are critical for an ideal inventory system. Consequently, this research seeks to integrate and enhance these existing solutions into a unified, more comprehensive inventory application tailored for BPS Riau Province. This includes multiple user roles (admin, staff, supervisor), each with different permissions: administrators manage and update inventory data, supervisors view all items, and staff view only the items assigned to them. Additional features include a real-time dashboard summarizing inventory conditions, a mutation log for asset transfers, and system-wide accessibility. While many inventory systems offer partial functionality such as online access or real-time updates, few integrate all essential components—role-based access, real-time data input, mutation logging, and data visualization—into a single platform. This research addresses that gap by combining these features using modern technologies (Laravel and ReactJS), ensuring performance, security, maintainability, and user satisfaction in line with ISO 25010 standards. To design and develop a comprehensive web-based inventory application that fulfills the needs of BPS Riau Province, improves oversight and management of assets, enables real-time access and updates, supports decision-making through visual dashboards, and records detailed asset mutation history for accountability.

RESEARCH METHODS

This study employed the Research and Development (R&D) method, which is used to develop a new product and assess its effectiveness in solving real-world problems. The R&D method is particularly appropriate when an application is intended to address specific needs, as it allows for iterative evaluation and refinement of the developed system. In this study, the application was developed using a prototype development model, which is ideal for capturing user feedback during the early design stages when requirements are not fully defined. The research phase was conducted through four main stages:

1. Interviews – Interviews were conducted with key stakeholders, particularly Mr. Agus Wardiman, the inventory officer at BPS Riau, to gather information about the current system and the ideal criteria for a modern inventory management solution.
2. Observation – The existing inventory workflow, data management practices, and system usage at BPS Riau were directly observed to understand system limitations and user behaviors.
3. Literature Study – Relevant literature, including previous studies on web-based inventory systems and official documentation from BPS and national statistical governance, was reviewed to support system design decisions.
4. Problem Formulation – Based on the findings from interviews and observations, specific problem statements were derived, and the functional requirements of the new system were documented.

The development of the application followed the Prototype Development Model, which consists of the following stages:

1. Communication. Initial meetings were held with stakeholders to gather basic system requirements and expectations. This step focused on understanding user needs and project constraints.

2. Quick Plan. Project planning included identifying required features, estimating development timelines, and assigning responsibilities. Technical specifications were outlined, including the use of Laravel 11 for backend development and ReactJS 18.2.0 for the frontend.
3. Modeling Quick Design. Early-stage system design models were created using UML (Unified Modeling Language), including Use Case Diagrams, Activity Diagrams, and ER Diagrams to outline functionality and data flow.
4. Construction of Prototype. A minimum viable product (MVP) was built to demonstrate system capabilities. The application was developed incrementally. The developed system was evaluated using multiple criteria derived from the ISO/IEC 25010 software quality standard. The quality characteristics tested include:
   a. Functional Suitability – to measure whether the application performs all required functions.
   b. Performance Efficiency – tested via load simulations.
   c. Compatibility and Portability – assessed by running the application across multiple devices and browsers.
   d. Reliability, Maintainability, and Security – analyzed through SonarQube inspection.
   e. Usability – evaluated through developer testing and user feedback using the User Experience Questionnaire (UEQ). The UEQ provided quantitative data on six dimensions of user experience: Attractiveness, Efficiency, Perspicuity, Dependability, Stimulation, and Novelty. Results were benchmarked using standardized scales to assess user satisfaction.
5. Deployment, Delivery, and Feedback. The prototype was presented to stakeholders for live testing and evaluation. Feedback was collected iteratively and used to improve system performance, usability, and functionality.

RESEARCH RESULTS AND DISCUSSION

The development of the web-based inventory application at BPS Riau Province was carried out iteratively using a prototype model. Several core features were successfully implemented and tested across different user roles: administrators, staff, and supervisors. Key outcomes from the development process include:

1. Multi-role Access**:** The system supports differentiated access levels: administrators can manage and edit all inventory records, staff can view items assigned to them, and supervisors can view all items for oversight.
2. Real-time Inventory Updates**:** The system allows inventory updates to be performed at any time, eliminating the previously rigid update cycles.
3. Mutation Logging**:** Each transfer or change in ownership of an item is recorded in the system to support audit trails and accountability.
4. Dashboard with Visualization**:** A responsive dashboard was integrated using chart libraries to display summaries of item conditions and categories.
5. QR Code Integration**:** Items can be tagged with QR codes, scanning then directly to detailed item pages, allowing easy scanning and tracking.

The results of the application design, meticulously crafted to meet the evolving needs of BPS Riau Province, are as follows:

1. Login Page

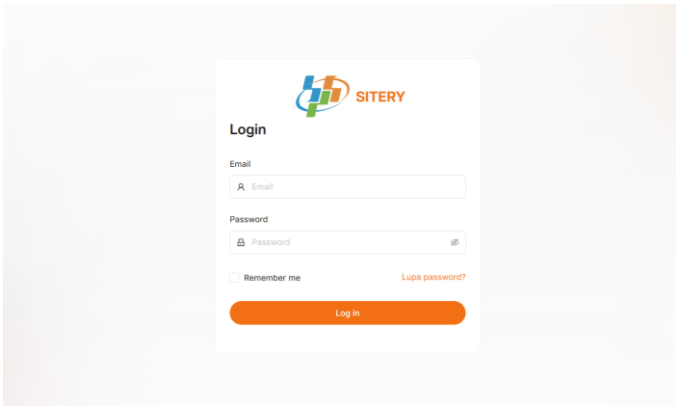

Figure 1. Prototype Login Page

Figure 1 shows the prototype **login page**, which serves as the initial gateway for users to access the system. This page is designed with a simple and straightforward interface, featuring email and password input fields, along with a login button. At the bottom, a link to the forgot password feature is available.

2. Forgot Password Page

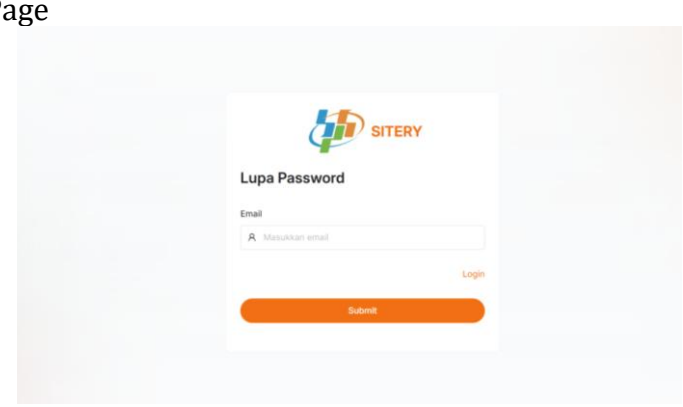

Figure 2. Prototype Forgot Password Page

Figure 2 illustrates the prototype forgot password page, enabling users to recover their account access. By entering their registered email address, users will be sent instructions or a verification code to initiate the password recovery process.

3. Code Confirmation Page

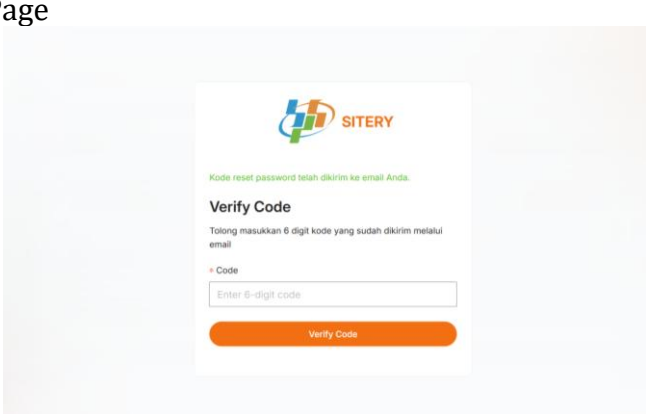

Figure 3. Prototype Code Confirmation Page

Figure 3 displays the code confirmation page, a verification step before users can change their password. This page provides a field for entering the code that has been sent via email.

4. Change Password Page

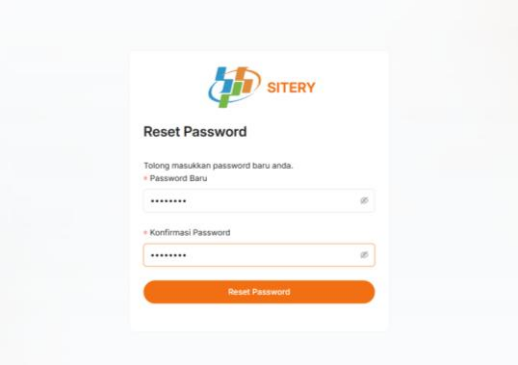

Figure 4. Prototype Change Password Page

Figure 4 presents the change password page, accessible after users have successfully verified the code. Users can create a new password and confirm it through two input fields. This prototype ensures that the password change process is smooth and secure.

5. Dashboard Page

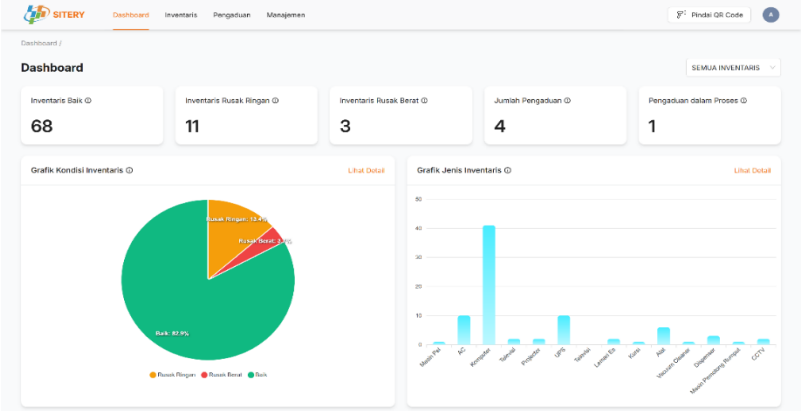

Figure 5. Prototype Dashboard Page

Figure 5 shows the main dashboard page, providing a comprehensive summary of inventory data. This page presents graphical information based on inventory condition and inventory type. This design aims to give users an instant overview after logging in, with engaging and informative visualizations. On this dashboard page, the type of graph display can be specifically changed to show ICT (Information and Communication Technology) items or non-ICT items.

6. Inventory List Page

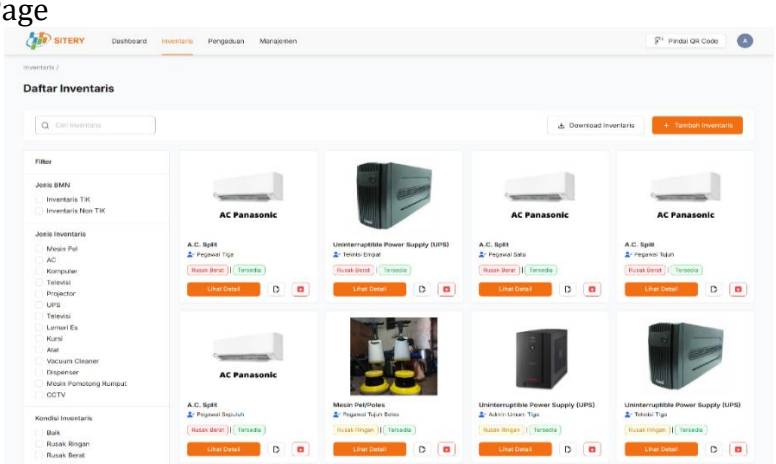

Figure 6. Prototype Inventory List Page

Figure 6 displays the prototype inventory list page, which organizes all item data in the form of cards showing the item image and brief item information. Users can utilize search, filter, and action buttons such as view details, edit, archive, restore from archive, download inventory, and add inventory.

7. Add Inventory Page

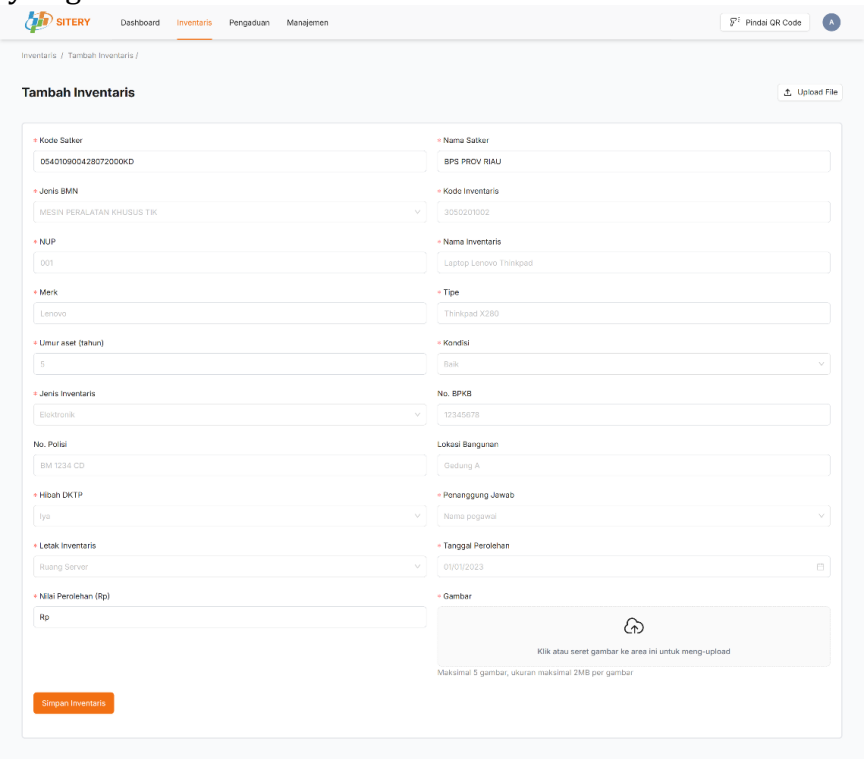

Figure 7. Prototype Add Inventory Page

Figure 7 illustrates the prototype add inventory page, designed for inputting new item data. This page will display a form including various fields such as item name, condition, and other complete information about the inventory item. The design of this page focuses on ease of input and validation to ensure that the entered data complies with established standards.

8. Inventory Detail Page

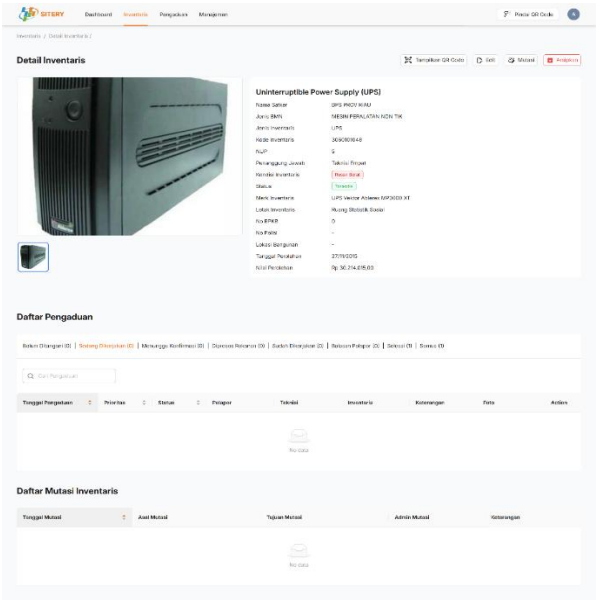

Figure 8. Prototype Inventory Detail Page

Figure 8 presents the inventory detail page, displaying complete information for a single item. Users can view data such as item specifications and mutation history. This page supports traceability and transparency for every registered item.

9. Edit Inventory Page

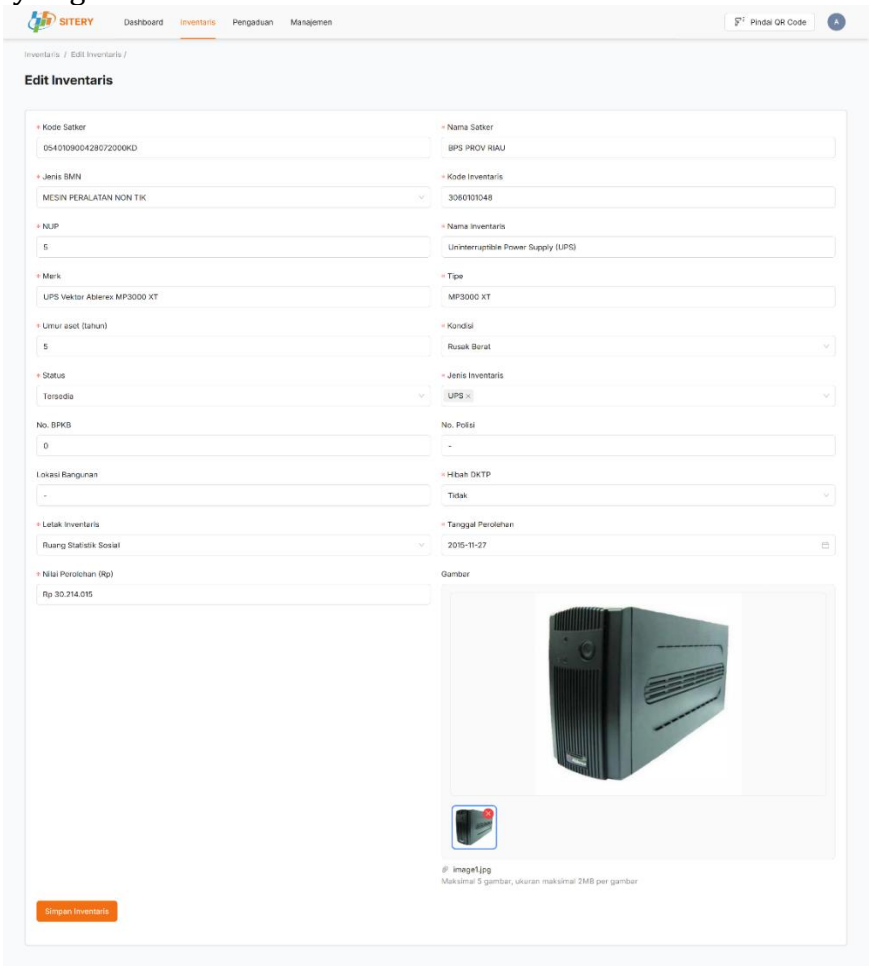

Figure 9. Prototype Edit Inventory Page

Figure 9 shows the edit inventory page, which allows users to update existing item information. Data is displayed in a form that can be modified and then saved back into the system. This page is designed to enable users to perform data updates quickly and accurately.

10. Display QR Code Page

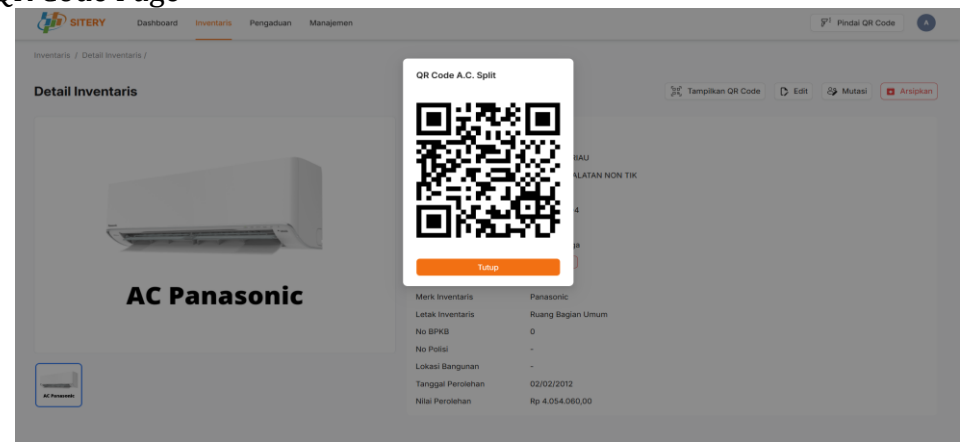

Figure 10. Prototype Display QR Code Page

Figure 10 displays the prototype page that shows a QR Code for each inventory item. This QR Code can be scanned using a mobile device to directly access the item's detail page. This design is highly useful for physical tracking needs and integration with digital inventory systems.

11. Inventory Mutation Page

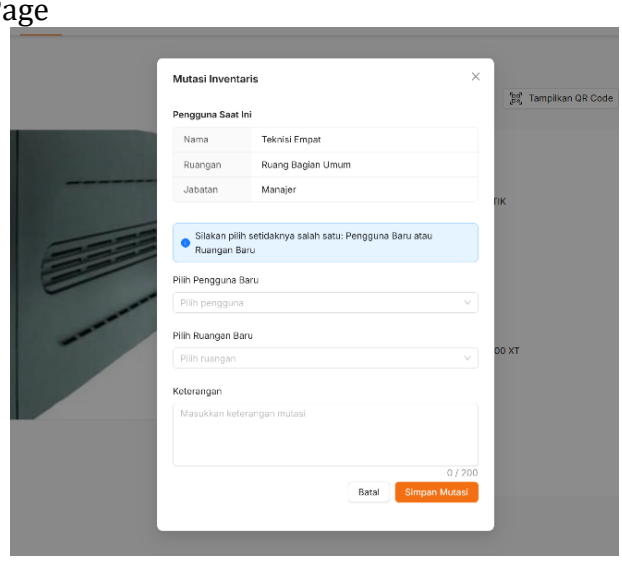

Figure 11. Prototype Inventory Mutation Page

Figure 11 illustrates the inventory mutation modal page, allowing for the transfer of items between rooms or between responsible parties. The mutation form includes options for origin and destination rooms, as well as a description of the reason for the mutation. This page is crucial for maintaining the accuracy of item location data.

12. User List Page

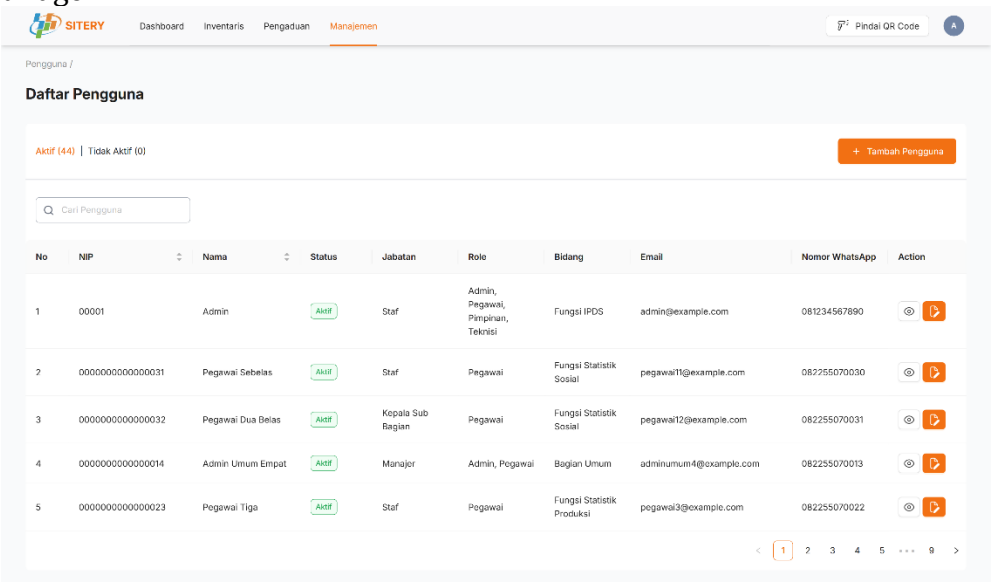

Figure 12. Prototype User List Page

Figure 12 displays the system user list in a table format, accompanied by information such as name, email, and role. Admins can view, edit, or add users from this page. This page's design supports efficient and structured user management.

13. Add User Page

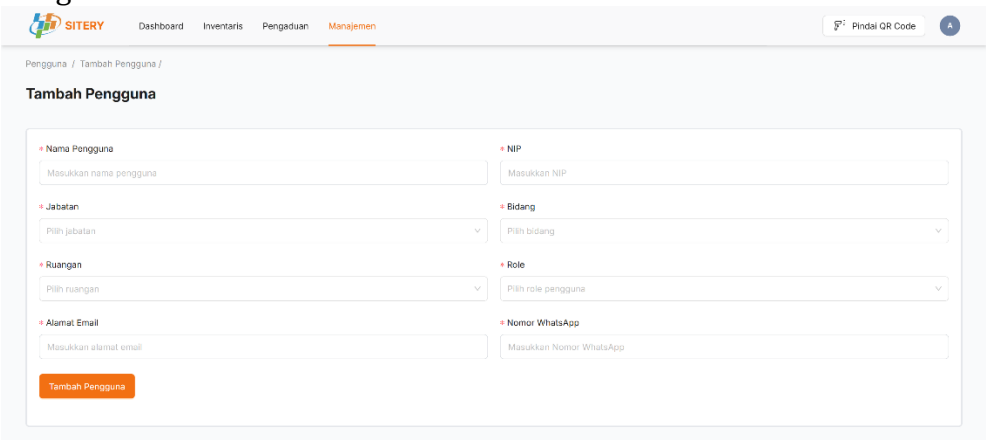

Figure 13. Prototype Add User Page

Figure 13 shows the add user page, designed for administrators to add new accounts. The form contains input fields such as full name, email, and user role. This page's layout facilitates data entry with a clear input flow and validation system.

14. User Detail Page

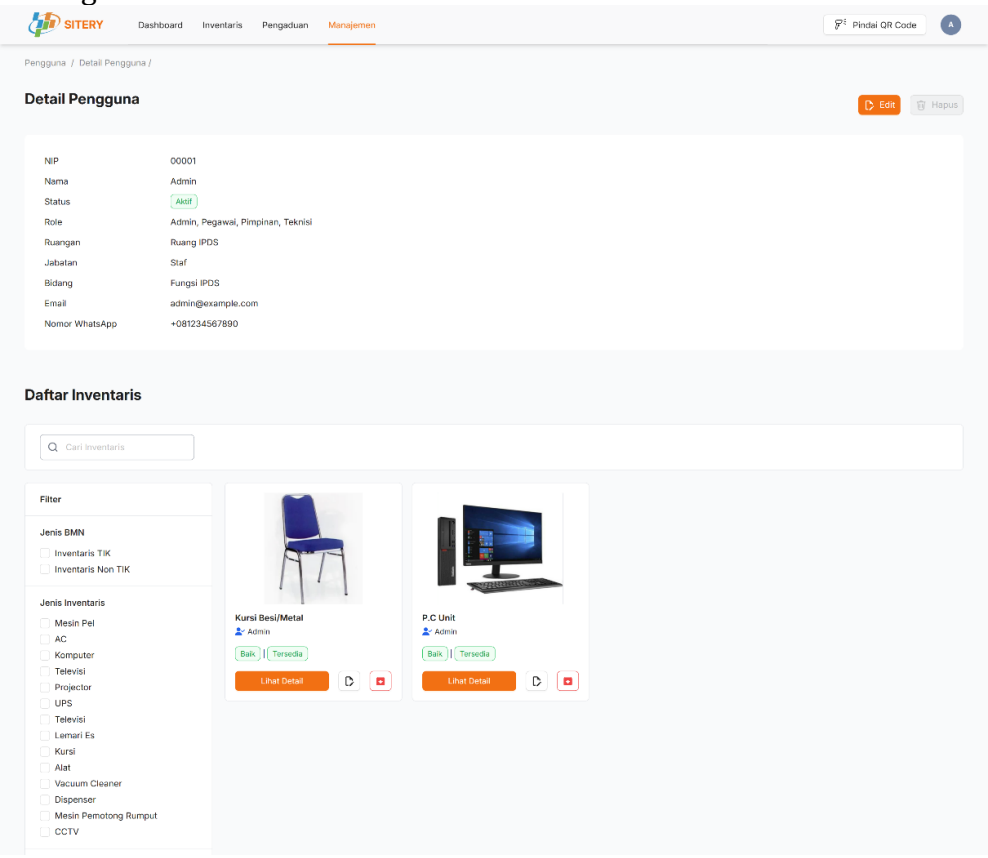

Figure 14. Prototype User Detail Page

Figure 14 presents complete information about a user, such as identity, account status, and access rights. This page is designed to support user data audits and ensure all user information is correctly recorded in the system.

15. Edit User Page

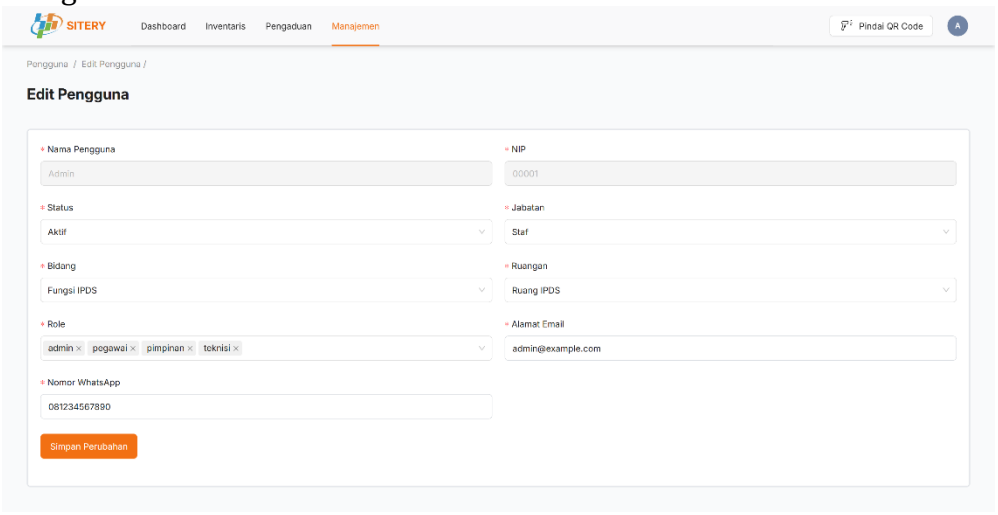

Figure 15. Prototype Edit User Page

Figure 15 displays the page for editing user data, such as updating email or role. This view maintains the design consistency of the form with the add user page, but focuses on modifying already saved data.

16. Room List Page

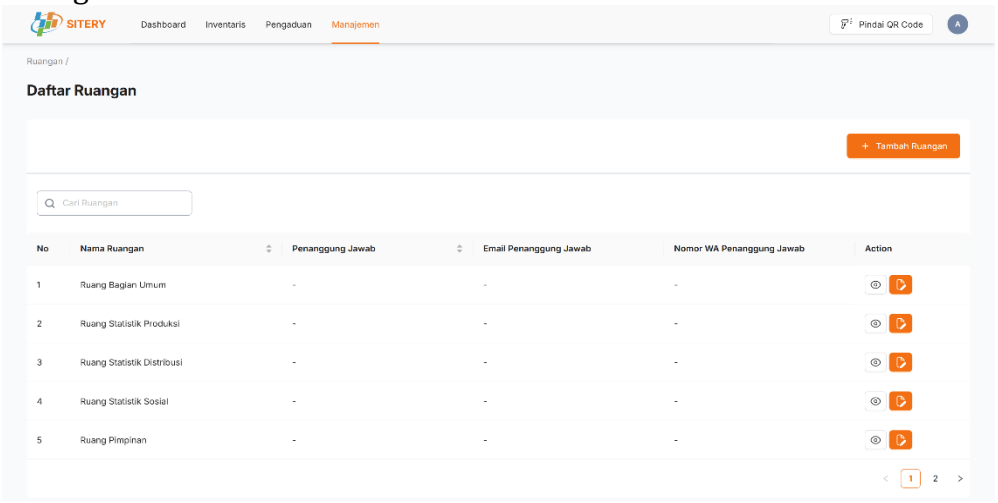

Figure 16. Prototype Room List Page

Figure 16 shows the list of rooms in the system, including room names and the data of the person responsible for each room. This page helps users manage room-related activities such as viewing room details, editing rooms, and adding rooms.

17. Add Room Page

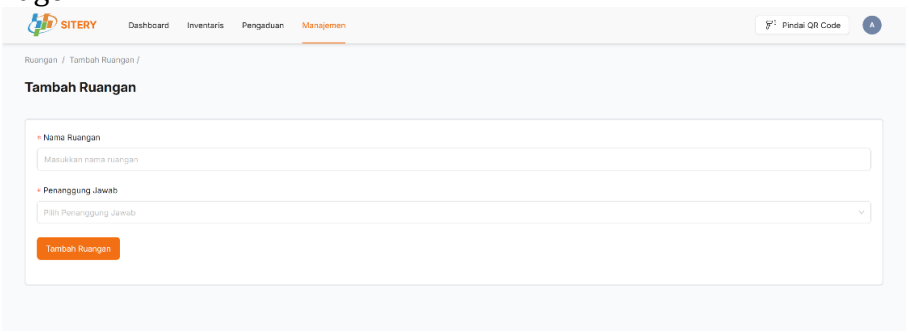

Figure 17. Prototype Add Room Page

Figure 17 illustrates the add room page, which allows users to add new storage locations. The input form includes room name and description, as well as location grouping according to organizational or building structure.

18. Room Detail Page

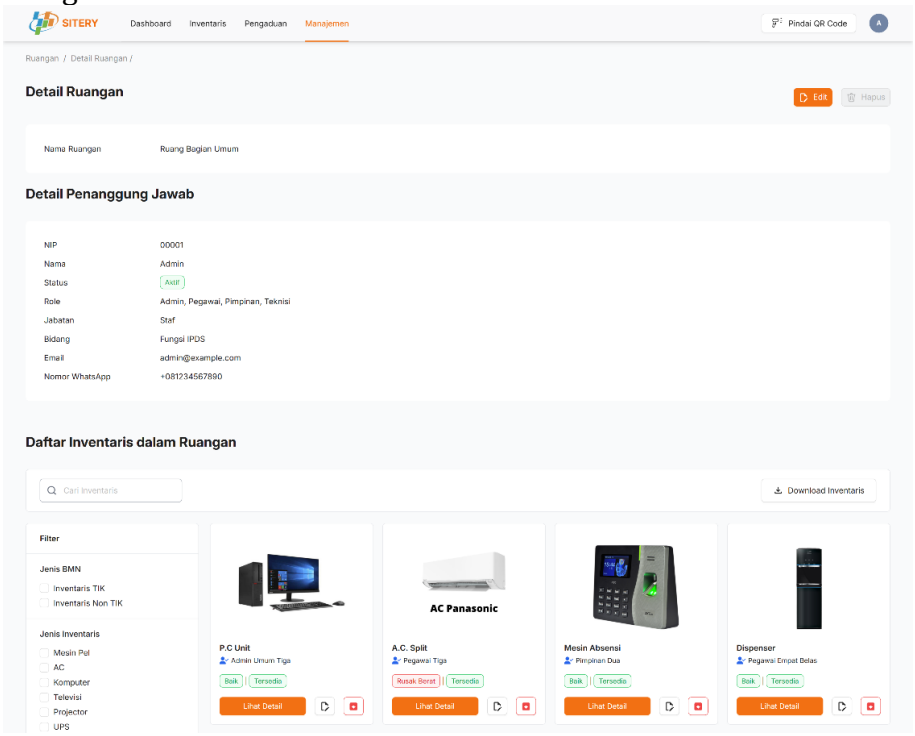

Figure 18. Prototype Room Detail Page

Figure 18 presents detailed information about a room, including the list of inventory items within it. This page supports physical item monitoring based on rooms and ensures the orderly storage of items.

19. Edit Room Page

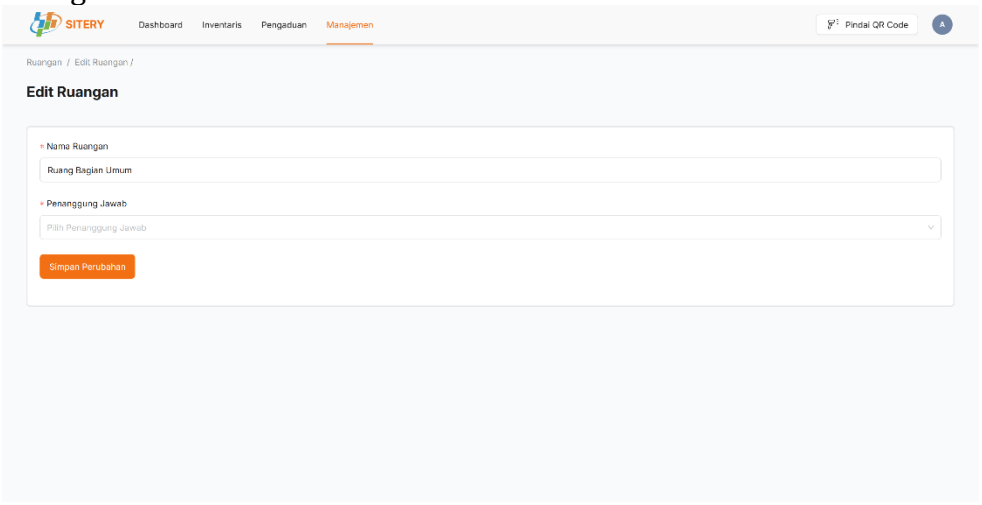

Figure 19. Prototype Edit Room Page

Figure 19 displays the page for updating room information, such as changing the name or responsible party. This page allows for flexibility in room management when organizational structure changes or facility rearrangements occur.

20. Scan QR Code Page

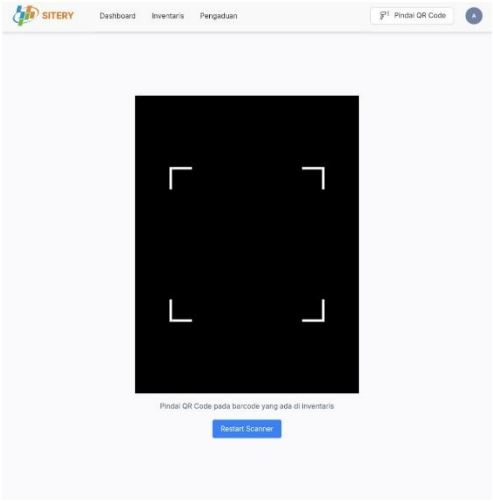

Figure 20. Prototype Scan QR Code Page

Figure 20 shows the page for scanning QR Codes via the device's camera. Once scanned, the user is directed to the related item's details. This page is important for increasing the efficiency of physically searching for inventory through technology support.

21. Add Inventory Page with File Upload

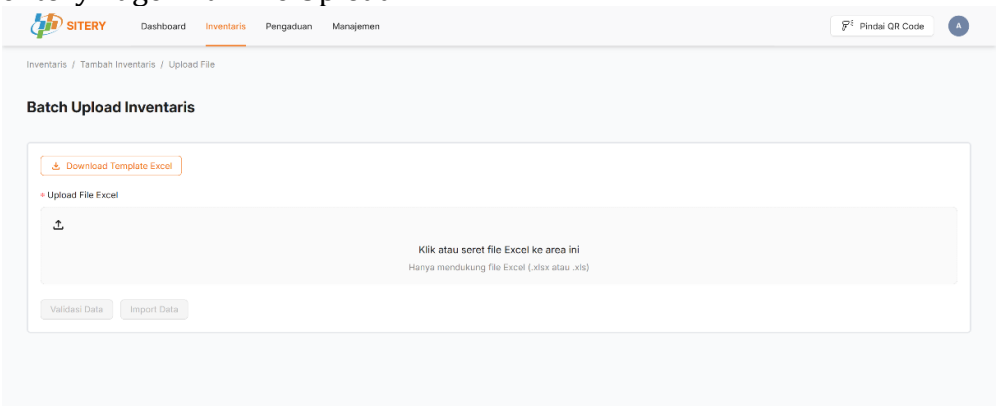

Figure 21. Prototype Add Inventory Page with Excel

Figure 21 shows the functional view of the Excel file upload page. Admins can select a file from their computer, download the required template, and view the upload results after processing by the system for subsequent data import.

The comprehensive testing conducted on the system, adhering to the ISO 25010 standard, demonstrates its robust quality and reliability across various crucial aspects. The results underscore the system's readiness for deployment and its capability to deliver a positive user experience. In terms of Functional Suitability, the system achieved a remarkable 100% feature success rate from 41 feature, indicating that all intended functionalities operate as designed and meet the specified requirements. This high score confirms the system's ability to perform its core tasks effectively. Furthermore, Performance Efficiency was rigorously tested, with the system remaining stable under simulated loads of up to 500 concurrent users. This suggests that the application can handle a significant number of users without compromising its speed or responsiveness. The system also exhibits excellent Compatibility and Portability, being fully compatible across major web browsers including Chrome, Firefox, and Safari, on both mobile and desktop platforms. This broad compatibility ensures a consistent user experience

regardless of the device or browser used. Reliability was a key focus, and testing revealed no critical errors during stress testing, with the system consistently remaining operational. This resilience is vital for maintaining continuous service and minimizing downtime. From a Security standpoint, a thorough code audit conducted with SonarQube showed no major vulnerabilities, highlighting the system's strong security posture and its ability to protect user data and system integrity. Maintainability scored high, indicating that the codebase is well-structured, modular, and readable, which will facilitate future updates, bug fixes, and enhancements. Finally, Usability was evaluated using the User Experience Questionnaire (UEQ), and the system consistently scored above average across all dimensions, confirming its intuitive design and ease of use for end-users.

Discussion

The development of this system directly addresses crucial shortcomings identified in the previous inventory management workflow at BPS Riau. By shifting from static data cycles to real-time data input and updates, the new system enables dynamic and timely inventory tracking. Furthermore, role-based access significantly enhances data integrity by limiting unauthorized modifications, while the integrated mutation logs ensure complete transparency and traceability of asset movement within the institution. From a systems architecture perspective, the choice of Laravel and ReactJS proved to be a robust foundation, providing both scalability and responsiveness. Laravel's RESTful routing and middleware support effectively streamlined backend processes, creating a powerful and efficient server-side. Concurrently, React's virtual DOM was instrumental in enabling rapid UI rendering, which is particularly vital for displaying the real-time graphical dashboards that offer immediate insights into the inventory status. This study notably consolidates and extends features found in prior research, creating a unified system specifically tailored to the operational context of a government institution like BPS Riau. For instance, while Prayogi et al. (2021) lacked asset visuals and graph features, and Nurhadi & Ridwan (2022) enabled XLS export but without a real-time audit trail, this system incorporates both. Additionally, unlike Annisa et al. (2023) which included asset images but not visual dashboards or mutation logs, this system integrates these critical components. A significant enhancement in this study is the inclusion of QR code support, which provides seamless interaction between physical and digital records, thereby boosting operational flexibility and inventory traceability. The positive user experience of the system is further validated by the User Experience Questionnaire (UEQ) results. The application received "Excellent" scores for Attractiveness (1.92), Efficiency (1.75), Perspicuity (1.80), and Dependability (1.78). It also scored "Good" for Stimulation (1.65) and Novelty (1.60). These strong results collectively confirm that the system is not only highly functional and robust but also delivers an intuitive and positive user experience, effectively supporting both administrative and operational tasks at BPS Riau.

CONCLUSION

This study successfully developed a web-based inventory application tailored for the Central Bureau of Statistics (BPS) of Riau Province. The application addresses critical limitations in the existing system, including restricted access, lack of real-time updates, absence of asset mutation history, and the unavailability of visual dashboards. By employing the Research and Development (R&D) method with a prototype development model, the system was built using Laravel for backend processes and ReactJS for the frontend interface. Functional testing demonstrated a 100% success rate across all major features. The application also achieved high performance in terms of compatibility, reliability, and maintainability based on

ISO 25010 standards. Usability testing using the User Experience Questionnaire (UEQ) further confirmed that the system offers an excellent user experience across all six evaluation dimensions. The application is expected to improve transparency, accountability, and efficiency in inventory management at BPS Riau Province. Future research could explore integrating mobile platform compatibility, automated procurement tracking, and advanced analytics to further enhance the system's functionality. The authors would like to thank BPS Riau Province, particularly Mr. Agus Wardiman, for his insights and cooperation during data collection. Gratitude is also extended to the Informatics Engineering Program at Universitas Riau for their academic support, as well as to the faculty advisors and peer reviewers who provided valuable feedback during the research process.

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