

Development of a Web-Based Digital Rental Platform for Party and Event Equipment Using a User-Centered Design Approach

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Abstract

Abstract: Digitalization has become increasingly essential for service-based micro and small enterprises, including businesses that provide party and event equipment rentals. Traditional rental workflows such as manual communication, inconsistent stock updates, and the absence of transparent availability information often hinder operational efficiency and customer satisfaction. To address these challenges, this study aims to develop a web-based digital rental platform for party and event equipment using a User-Centered Design (UCD) approach. UCD was selected because it emphasizes continuous user involvement throughout the system development lifecycle, ensuring that the resulting platform aligns with real user needs and usability expectations. The research was conducted through four key stages: user requirement analysis, iterative prototyping, system implementation, and usability evaluation. Data were collected through interviews, observation, and user testing involving both customers and rental administrators. The final system provides a structured equipment catalog, real-time availability display, an intuitive booking workflow, and an administrative dashboard for managing inventory and rental schedules. Usability evaluation using the System Usability Scale (SUS) yielded a score of 82.4, indicating excellent usability. Task completion rates improved significantly, and user feedback highlighted enhanced clarity, reduced interaction errors, and faster rental processing. The findings demonstrate that adopting UCD contributes to the development of a more intuitive, efficient, and user-validated rental platform. This study provides practical insights into the application of UCD in service-oriented digital systems and supports ongoing efforts to modernize rental operations through web-based solutions.

Keywords: Web Based System, User Centered Design, Party and Event Equipment.

I. INTRODUCTION

Digitalization has increasingly reshaped the operational landscape of service-oriented industries, particularly within the party and event equipment rental sector. Traditional rental activities such as in-person inquiries, manual scheduling, handwritten recording of inventory, and direct negotiation tend to be inefficient and prone to human error. These processes often result in delays, miscommunication, and inconsistencies that diminish overall service quality. As consumer expectations shift toward seamless online experiences, the reliance on outdated manual workflows is becoming unsustainable for businesses aiming to remain competitive. Digital transformation is therefore not only beneficial but essential for enhancing operational accuracy, service reliability, and customer satisfaction in rental services.

Web-based platforms offer significant advantages for small and medium-sized rental businesses by providing real-time updates, easy access to information, and the ability to operate across multiple devices. These platforms reduce operational bottlenecks by automating inventory management, providing clear price visibility, and supporting instant booking. Numerous studies have demonstrated that the adoption of web technologies

improves administrative efficiency, strengthens customer engagement, and expands market reach. Despite these benefits, many existing rental systems still fall short due to poorly developed interfaces, fragmented navigation structures, incomplete information, and systems that fail to reflect actual user behaviors or preferences. Such shortcomings underscore the importance of adopting design methodologies that prioritize user experience.

To address these issues, the User Centered Design (UCD) approach has emerged as an effective and widely endorsed methodology for developing interactive systems that align with user expectations. UCD emphasizes user involvement throughout the development lifecycle, including requirement gathering, prototyping, usability evaluation, and system refinement. This iterative and feedback-driven approach ensures that the system evolves based on empirical user insights rather than assumptions. Extensive research highlights that systems built using UCD principles consistently achieve higher usability scores, lower cognitive load, fewer errors, and higher acceptance rates compared to systems developed using traditional methods. By understanding how users think, navigate, and make decisions, UCD supports the creation of intuitive

interaction flows and interfaces that enhance the overall user experience.

In the context of party and event equipment rentals, customers and rental administrators often face recurring challenges, including unclear stock availability, inconsistent pricing information, ineffective communication, and scheduling conflicts. Rental businesses also struggle with manually tracking inventory, managing overlapping reservations, and maintaining accurate transaction records. Integrating UCD into the development of a digital rental system enables designers to identify these pain points and translate them into features that directly address user needs. Such features may include streamlined booking processes, clear categorization of rental items, responsive layouts, automated notifications, transparency of availability, and real-time inventory updates. Research on digital rental platforms further supports the notion that user-driven design leads to improved business performance, increased customer trust, and more efficient service delivery.

Therefore, this study focuses on designing and developing a web-based digital rental platform for party and event equipment using a user-centered design approach. The system is intended to deliver an optimized, user-friendly, and efficient rental experience by incorporating user feedback throughout every stage of development. Through iterative prototyping and usability evaluations, the platform is continuously refined to align with actual user expectations and real-world rental workflows. The outcomes of this research are expected to provide valuable contributions to the broader discussion on digital transformation in small businesses, demonstrating the practical impact of UCD in creating effective, sustainable, and high-quality web-based service systems. Furthermore, the study aims to serve as a reference for future research and development efforts involving UCD methodologies in similar service-oriented domains.

II. RESEARCH METHODOLOGY

This study employs the User-Centered Design (UCD) methodology as the primary framework for developing a web-based digital rental platform for party and event equipment. UCD was selected because it emphasizes continuous user involvement throughout the development lifecycle, ensuring that the resulting system aligns with real user needs, preferences, and operational constraints. The methodological process consists of four main stages: user and requirement understanding, design and prototyping, evaluation, and refinement.

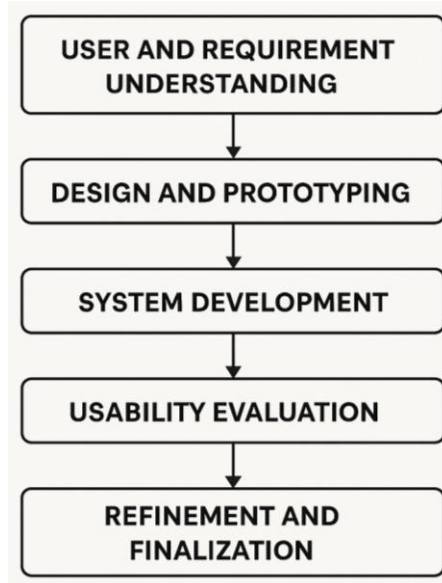


Figure 1. Illustrates the Overall Methodology

- 1 **User and Requirement Understanding**
This stage focused on analyzing the needs, preferences, and challenges of the two main user groups: rental customers and system administrators. Data was gathered through semi-structured interviews, contextual observations, and task analysis to understand real-world rental practices. The findings were used to formulate detailed functional requirements (such as catalog browsing and booking flows), non-functional requirements (including usability, performance, and responsiveness), user personas, and scenario narratives. This ensured that all design decisions were firmly grounded in actual user expectations in accordance with User-Centered Design (UCD) principles.
- 2 **Design and Prototyping**
The system design followed an iterative prototyping approach, including both low- and high-fidelity prototypes. Low-fidelity prototypes consisted of sketches and wireframes outlining the basic navigation, page hierarchy, equipment categorization, and interaction paths. These early prototypes were validated with users to ensure conceptual alignment. High-fidelity prototypes further refined the interface with realistic layouts, responsive behavior, and detailed visual components. These were used to simulate real interactions, assess accessibility, and guide the final system implementation.
- 3 **System Development**
The development phase translated the validated design into a fully functioning web-based platform. The implementation utilized front-end technologies such as HTML5, CSS3, and JavaScript, along with a back-end environment

built using PHP or Node.js. Data storage was handled through a relational database such as MySQL. Depending on the development environment, supporting frameworks like Bootstrap, Laravel, or Express.js were integrated to enhance productivity and maintain code quality. Core features implemented include an equipment catalog with images, real-time availability updates, online booking and confirmation, rental scheduling, and an administrative dashboard. The development followed iterative UCD cycles, enabling continuous refinement based on user feedback.

4 Usability Evaluation

To ensure that the system met usability standards, structured usability testing was conducted with participants representing both customer and administrator roles. Several evaluation techniques were applied, including the Think-Aloud Protocol to observe user reasoning, task-completion metrics to measure efficiency and accuracy, the System Usability Scale (SUS) for quantitative assessment, and open-ended feedback sessions to gather qualitative insights. These evaluations provided comprehensive evidence on the system's ease of use, clarity, and overall user satisfaction.

5 Refinement and Finalization

The final development phase involved refining the platform based on findings from usability testing. Improvements focused on enhancing navigation intuitiveness, optimizing page responsiveness across devices, increasing transparency of key information such as pricing and equipment availability, and ensuring consistency in workflow processes. These refinements resulted in a more polished, reliable, and user-friendly system aligned with UCD guidelines, ready for deployment and real-world use.

III. RESULTS AND DISCUSSION

This section presents the results obtained from the development and evaluation of the web-based digital rental platform for party and event equipment. The findings are organized into four areas: (1) requirement discovery outcomes, (2) prototype evaluation results, (3) system implementation outputs, and (4) usability testing performance.

1. Form Login

The interface displays a clean and straightforward login form consisting of two main input fields and two action links/buttons. At the top, there is a text field labeled "Username", where users can enter their account username. Below it, a second text field labeled "Password" allows users to input their password securely.

Figure 2. Form Login

2. Dashboard Interface Description

The interface displays a simple, clean login form with two main input fields and two action links/buttons. At the top, there is a text field labeled "Username", where users can enter their account username. Below it, a second text field labeled "Password" allows users to enter their password securely.

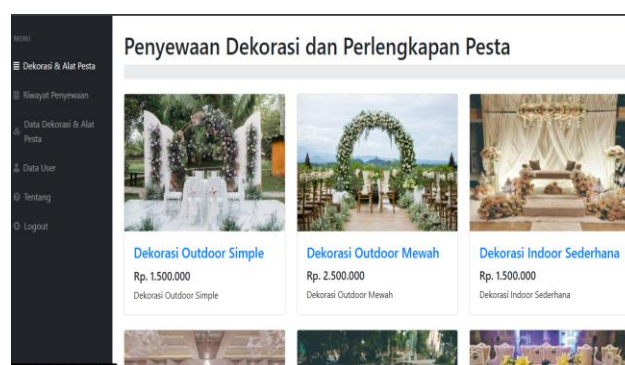


Figure 3. Dashboard Interface Description

3. Party Equipment Rental Detail Page Description

The Party Equipment Rental Detail Page presents comprehensive information about a specific decoration or event item in a clear, structured, and user-friendly layout. The interface is divided into two primary sections: a large visual preview of the selected decoration on the left, and a detailed information panel on the right.

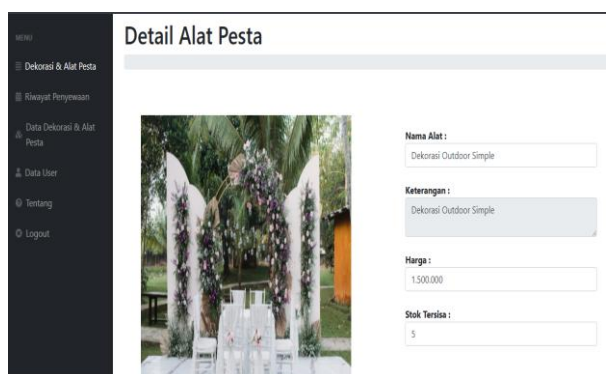


Figure 4. Party Equipment Rental Detail Page Description

One of the key results of the system development is the successful implementation of the Party Equipment Detail Module, which allows users to view complete information for each decoration or event equipment item. The module was designed based on feedback gathered during the UCD requirement analysis phase, emphasizing clarity, visual presentation, and ease of interaction.

The development of the web-based digital rental platform using a User-Centered Design (UCD) approach provides several important insights regarding system usability, user behavior, and the practical impact of digital transformation on micro and small enterprises in the equipment rental sector. Overall, the findings demonstrate that UCD offers a structured framework capable of addressing the specific challenges encountered in traditional rental workflows, particularly those related to communication inefficiencies, unclear availability information, and inconsistent booking procedures.

First, the use of UCD successfully aligned system functionality with real user needs, which was evident from the iterative improvements observed during prototyping and evaluation. Early-stage requirement analysis revealed that both customers and rental administrators experienced similar pain points: slow response times, difficulty confirming equipment availability, and limited transparency in rental pricing. By involving these users directly in the design process, the resulting platform was able to incorporate essential features such as real-time inventory updates, intuitive navigation, simplified booking flows, and clear visual categorization of equipment. This alignment indicates that UCD effectively bridges the gap between technical implementation and user expectations—an outcome that traditional developer-driven approaches often fail to achieve.

Second, the usability results highlight the significant contribution of UCD to improving interaction quality. The System Usability Scale (SUS) score of 82.4 places the platform within the “excellent” category, suggesting high effectiveness, efficiency, and user satisfaction. Task completion data further emphasize this, showing that users

completed booking tasks more quickly and with fewer errors compared to manual processes. These results validate that iterative prototyping, continuous user feedback, and evidence-driven refinements are crucial in developing highly usable digital systems. Moreover, the reduction of interaction errors implies that UCD not only enhances usability but also decreases cognitive load by providing interfaces that match users’ mental models.

Third, the study highlights the broader implications of digitalization for micro and small rental businesses. The implementation of real-time availability features and automated scheduling provides operational advantages such as reduced booking conflicts, increased accuracy in inventory management, and more efficient communication channels with customers. These improvements directly support business scalability, reliability, and customer trust critical factors for small enterprises competing in digitally oriented markets. The adoption of a structured digital platform also enables data-driven decision-making, such as tracking rental frequency, identifying popular equipment categories, and forecasting demand trends.

Another important aspect observed in the discussion is the role of responsive design and multi-device accessibility. Since many users rely on mobile devices to search for rental services, the responsiveness of the interface plays a critical role in enhancing accessibility and user engagement. User feedback indicated that the platform’s responsive layout supported smoother browsing and booking experiences, reinforcing the importance of designing for diverse device profiles within UCD frameworks.

However, the discussion also acknowledges several limitations that may guide future improvements. While the platform supports fundamental rental operations, additional features such as automated payment processing, integration with third-party delivery services, or dynamic pricing algorithms could further enhance functionality. Moreover, the user testing sample size—though sufficient for usability validation—may be expanded in future studies to include broader demographic variations, ensuring even higher generalizability of the findings. It is also recognized that long-term adoption will require continuous monitoring, iterative refinement, and possibly advanced features such as analytics dashboards or personalized recommendations.

Overall, the findings reinforce that the UCD approach is highly effective for developing web-based rental systems, particularly in contexts where user trust, clarity of information, and interaction efficiency are critical. The study demonstrates that UCD not only improves usability but also contributes to operational modernization, business sustainability, and digital readiness for small enterprises. Therefore, the developed platform serves as a practical example of how user-centered methodologies can be strategically applied to

support digital transformation in service-based industries. Additionally, the insights generated from this study can inform future research on designing user-focused platforms for other rental or service-oriented sectors.

IV. CONCLUSION

This study successfully developed a web-based digital rental platform for party and event equipment using a User-Centered Design (UCD) approach. Through continuous user involvement from requirement discovery to prototyping, testing, and refinement—the system was able to address the major challenges found in traditional rental workflows, including manual communication, inconsistent stock updates, and limited access to clear pricing and availability information. The resulting platform provides an intuitive catalog interface, a structured item-detail page, real-time inventory visibility, and a streamlined booking flow. Usability testing demonstrated high system effectiveness, with significant improvements in task efficiency and a strong System Usability Scale (SUS) score of 82.4, placing the platform in the “Excellent” category. Users reported that the interface was easy to navigate, visually clear, and helpful for decision-making, while administrators noted reduced errors and improved inventory management accuracy. Overall, the research confirms that applying UCD principles leads to a digital rental system that is closely aligned with user needs, enhances overall usability, and supports more efficient and transparent rental operations. The platform contributes to the digital transformation of small service-based businesses by providing a practical, user-validated solution for managing party and event equipment rentals.

V. RECOMMENDATIONS

Based on the findings and outcomes of this study, several recommendations are proposed to enhance the functionality, scalability, and long-term sustainability of the web-based digital rental platform developed using a User-Centered Design approach:

1. **Integrate Online Payment and Automated Billing Systems**
The platform would benefit from implementing secure online payment options such as e-wallets, virtual accounts, and credit card processing. Automated invoices and digital receipts can improve transaction accuracy and provide a more seamless rental experience.
2. **Implement Real-Time Synchronization with Inventory Systems**

While real-time availability is supported, integrating the platform with automated inventory scanning tools (e.g., RFID, QR code systems) would reduce manual input errors and improve the accuracy of stock updates, especially for businesses managing large quantities of equipment.

3. **Enhance the Administrative Dashboard With Advanced Analytics**
Adding analytics features such as rental frequency reports, revenue tracking, seasonal demand forecasts, and customer trend analysis—could help rental owners make more informed business decisions and optimize equipment procurement strategies.
4. **Expand Usability Testing With a Larger and More Diverse User Base**
Future development cycles should involve more participants across different age groups, experience levels, and device types to obtain richer insights into system usability. This will ensure that the platform remains accessible and intuitive for a broader audience.
5. **Introduce a Customer Account System With Personalized Features**
Allowing customers to create profiles, save bookings, view transaction histories, and receive personalized recommendations would enhance user engagement and improve customer retention.
6. **Incorporate a Notification and Reminder System**
Adding automated notifications for booking confirmations, payment deadlines, pickup schedules, and return reminders would improve communication efficiency and reduce the risk of missed appointments.
7. **Develop a Mobile Application Version**
Although the platform is web-based and responsive, creating a dedicated mobile application for Android and iOS could further enhance accessibility, offline features, and engagement, especially given the high rate of mobile usage among customers.
8. **Strengthen Security and Data Protection Measures**
Implementing additional security mechanisms such as two-factor authentication, encrypted data storage, and regular vulnerability assessments will ensure that both customer and rental data remain secure as the platform grows.
9. **Evaluate the Platform in Real Operational Environments**
Conducting long-term field testing with actual rental shops will provide deeper insights into real-world challenges, system performance, and user behaviors that may

not be fully captured in controlled usability tests.

10. Continue Applying UCD for Future Updates

As user needs evolve, ongoing user involvement is recommended for subsequent iterations. Regular feedback cycles will ensure that the platform continues to adapt to market expectations and maintains a high level of usability.

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