

Design of a Website-Based Climbing Equipment Registration and Rental Information System Using the Waterfall Method

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Abstract

This research was motivated by the manual registration and equipment rental process at Lembah Lohe, Gowa Regency, which led to data recording errors, data loss risks, and low administrative efficiency. The objective of this study was to design a web-based hiking registration and equipment rental information system to improve data management effectiveness. The research applied the Waterfall method consisting of requirement analysis, system design, implementation, testing, and maintenance stages. The system was developed using PHP and MySQL and tested using Black Box Testing (Alpha and Beta). The results showed that all system functions operated according to specifications, and Beta testing produced an average index score of 82.40%, categorized as Very Good. Therefore, the developed system improves efficiency, accuracy, and accessibility of information for both hikers and administrators.

Keywords: *equipment rental, hiking, information system, waterfall*

1. Introduction

Indonesia has enormous potential for natural tourism, particularly in the mountain tourism sector, which is spread across various regions [1][2]. Climbing activities not only serve as a means of recreation, but also contribute to the economic development of local communities through registration services and rental of climbing equipment [3]. Gowa Regency is one of the areas with this potential, especially the Lohe Valley area which is increasingly popular with climbers [4][5]. This increase in the number of visitors requires a more effective and structured administrative management system.

However, the climbing registration and equipment rental processes in the Lohe Valley are still done manually, potentially leading to recording errors, data loss, and limitations in reporting [6]. Furthermore, information related to climbing procedures and equipment availability has not been digitally integrated, making it difficult for climbers to obtain information quickly and accurately. However, the implementation of a digital-based information system has been proven to improve data management efficiency and administrative transparency [7][8].

Based on these problems, it is necessary to develop an integrated website-based rock climbing equipment registration and rental information system. This study uses the Waterfall method because it has systematic and well-documented development stages, and is in accordance with clearly defined system requirements [9][10][11]. With this approach, the system is expected to improve the effectiveness of administrative management, data accuracy, and service quality for climbers and managers in the Lohe Valley area.

2. Theoretical Foundation

2.1. Waterfall Methods

Yang The Waterfall method is a sequential and systematic software development model, where each stage is carried out sequentially, starting from requirements analysis to system maintenance [10]. This model emphasizes clear documentation at each phase, thus facilitating the process of controlling and evaluating system quality. The main stages in the Waterfall method include requirements analysis, system design, implementation, testing, and maintenance. This approach is suitable for systems with clearly identified requirements from the early stages of development [11].

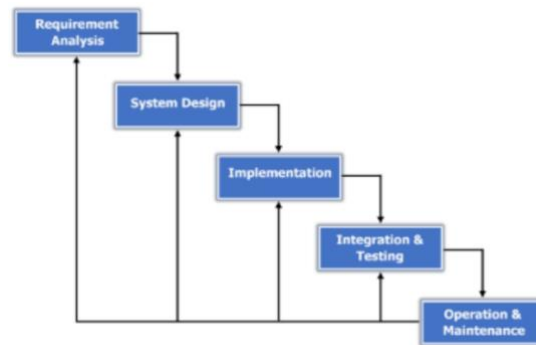


Fig. 1: Metode Waterfall

Based on the figure, the development process begins with the needs analysis stage to identify problems and specifications for the system to be built. Next, the system design stage is carried out, which includes modeling using UML and database design. The implementation stage is carried out through a coding process according to the design that has been prepared. After the system is developed, testing is carried out to ensure that all functions run according to specifications. The final stage is maintenance, which aims to correct errors and adjust the system if there are changes in needs. The application of the Waterfall method in this study was chosen because it is able to provide a structured, well-documented development flow, and is in accordance with the characteristics of systems that have relatively stable needs [9][10][11].

2.2. Management Information

An information system is an integrated system consisting of software, hardware, procedures, and human resources components that work together to process data into useful information to support decision making [12]. In the context of digital-based service management, information systems play a role in increasing data processing efficiency, accelerating information access, and minimizing administrative errors through centralized data storage [13]. The application of information systems to rock climbing registration management and equipment rental aims to create a more structured, transparent, and well-documented administrative process, thereby improving the quality of service to users [8].

2.3. Website

Websites are a crucial element in supporting the success of all university missions in the future. Website evaluation can be done by assessing the design, usability, and popularity of the content, which is usually measured by the number of visits or visitors [10]. With the advantages of website technology, such as easy access via a browser without the need for additional installation, users can obtain the information they need anytime and anywhere. In addition, the process of updating data on websites also tends to be faster and more practical than conventional applications, thus supporting the presentation of information that is always relevant and up-to-date [11]

3. Research Method

3.1. Analysis

The research phases were conducted systematically, following the Waterfall model. These phases included observation and interviews to identify system requirements, analysis of functional and non-functional specifications, design using UML and databases, implementation through PHP and MySQL coding, and testing using Black Box Testing. The final phase, maintenance, was conducted to ensure optimal system performance. This phased approach ensured structured system development that met user.

3.2. Design

Use case diagrams are an important component of the Unified Modeling Language (UML) used to represent the functional requirements of a system by modeling the relationship between users (actors) and the system. Through the use of use case diagrams, system requirements can be formulated systematically and easily understood from the early stages of development, thus supporting the process of needs analysis, system design, and testing stages [14].

a. Use Case Diagram

Use Case Diagram depicting the interaction between two actors, namely the Manager and the Climber, in a website-based climbing equipment registration and rental information system. The Manager is responsible for managing registration data, rentals, equipment data, and reports, while the Climber can register an account, register for climbing, rent equipment, and view history and related information. All system activities are carried out after the login process as an authentication mechanism and access control in figure 2.

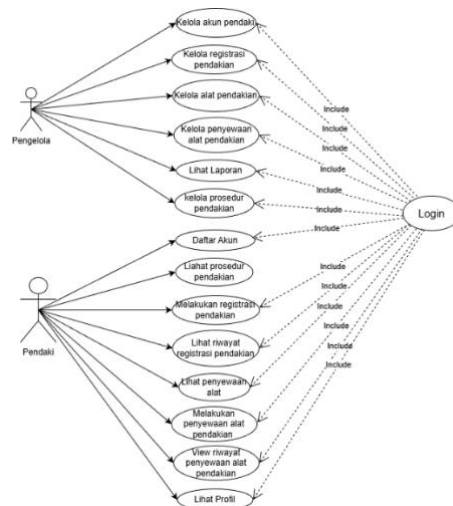


Fig. 2: Use Case Diagram

b. Database Skema

The database schema is designed using a relational model to integrate the climbing registration and equipment rental processes. The main tables include users, climbing_registration, rental, tools, and tools_category, which support user data management, registration, transactions, and equipment inventory. The transaction process is managed through the cart, cart_item, rent_item, and payment tables to record item details, duration, status, and payment verification in a structured manner. Supporting tables such as notification, pos_config, procedure_item, and hiking_member complete the system's functions. Relationships between tables use primary keys and foreign keys to maintain data integrity and consistency in a centralized and systematic manner.

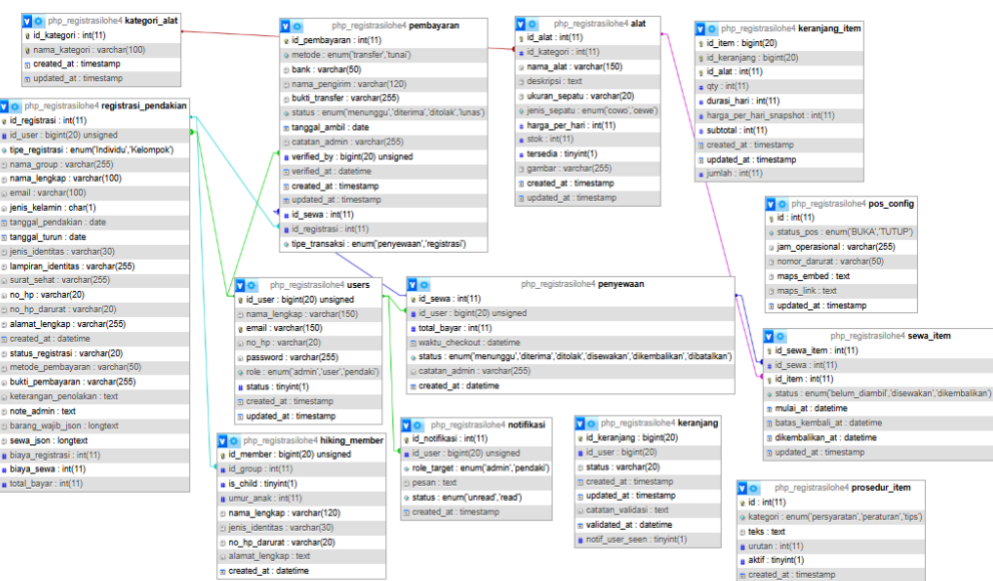


Fig. 3: Database Svhemta

4. Research Result

The results of the study indicate that the website-based climbing equipment registration and rental information system was successfully developed and implemented according to user needs. Based on Black Box Testing (Alpha), all main functions of the system run according to the designed specifications. Meanwhile, the results of Beta testing involving 41 respondents obtained an average index of 82.40% which is in the Very Good category, so the system is considered suitable for use and able to improve the efficiency, accuracy, and ease of managing climbing administration and equipment rental.

1. Climber Registration Page

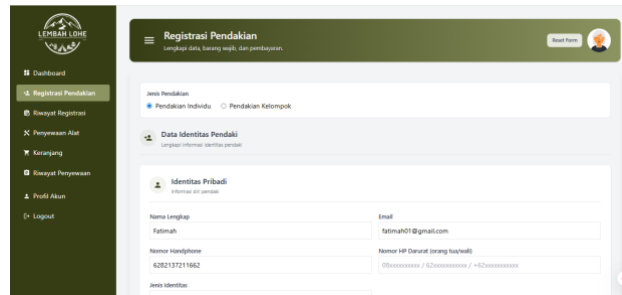


Fig. 4: Climber Registration Page

The registration page is used to input identity information and select the type of climb. Validated data will be stored in the database and can be viewed through the registration history.

2. Equipment Rental Page

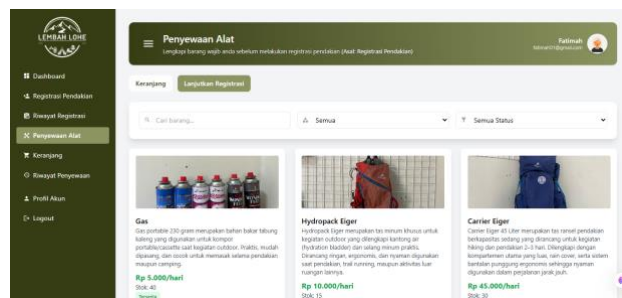


Fig. 5: Equipment Rental Page

The equipment rental page displays a list of available climbing equipment, complete with pricing, category, and stock levels. Climbers can select the equipment they need and proceed with the online rental process. This interface is designed to provide easy access to information and improve transaction efficiency.

3. Equipment Data Management Page

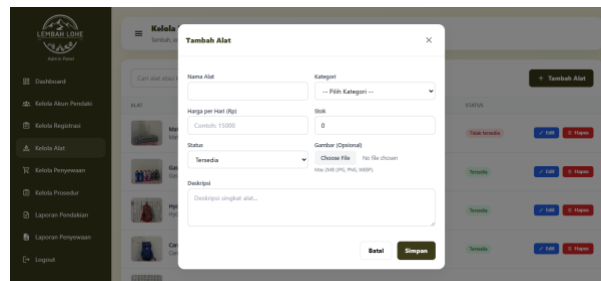


Fig. 6: Equipment Data Management Page

This page is used by managers to add and update climbing equipment information, including categories, prices, and stock quantities in a structured manner.

4. Registration Data Management Page

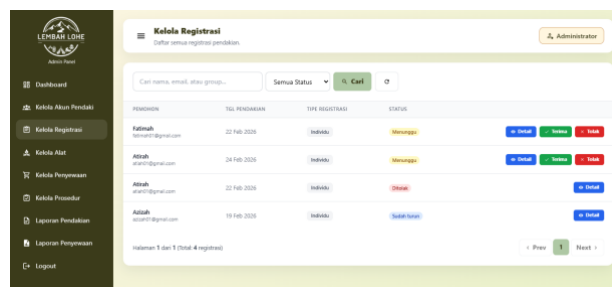


Fig. 7: Registration Data Management Page

The registration data management page is used to monitor and verify climber registration data. Administrators can view registration details, approve or reject applications, and systematically manage data. This feature supports a more transparent and efficient administration process.

4.1. Blackbox (Alpha) Test Results

Blackbox (Alpha) testing was conducted to verify the system's functionality meets the designed specifications. Testing focused on key features, namely login, climbing registration, and equipment rental, using both normal and error test scenarios. The test results demonstrated that the system was capable of processing valid input and producing expected output, while also rejecting incomplete or inappropriate input through a validation mechanism. Overall, all key system functions performed well and met established functional requirements.

4.2. Blackbox (Beta) Test Results

Blackbox (Beta) testing was conducted with 41 respondents, consisting of climbers and administrators, to evaluate the system's acceptance and quality. The evaluation was conducted through a questionnaire using a Likert scale with six assessment indicators, including interface appearance, ease of operation, feature use, response speed, system consistency, and ease of information monitoring. The analysis results showed an average overall index of 82.40%, which is in the Very Good category. These results indicate that the developed system has met user expectations and is suitable for implementation in supporting the digital management of climbing equipment registration and rental.

5. Conclusion

This study successfully designed and implemented a web-based hiking registration and equipment rental information system using the Waterfall development method. The system integrates registration and rental services into a structured digital platform, improving administrative efficiency, data accuracy, and service quality. Alpha testing confirmed that all main functions operated according to specifications, while Beta testing involving 41 respondents resulted in an average score of 82.40% (Very Good category). These findings indicate that the proposed system is feasible and effective in supporting the management of hiking activities at Lembah Lohe.

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