Development of a Website-Based Information System for Recapitulating Sea Practice Assessment Scores in the Nautical and Marine Engineering Study Programs at the Politeknik Transportasi Sungai, Danau, dan Penyeberangan Using the Prototype Method

Paulina M Latuheru[1], Raden Muhamad Firzatullah[1*], Miko Priambudi[1], Dadang Abdul Aziz[1], M. Zuchoir Rangkuti[1], Alya Vanhiaz[1]

[1]Politeknik Transportasi Sungai, Danau dan Penyeberangan Palembang, Indonesia

Email: firza.bogor@gmail.com

Abstract : This research was conducted at Politeknik Transportasi Sungai, Danau, dan Penyeberangan (Poltektrans SDP) Palembang to support vocational education in the Nautical and Marine Engineering study programs, which adhere to the International Maritime Organization (IMO) and STCW standards. As part of their academic requirements, students must complete a 12-month sea-training program and receive assessments from academic supervisors and onboard mentors. The previous manual assessment process resulted in several issues, including delays in data submission, difficulties in coordination, and potential manipulation of scores by students. Therefore, this study aims to develop a web-based information system to facilitate effective, transparent, and accountable recording of sea-training assessment scores. The Prototype method was applied to allow iterative system development based on user feedback, while the White Box Testing method was used to ensure system quality and reliability. The results indicate that the proposed system successfully improves assessment efficiency, minimizes errors, and enhances transparency in managing sea-training scores for students at Poltektrans SDP Palembang.

Keyword: Cadet, Score Recording, Sea-Training

1. INTRODUCTION

Politeknik Transportasi Sungai, Danau, dan Penyeberangan (Poltektrans SDP) Palembang is a higher education institution that provides vocational education in the study programs of Inland Waterway Transportation Management, Nautical Studies, and Marine Engineering [1]. Based on the Regulation of the Minister of Transportation Number 105 of 2018, this institution aims to produce competent human resources in the field of water transportation, particularly in the operational and technical management of vessels [2].

In implementing the educational curriculum for the Nautical Studies and Marine Engineering programs, Poltektrans SDP Palembang refers to the International Maritime Organization (IMO) Model Course and the Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) [3]. These standards require students enrolled in the Nautical Studies and Marine Engineering programs to complete a 12-month sea training onboard a vessel. During this training period, students are assigned several field-based project courses equivalent to the credit load of two academic semesters [4].

During the sea training, students are supervised by two academic advisors from Poltektrans SDP Palembang and one onboard supervisor from the vessel's crew at the training location [5]. Upon completing the sea training, as evidenced by entries in the seaman's book, students will receive grades for the relevant courses from both academic advisors and the onboard supervisor [6].

However, in practice, the assessment process is still conducted manually[7]. This results in several issues, such as communication barriers between onboard supervisors and program administrators responsible for managing student grades [8]. Additionally, the manual process opens the possibility for grade manipulation by irresponsible students. Therefore, a more effective and efficient solution is needed to ensure accurate and transparent grade recording [9][10].

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To address these challenges, this research aims to develop a website-based information system that can be used for recording and managing the sea training grades of students in the Nautical Studies and Marine Engineering programs at Poltektrans SDP Palembang [11][12]. The system is expected to enhance transparency and efficiency in managing sea training assessments [13][14][15].

The development of this information system will utilize the Prototype Method, allowing iterative system development based on user feedback. Furthermore, to ensure system quality, White Box Testing will be conducted to identify and fix potential errors in system implementation.

With the implementation of this website-based information system, it is expected that the student sea training assessment process can be carried out more effectively, transparently, and accountably, thereby supporting improvements in the quality of education at Poltektrans SDP Palembang.

2. METHODOLOGY

2.1. RESEARCH FRAMEWORK

The flowchart above illustrates the research stages in the Development of a Web-Based Information System for Recording Sea Training Grades using the Prototype method. The research begins with Problem Identification, where the main issues within the manual student grade recording system are identified. Following this, Data Collection is conducted through literature studies and interviews with stakeholders such as academic supervisors and onboard instructors.

After data is collected, the next stage is System Design using the Prototype Method, which aims to design an initial system based on the analyzed requirements. From this design, a Prototype Development phase is executed, producing an early version of the information system to be developed. This prototype then undergoes an Evaluation Stage, where users (lecturers, students, and onboard supervisors) provide feedback on the initial design. If the prototype does not meet expectations, revisions are made before re-evaluation.

Once the prototype is approved, the process proceeds to System Development, which involves creating the final version of the information system based on the validated prototype. After development, System Testing using White Box Testing is conducted to evaluate the source code and ensure that the system functions according to the expected specifications. If the system fails this testing phase, it returns to the development stage for improvements.

If the system passes the testing phase, it moves to System Implementation, where the system is deployed in the real environment at Politeknik Transportasi Sungai, Danau, dan Penyeberangan Palembang. Following implementation, Result Analysis and Evaluation are carried out to assess the system's effectiveness in simplifying the sea training grade recording process. Finally, the research concludes with Conclusions and Recommendations, documenting the outcomes and providing suggestions for future development. The final stage is Completion, marking the end of the research process.

This flowchart provides a systematic overview of how the information system is developed through structured phases to ensure that the final system effectively meets user needs.

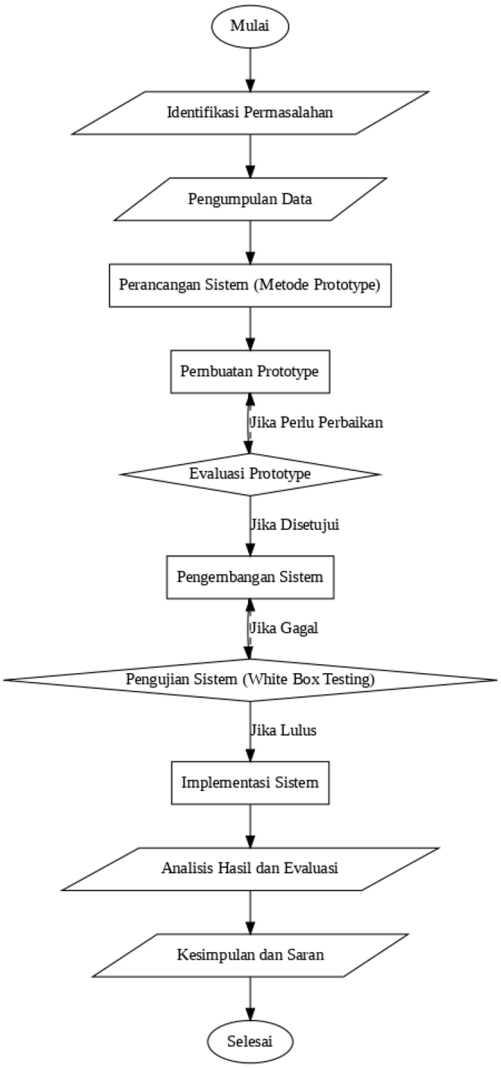

Figure 1. Research Framework

2.2. INFORMATION SYSTEM DEVELOPMENT STAGES

The Prototype Method is an approach in software development that enables system designers to create an initial model that can be tested and improved before the final system is developed. In this study, the development of a web-based information system for recording sea training scores was carried out through several main stages. The first stage was requirements identification, which involved gathering information from system users, such as academic supervisors, onboard supervisors, and students, to understand the necessary system features.

Next, the prototype design phase was conducted by creating an initial system design that included the user interface and basic system structure based on the collected requirements. After the initial prototype was completed, an evaluation and improvement phase was performed by involving users to provide feedback on the system's design and functionality.
If deficiencies or features requiring adjustment were found, the prototype would be refined until it met user expectations. Once the prototype was approved, the system was fully developed by implementing the main features, integrating the database, and optimizing system performance. The final stage was system implementation and testing, in which White Box Testing was used to ensure that all program flows operated correctly and in accordance with user needs. By using the Prototype Method, the information system could be developed more flexibly and responsively according to user requirements before full implementation.

a) Requirements Identification

The requirements identification stage is the initial step in information system development to ensure that the system created truly aligns with user needs. In this study, requirements identification involved collecting information from various stakeholders in the sea-training score recording process, namely students, academic supervisors, and onboard supervisors. Data was obtained through interviews, observations, and analysis of the existing manual system.

Based on this stage, several key issues were identified, such as manual scoring processes that caused delays, susceptibility to data manipulation, and difficulty in accessing and compiling scores from various locations. Therefore, the developed system must enable real-time score input and recording, improve transparency in assessments, and facilitate communication between students, academic supervisors, and onboard supervisors. With clear requirements identification, system development becomes more focused and effective in addressing existing issues.

b) Prototype Design

The prototype design stage is a crucial step in system development to produce an initial system model for testing and further refinement. At this stage, user interface (UI/UX) design, database structure, and system workflow were created based on identified user needs. The design process began by creating simple wireframes showing system layout and navigation, including main features such as score input by supervisors, student access to score reports, and verification by academic supervisors.

In addition, a structured and secure database was designed to store score data and maintain integration among students, academic supervisors, and onboard supervisors. After the initial design, an interactive prototype was developed using suitable design tools or frameworks, enabling users to review and provide feedback before full system development. If improvements were needed, the prototype would be updated accordingly. This approach ensures flexible and adaptive development, reducing the risk of errors during implementation.

c) Prototype Evaluation and Improvement

The prototype evaluation and improvement stage aims to ensure that the developed system meets user needs before full implementation. Once the initial prototype was designed, testing was conducted by involving potential users—academic supervisors, onboard supervisors, and students—to evaluate functionality, usability, and compatibility with sea-training score recording procedures.

This evaluation was carried out through direct prototype trials, where users provided feedback regarding aspects needing improvement, such as interface design, navigation flow, and system performance. If shortcomings were found, adjustments were made to improve the prototype until it met user expectations. This iterative process ensures that the system is adaptable to user needs, minimizes implementation risks, and ensures that the final system improves efficiency and accuracy in sea-training score recording.

d) Final System Development

The final system development stage involves fully building the information system after prototype evaluation and refinement. During this phase, program coding was implemented, the database was integrated, and system performance was optimized to ensure smooth operation in a real environment. All key features—such as score entry and verification by supervisors, real-time access by students, and automated score compilation—were developed while ensuring data security and usability.

Furthermore, the system was tested to ensure all components function as specified. System development also included optimizing website responsiveness for access on various devices, such as computers and mobile phones. After full system development, trials were performed prior to official deployment to ensure system reliability and functionality in supporting sea-training score recording.

2.3. Evaluation Instrument

System testing is an important stage in the software development process to ensure that the system operates in accordance with the specified requirements. In this study, the system testing process utilized the White Box Testing method. This method was selected because it focuses on testing the internal structure, logical flow, and source code of the developed information system.

White Box Testing is a software testing technique that examines the program code directly by analyzing its internal structure. The objective of this testing is to evaluate how the system processes inputs, how decisions are made within the program code, and to ensure that no logical or security errors are present in the system. Through this method, each code branch, loop, and logical statement is tested in detail to detect potential bugs or errors.

In this research, the web-based information system for sea training score recording was tested through the following stages:

- **Code Structure Analysis**
  The testing process began by analyzing the system's code structure, including programming logic used for score calculation, input validation, and data storage into the database.
- **Program Flow Testing (Control Flow Testing)**
  This stage tested the execution flow of the program to ensure that every conditional branch (if-else), loop, and logical instruction functioned correctly.
- **Condition and Decision Testing (Decision Testing)**
  Each condition in the program code was tested to determine whether the decisions made by the system were accurate. For example, the processing of student grades must comply with applicable academic guidelines.
- **Data Flow Testing**
  Testing was performed to ensure that each variable in the code was properly initialized, manipulated, and utilized without causing errors or data leakage.
- **Loop Testing**
  Each iteration process in the system, such as displaying a list of student grades or performing grade recap, was tested to avoid infinite loops or other logical errors.

Testing was conducted using programming and debugging tools such as Python Debugger (pdb) or debugging features in the development framework used, such as Django Debug Toolbar. Each section of the tested code was evaluated based on its execution results to determine whether it functioned as expected or required improvement.

White Box Testing results were then compared with the predetermined testing scenarios. If any logical errors were found, corrections were made before further system implementation. Additionally, this testing process helped improve system efficiency and security so it could operate optimally in the student sea training score recording process.

By applying the White Box Testing method, the web-based information system developed is expected to have a more structured codebase, be free from logical errors, and operate optimally in managing sea training grade data for students at the Politeknik Transportasi Sungai, Danau, dan Penyeberangan Palembang.

3. Result and Discussion

3.1. Implementation

Based on the analysis and planning that have been conducted, the next step is the development of the system components to be implemented. The implementation of the information system serves as a benchmark for evaluating the design process and the full deployment of the system, both in terms of software and hardware components.

3.2. Software and Tools

The software used in the development of the information system serves to control essential hardware components, including the operating system, programming language, and supporting utilities. The software tools utilized in this project include Microsoft Windows 11 as the operating system, XAMPP as the local

server environment, Microsoft Visual Studio Code as the code editor, Microsoft Edge as the web browser, Postman for API testing, Composer as the dependency manager, and CodeIgniter 3 as the PHP framework for system development.

3.3. HARDWARE

Hardware plays an important role in program development and data processing, as proper implementation of the designed information system requires hardware that is compatible with the proposed system. The hardware used in this project includes an MSI Thin laptop with a 10th-generation Intel Core i7 processor, 8 GB of RAM, an Nvidia GeForce RTX 2040 GPU, and a 512 GB SSD. Additionally, a virtual machine was utilized with 2 vCPUs, 4 GB of RAM, and a 60 GB SSD.

3.4. INTERFACE

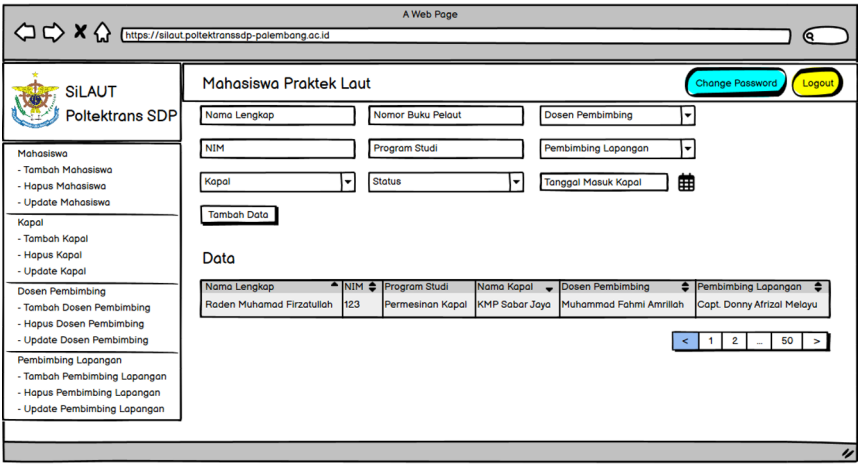

Figure 2. Mockup User Interface Administrator

Figure 2 presents the initial design or user interface mockup for the Administrator role in the Student Sea Practice Information System at Politeknik Transportasi SDP Palembang. This mockup was created as a visual guideline prior to the system development stage. The interface displays the main layout, including a navigation menu on the left side that contains features for managing data related to Students, Ships, Academic Supervisors, and Field Supervisors. Additionally, there is a data input form for sea practice students consisting of fields such as name, student ID (NIM), study program, ship, status, academic supervisor, and field supervisor, along with a data table for displaying the entered information.

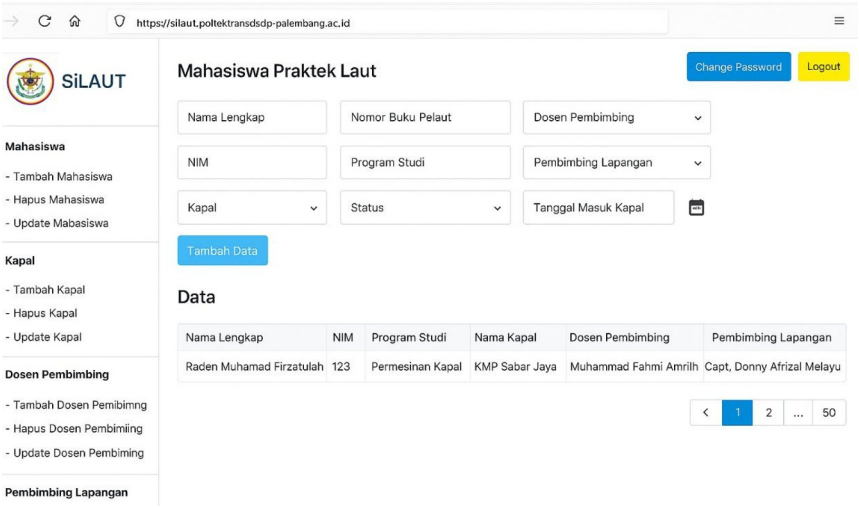

Figure 3. User Interface Administrator

Figure 3 displays the user interface resulting from the development process, which has been implemented based on the design shown in Figure 2. This interface represents the real system interface of SiLAUT (Sea Practice Information System) at Poltektrans SDP Palembang. Visually, the system utilizes a modern web-based application design with a combination of blue and yellow colors to create a professional appearance and enhance usability. The features shown in the mockup have been successfully implemented, including the Add Data button, student data table with pagination functionality, and the management menu on the left side of the page.

A comparison between Figure 2 and Figure 3 indicates that the development process followed the initial design with several improvements in terms of aesthetics and layout. The implementation in Figure 3 showcases a more responsive, structured, and user-friendly interface compared to the initial mockup. In addition to the main menu items, the Administrator role also includes additional menus such as Manage Grades and Manage Reports to support more comprehensive data management. Thus, the development results ave successfully transformed the interface design into a functional application that aligns with user requirements.

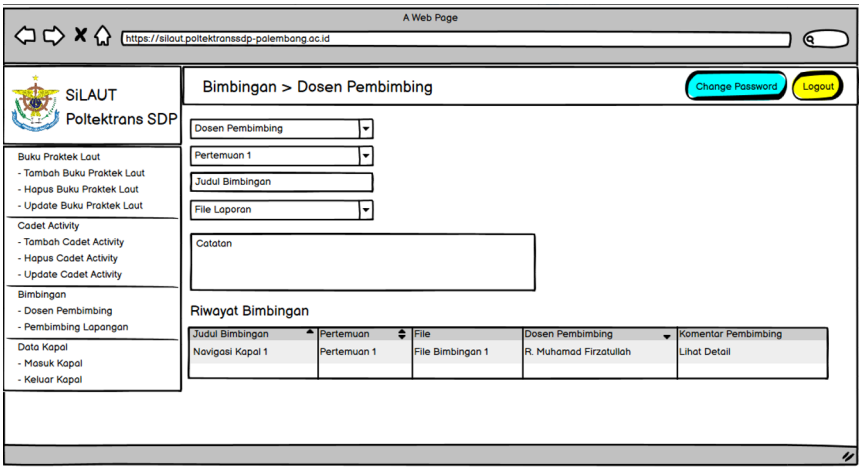

Figure 4. Mockup User Interface Cadet

Figure 4 presents the initial design (user interface mockup) for the Student role in the Sea Practice Information System of Politeknik Transportasi SDP Palembang. This interface is designed to facilitate students in conducting guidance sessions with their academic supervisors during the sea practice period. The mockup includes several key elements, such as supervisor selection, guidance meeting input, guidance title, report file upload, and a notes section. At the bottom, there is a Guidance History table that displays records of previous guidance sessions, including guidance titles, meeting numbers, report files, supervisor names, and supervisor comments.

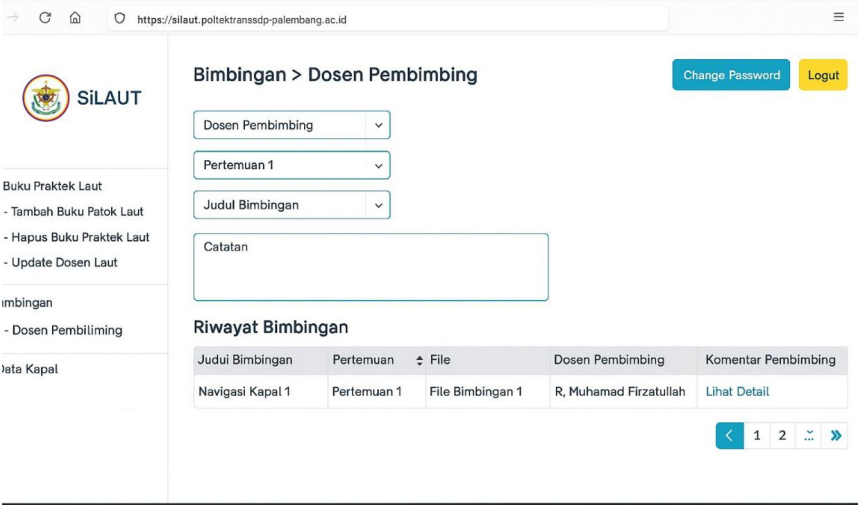

Figure 5. User Interface Cadet

Figure 5 shows the actual implementation of the previously designed mockup. The user interface in the real system adopts a modern web-based design with a cleaner layout and interactive elements that enhance user convenience. The functions included in the initial design have been successfully implemented, such as supervisor selection, note input, and the guidance history table equipped with a *View Details* button to display supervisor comments more comprehensively. The system also provides a navigation menu on the left side to access other features such as Seafarer Book Management, Guidance Process, and Ship Data, which are part of student activities during sea practice.

A comparison between Figure 4 and Figure 5 demonstrates that the system development has successfully transformed the initial design into a visually and functionally improved implementation. The developed interface appears cleaner, more responsive, and consistent with user-friendly principles. Additionally, the use of appropriate colors and proportional layout enhances user comfort in interacting with the system. Therefore, the student interface developed in this system effectively supports the guidance and reporting processes in an efficient manner and is well integrated into the sea practice information system.

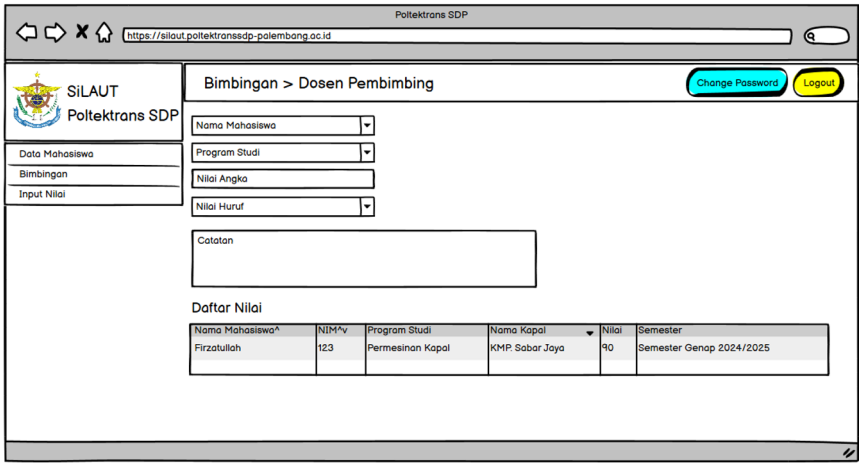

Figure 6. Mockup Interface User Lecturer

Figure 6 presents the initial user interface mockup for the Lecturer role in the student sea practice information system at Politeknik Transportasi SDP Palembang. This mockup serves as an early design guide for developers to determine the arrangement of interface elements and interaction flow. The display includes main navigation menus such as Student Data, Guidance, and Grade Input, as well as form components for selecting student names, study programs, numeric grades, letter grades, and notes. The mockup also features a grade list table that will display students who have been supervised along with the grades entered. With this mockup, the design process becomes more structured, as developers have a visual reference before entering the implementation stage.

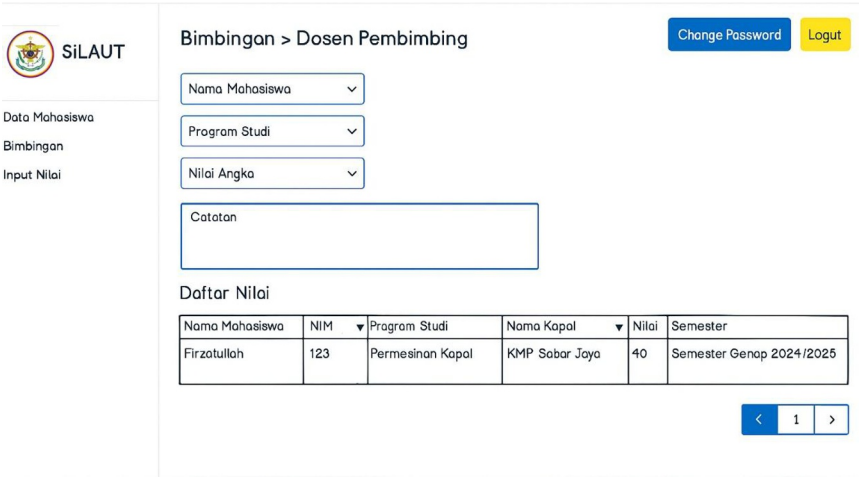

Figure 7. Interface User Lecturer

Meanwhile, Figure 7 represents the actual developed interface for the Lecturer role that has been implemented in the system. In general, the final interface follows the design structure of the mockup, but with refinements such as a cleaner visual appearance, consistent color usage, and the addition of navigation buttons such as **Change Password** and **Logout**. In addition, the table display in the real version is more organized with clear borders and a pagination feature at the bottom. The grade input form is also supported with dropdown options to make it easier for users to select student-related data.

A comparison between the mockup and the implemented system interface shows that the development process adhered to the principles of user-centered design. The main elements planned during the design phase were successfully applied and optimized in the final implementation. Adjustments were primarily focused on improving the aesthetics, layout organization, and adding functionality to enable lecturers to carry out guidance and grade input more efficiently. This demonstrates that the mockup played an important role as a design blueprint, while the implementation results reflect the success of the system development process in meeting user needs.

3.5. UNIT TESTING RESULT

Table 1. Unit Testing Result

No	Unit Testing	Result
1	Sistem menampilkan halaman dashboard sesuai role pengguna (Admin, Dosen, Mahasiswa)	Successs
2	Sistem menampilkan data mahasiswa praktek laut	Successs
3	Sistem menampilkan data kapal praktek laut	Successs
4	Sistem menampilkan data dosen pembimbing dan pembimbing lapangan	Successs
5	Sistem menambahkan data mahasiswa praktek laut	Successs
6	Sistem mengubah data mahasiswa praktek laut	Successs
7	Sistem menghapus data mahasiswa praktek laut	Successs
8	Sistem mengelola data kapal (tambah, ubah, hapus)	Successs
9	Sistem mengelola data dosen pembimbing dan pembimbing lapangan	Successs
10	Sistem menampilkan halaman bimbingan mahasiswa	Successs

No	Unit Testing	Result
11	Mahasiswa dapat menginput dan mengunggah laporan bimbingan	Successs
12	Dosen dapat memberikan catatan bimbingan kepada mahasiswa	Successs
13	Sistem menampilkan riwayat bimbingan mahasiswa	Successs
14	Dosen dapat menginput nilai praktek laut mahasiswa	Successs
15	Sistem menampilkan daftar nilai mahasiswa	Successs
16	Sistem melakukan pagination pada tabel data	Successs
17	Sistem menyediakan fungsi *Change Password* dan *Logout* sesuai role	Successs
18	Sistem Successs menyimpan catatan bimbingan dan nilai	Successs

Unit testing for the Cadet Sea Practice Score Recapitulation Information System was conducted to ensure that all designed functions operate according to user requirements. Based on testing of the core features—ranging from role-based authentication (Admin, Lecturer, Student), management of sea practice student data, ships, supervising lecturers, to the guidance process and grade input—all functionalities operated as intended. Menu navigation, form completion, data storage, and information table display also ran smoothly, indicating that the system interface and workflow aligned well with the initial design.

All student guidance processes, from report uploads to lecturer feedback, were tested successfully and functioned properly. The grade input feature for lecturers and its display in the grade list also worked according to the system procedures. Additionally, supporting features such as pagination, change password, and logout were tested and proven to operate correctly. These results indicate that the system provides a stable and responsive user experience and meets the expected functional standards.

In total, 18 unit test cases were executed, and all were successful, resulting in a 100% success rate. This demonstrates that the system is capable of optimally supporting the administrative and monitoring processes of cadet sea practice activities in accordance with institutional needs. Therefore, the system is considered feasible for daily operational use and can serve as a foundation for future development, should additional features or system integration be required.

4. Conclusion and Recommendation

4.1. Conclusion

Based on the results presented in the previous chapter, the following conclusions can be drawn:

1. This research successfully developed a web-based information system for recording sea training grades that effectively facilitates the process of documenting student (cadet) scores for the Nautical and Marine Engineering study programs. The system provides features for managing student data, inputting and monitoring mentoring results, as well as grade submission by lecturers. With this system, administrative processes that were previously carried out manually can now be performed more quickly, accurately, and in a structured manner.
2. The system development using the Prototype method proved to be effective in ensuring alignment with user requirements. Through phases of communication, mock-up design, and iterative evaluation with users (Admin, Lecturers, and Cadets), the system could be directly refined based on the feedback provided. This ensures that every function, interface, and system workflow truly supports operational needs within Politeknik Transportasi SDP Palembang.
3. System testing was carried out using the White Box Testing method to verify the program's logic structure and ensure that each process flow operated as designed. Based on the testing results, all functional units were verified and performed correctly, demonstrating that the system has a high level of reliability and is ready to be used for recording cadet sea-training grades. The testing results indicate a 100% success rate, showing that the system is feasible and suitable for implementation.

4.2. Recommendation

Based on the conclusions obtained, the following recommendations are suggested for future research:

1. The system can be further developed by adding features such as notification services, automatic integration with the campus academic system, and a grade monitoring dashboard to enhance monitoring convenience for the study program and institutional management.
2. Security improvements are needed through the implementation of secure login mechanisms, proper session handling, and periodic database backups to maintain the confidentiality of cadet data and prevent data loss due to system failures.
3. Although the testing results demonstrated a 100% success rate, it is recommended to conduct system trials in a real operational environment with a larger number of users to ensure system performance and stability when fully utilized by all cadets and supervising lecturers.

Acknowledgement

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