

Design and implementation of a web-based thesis guidance system using the waterfall method

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ABSTRACT

The advancement of technology and the internet has opened up opportunities for the development of information systems in higher education in Indonesia. One significant system is the online thesis guidance system for students. Currently, the guidance process at ISI Surakarta is conducted manually and face-to-face, which has proven to be less effective due to scheduling conflicts between students and lecturers, leading to delays in thesis progress. The development of the online thesis guidance system aims to facilitate interaction between lecturers and students while digitally storing review histories and revisions, enhancing the efficiency of administrative data collection. Additionally, the system is designed to provide announcements and timelines from proposal submission to eligibility examinations, helping students monitor their performance to graduate on time. The Waterfall method is employed in this system's design to ensure a systematic development process, covering all stages from requirements analysis to maintenance. This method allows early detection of potential conditions and ensures that user needs are met before the system is implemented. The implementation of this system is expected to improve the efficiency and quality of academic services, support students in completing their studies on time, and provide benefits to the entire academic community of ISI Surakarta.

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1. INTRODUCTION

The thesis guidance process in higher education often experiences obstacles, such as difficulties in coordination between students and lecturers, lack of neat documentation for revision notes, and limited access to a structured guidance information system [1]. In its position as the main pillar of the national education system, higher education institutions in Indonesia require the development of information systems that are able to support improving the quality of educational services, especially in the process of supervising students' final assignments [2]. A well-running guidance process is crucial to ensure that students receive clear guidance, receive timely feedback, and are able to complete their theses with high quality according to the set schedule [3]. The development of information technology and the internet opens up opportunities to create digital solutions that can overcome these challenges and increase the effectiveness of academic guidance [4]

Several previous studies have examined how thesis guidance systems can be developed and optimized. In an effort to increase the effectiveness of academic guidance, Aktsar et al. (2021) [5] developed a web-based thesis guidance management system. This system is designed to bring together lecturers and students on one digital platform, with journal and keyword recommendation features based on the TF-IDF and cosine similarity algorithms, and is built using a waterfall development model. Additionally, In a study conducted by Permatasari et al. (2022) [6], an Android-based thesis guidance system was developed for the Informatics and Computer Engineering Education Study Program at Bung Hatta University. This system is designed to optimize the guidance process in situations that limit face-to-face meetings, such as those that occurred during the COVID-19 pandemic. Another study conducted by Ramadhani et al. (2023) [7] provides an overview of the development of a comprehensive and integrated academic management guidance system for theses, which has the potential to increase the effectiveness of academic guidance. Thus, previous studies have shown a lack of limitations in providing a complete and integrated system for monitoring and guiding theses.

Therefore, this study aims to develop a more efficient, user-friendly, and integrated online thesis guidance system that effectively facilitates interaction between students and their supervisors. The objective is to provide a platform that not only monitors thesis progress but also digitally stores review histories and revisions, along with offering clear announcements and timelines for students.

In this way, this research fills the existing gap in the literature by offering an innovative solution for a more structured and effective thesis guidance system at ISI Surakarta.

2. METHOD

This study employs the Waterfall model for system development. This method provides a systematic and sequential approach, allowing software development to be conducted in a structured manner [8]. Below is a diagram of the software development process illustrating the System Development Life Cycle (SDLC) implemented through the Waterfall method [9]. This model features key stages that reflect the essential activities required in system development. Five stages are identified within the Waterfall method (see Figure 2), namely: requirement analysis and definition, system and software design, implementation and unit testing, integration and system testing, and operation and maintenance.

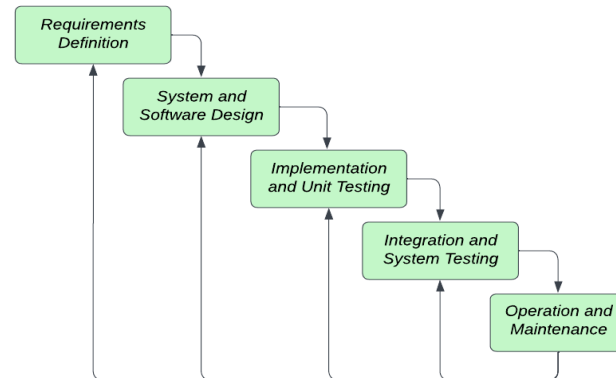


Figure 1. Waterfall model

The explanation of the waterfall model stages is as follows:

a) Requirement Analysis and Definition

In this process, various data collection methods are used such as interviews, surveys, and meetings to understand user needs comprehensively. The interview method, for example, allows analysts to interact directly with users to obtain in-depth information, including needs that are not always expressed in writing.

b) System and Software Design

The system architecture is designed based on predefined requirements. In addition, identification and depiction of the basic abstraction of the software system along with its relationships will be carried out.

c) Implementation and Unit Testing

In this Implementation and Unit Testing stage, the results of the software design will be realized as a set of programs or program units. Each unit will be tested to see if it meets its specifications.

d) Integration and System Testing

In this Integration and System Testing stage, each program unit will be integrated with each other and tested as a complete system to ensure that the system meets the existing requirements. After that the system will be sent to the system user.

e) Operation and Maintenance

In this Operation and Maintenance stage, the system is installed and started to be used. In addition, it also fixes errors that were not found in the creation stage. In this stage, system development is also carried out such as adding new features and functions.

3. RESULTS AND DISCUSSIONS

Requirement Analysis and Definition

Primer data collection for the alumni training database was conducted through a literature review on student thesis proposal data, obtained by contacting the heads of respective study programs or those responsible for student proposal data. The determination of the features to be designed and implemented was previously consulted with stakeholders, including the Heads of Study Programs at ISI Surakarta and the academic department responsible for student thesis data, as well as several students to gather opinions from the research subjects.

The needs collection process was carried out comprehensively, where all relevant information was gathered and subsequently analyzed to clearly define the requirements that must be met by the program to be developed. This phase is crucial and must be executed thoroughly, as the results of this analysis with UML (United Modeling Language) will serve as the foundation for producing a complete and effective system design, ensuring that all necessary aspects have been considered and accommodated in the software development process [10].

System and Software Design

At this stage the author designs and creates a program using UML (United Modeling Language) which uses Activity Diagrams and for database design the author uses ERD (Entity Relationship Diagram). The system flowchart can be seen in Figure 2.

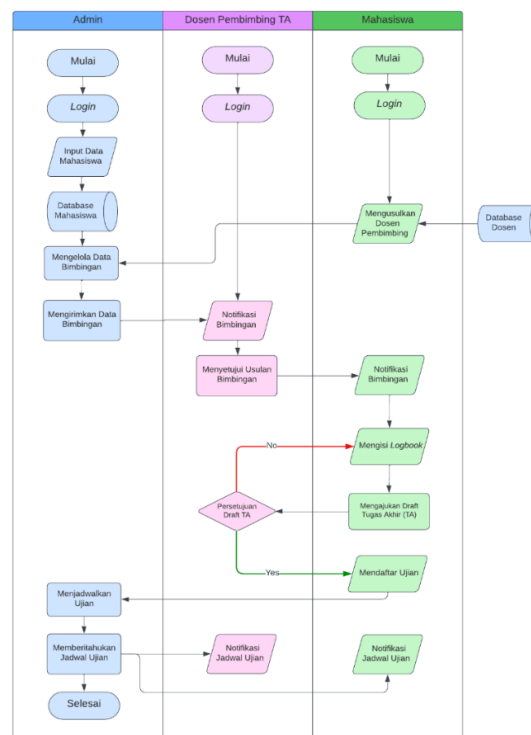


Figure 2. Flowchart system

Implementation and Unit Testing

Implementation

Implementation is the phase where the entire system design formulated earlier is translated into

program code. In this phase, code is written for each necessary module based on the system design specifications. The resulting code consists of separate modules that will later be integrated to form a complete system. Implementation focuses on development and coding, ensuring that each part of the design can be realized in functional code.

This system is built to be used by four actors, each of whom has a different Landing page: 1) Visitor; 2) Administrator; 3) Dosen; and 4) Student. These four roles were chosen because they represent the parties directly involved in the thesis guidance process. Visitors can access general information without logging in, Administrators are responsible for managing data and users, Lecturers provide guidance and evaluation, while Students manage the thesis submission and preparation process. This division of roles is designed to support the system's functionality effectively and in accordance with the existing academic flow.

The following are several files containing PHP code created to build this thesis guidance system (see Figure 3), along with an example of the program code for 'index.php' for the landing page for 'Visitor' users (see Figure 4).

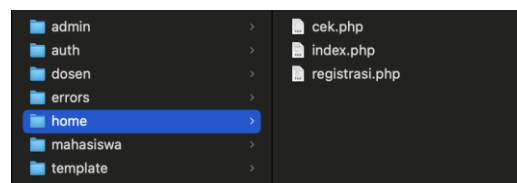


Figure 3. File on user 'Visitor'

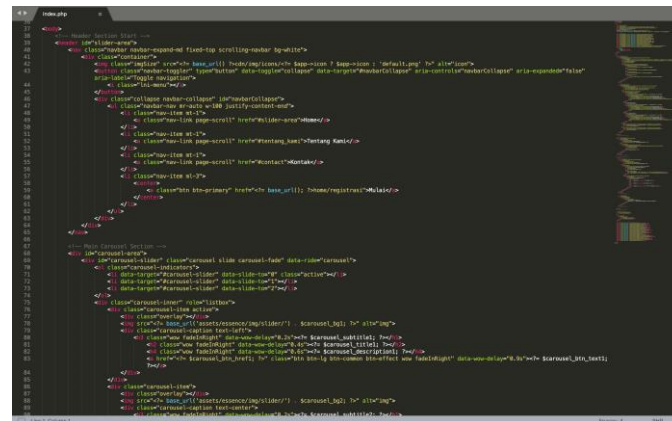


Figure 4. Program code in the 'index.php' file for the user 'visitor'

Unit Testing

At this stage, the codes that have been created are combined and tested to find out whether the software that has been created is in accordance with its design and whether the software function has errors or not. The following is a display of the results of testing the program code that has been created (Figures 5 to 11).



Figure 5. Visitor homepage (landing page)

The visitor homepage (landing page) on the thesis guidance system is the initial page intended for users who have not logged in. This page provides navigation for logging in, registering, and contact information, so that it functions as the main entry point before users access the features according to their respective roles.

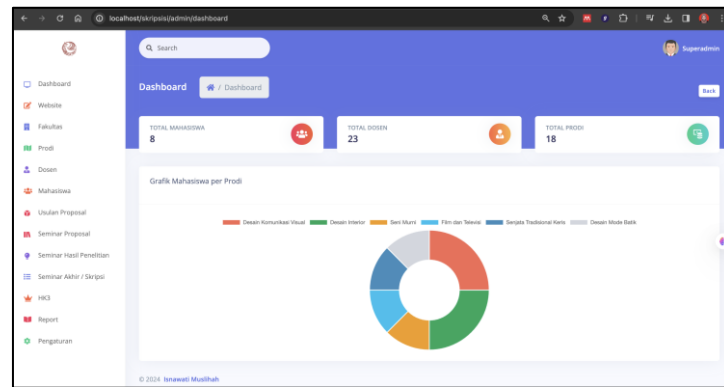


Figure 6. Administrator dashboard page

Administrator dashboard page is the main page displayed after the administrator successfully logs into the system. This page functions as a control center to manage all data and activities in the thesis guidance system, such as managing lecturer and student accounts, monitoring thesis topics, setting schedules, and viewing system usage statistics. This dashboard is designed to make it easier for administrators to ensure the system runs regularly and efficiently.

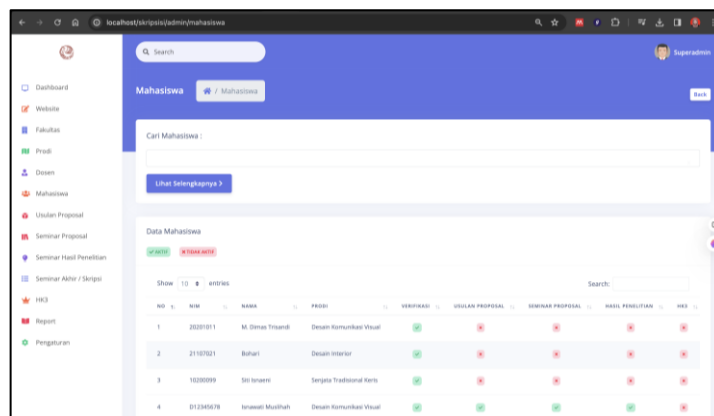


Figure 7. View on the 'Mahasiswa' menu

View on the 'Mahasiswa' menu is a page that displays a list of student data, such as NIM, name, study program, and final assignment status, along with a student search feature.

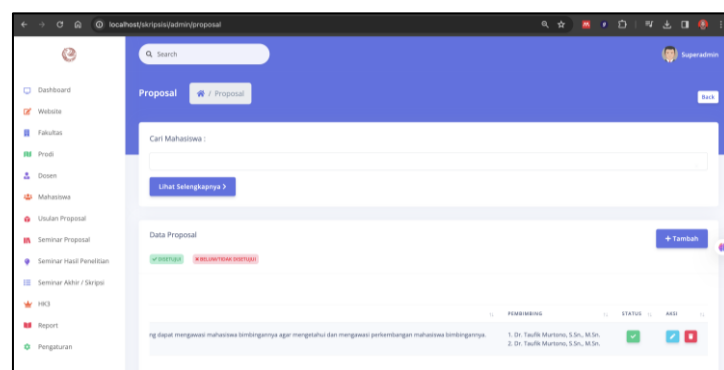


Figure 8. View on the 'Usulan Proposal' menu

View on the Proposal Proposal menu is a page that displays a list of submitted proposals, containing information such as proposal title, proposer, supervisor, status (accepted, rejected, processed), and buttons to view details, edit, or delete the proposal proposal.

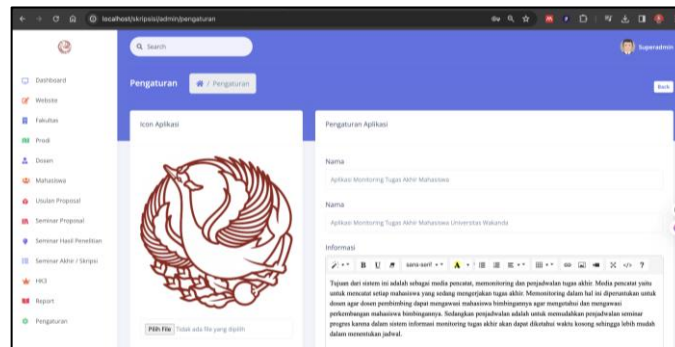


Figure 9. View on the 'Pengaturan' menu

View on the Settings menu is a page for setting system or account preferences, such as changing the system icon, system name, and information. There is usually also an option to log out or reset settings.

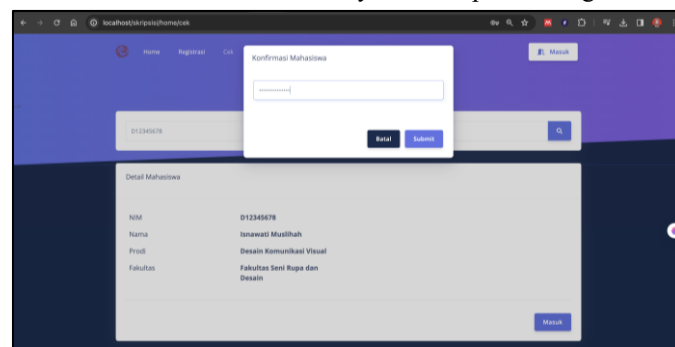


Figure 10. Student login view

Student login view is a page for students to enter their username and password to access the system. Student details will be displayed such as name, student ID number, study program, and faculty.

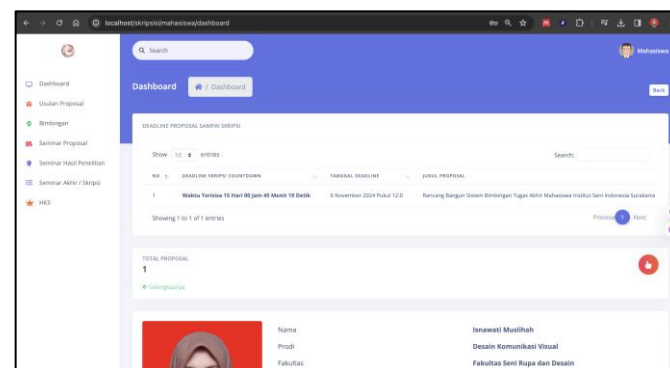


Figure 11. Student dashboard page

The student dashboard page in the thesis guidance system is the main page that displays student data, final assignment status, guidance schedule, and the progress of the student concerned.

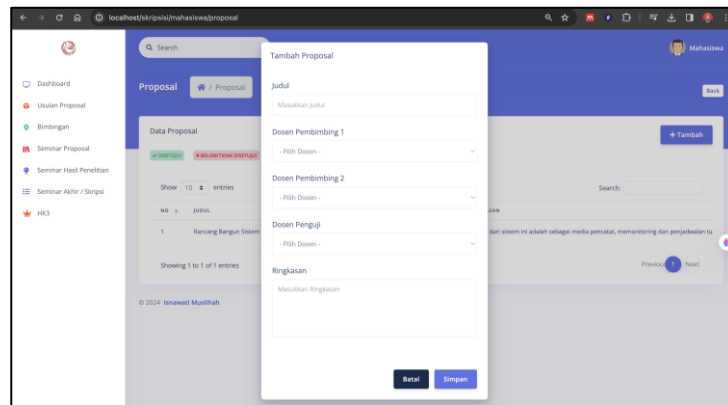


Figure 12. View of the proposal addition menu

View of the proposal addition menu is a page for writing the title, abstract, field, and uploading the thesis proposal documents, as well as selecting a supervisor.

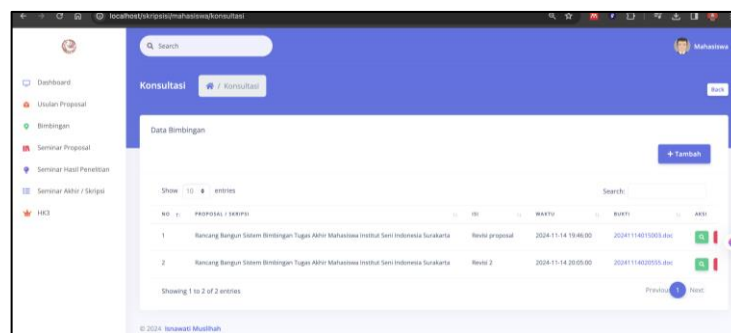


Figure 13. View of the 'Bimbingan' menu

View of the 'Bimbingan' menu adalah halaman yang menampilkan riwayat dan progres bimbingan skripsi, termasuk tanggal bimbingan, catatan dosen, status revisi, dan fitur unggah dokumen.

Then to store all the data a database is needed. MySQL is a relational database management system (RDBMS) that uses SQL (Structured Query Language) to manage and access data. MySQL is widely used in web and desktop applications because it is lightweight, fast, and open-source. The mysql database display can be seen in Figure 14, then all the tables in this thesis guidance system are displayed in Figure 15.

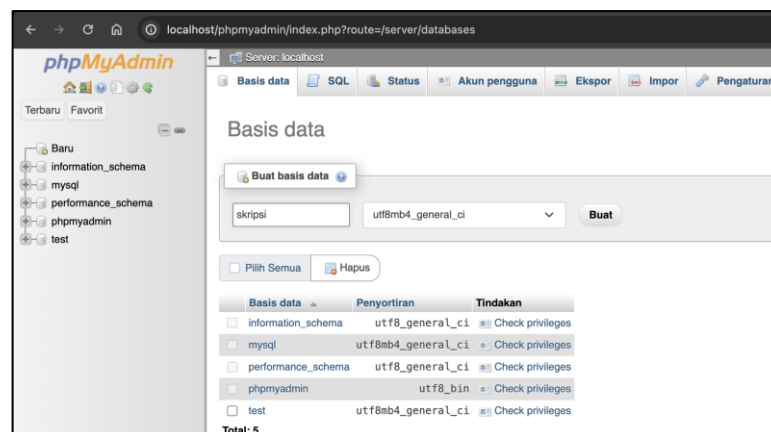


Figure 14. Mysql database

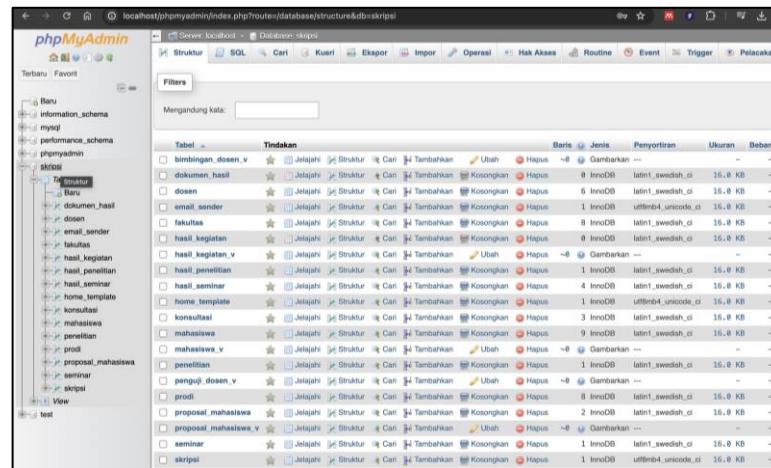


Figure 15. View of the database 'skripsi.sql'

System Integration and Testing

At this stage, each program unit is integrated and tested as a single system to ensure that all functions run according to the specified requirements. Although the system is still in the prototype stage and is not yet available in an online version, initial testing has been carried out locally using several accounts, namely as administrator, student, and lecturer. This testing aims to ensure that the login flow and basic functions of each role can run well before the system is fully released to end users.

Operation and Maintenance

At this stage, the system starts running in prototype form by utilizing localhost and phpMyAdmin. The system is installed on several devices to test whether it can run smoothly in a localhost environment. During this process, several obstacles were found, especially in adjusting supporting tools, such as the XAMPP version that is not compatible with the PHP version required by the system. This finding is important input for adjusting and maintaining the system before it is launched online.

4. CONCLUSION

The developed thesis guidance system is expected to improve the efficiency and effectiveness of the guidance process at the Indonesian Institute of the Arts Surakarta. Initial test results show that this system helps speed up communication and facilitates monitoring of student progress in a structured manner. Digital record keeping provides administrative data management and supports timely permissions. For ongoing development, user feedback will be collected through surveys and iterative development cycles.

In the future, development can be focused on additional features such as integration with campus repositories, automatic guidance scheduling, and guidance data analysis, according to user needs in an ever-evolving academic environment

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