

Design and Implementation of a Web-Based Course Schedule and Task Reminder Application Using the Waterfall Method

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Abstract

This research develops a web-based task management application to support the productivity of students and professionals. The Waterfall method is applied through the stages of requirements analysis, system design (DFD, ERD, CDM, PDM), implementation, testing, and maintenance. The system uses a database with three main entities (Users, Tasks, Schedule) that are integrated for data accuracy. The result is a responsive application with a simple interface that centralizes recording, sorting, and monitoring of tasks and schedules. All functions have been validated through Blackbox Testing and operate according to specifications. This application effectively manages academic and personal activities in one platform and has the potential to form the basis for developing more complex productivity systems in the future.

Keywords

Blackbox Testing; Task Management; To-Do List; Waterfall Method; Web Application.

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Introduction

The rapid advancement of information technology in the digital era has transformed many aspects of human life, particularly in education. Web-based technologies have become essential tools for supporting students in completing academic tasks. Almost all learning activities are now connected to digital systems, ranging from school administration and online learning platforms to task and class schedule management systems. This development indicates that technological progress not only improves communication and data storage but also assists students in managing their time and learning activities more effectively. Nurzi and Ab Wahab (2022) emphasize that web-based task management systems can significantly enhance student productivity and effectiveness by providing integrated task tracking and reminder features.

As members of the academic community, students play an important role in planning class schedules, completing assignments, and participating in various school-related activities. However, the

increasing number of academic tasks often makes time management difficult. Many students still rely on traditional methods, such as handwritten notes or simple mobile notes without reminder systems. As a result, students frequently miss assignment deadlines, record schedules incorrectly, or lose important information due to unorganized notes. These conditions reduce productivity, disrupt academic discipline, and increase the likelihood of late assignment submission. Putra and Kurniawan (2023) also found that digital reminder systems in e-learning platforms significantly help users remember academic schedules and reduce delays in task completion.

These challenges indicate the need for a system that can assist students in managing their academic responsibilities efficiently and effectively. One potential solution is the development of a web-based application that integrates class schedule management and task reminders into a single platform. Such an application should allow students to record, track, and organize daily activities without switching between multiple systems. Through an integrated digital platform, users can add class schedules, set meeting times, create task lists, and receive automated notifications or reminders for upcoming deadlines. Meitarice et al. (2025) reported that students generally have positive perceptions of digital task management systems because they help improve discipline, responsibility, and learning efficiency.

Web-based class schedule and task reminder applications offer advantages over conventional applications because they can be accessed across multiple devices, including laptops, desktop computers, and smartphones, as long as an internet connection is available. Additionally, web-based systems do not require installation on user devices, making them simpler and more practical to use. With cross-platform functionality, these applications allow flexible access anytime and anywhere, which is particularly beneficial for students with busy schedules. From a development perspective, web-based applications are also easier to update and maintain, as system updates can be implemented centrally on the server side without requiring reinstallation on user devices.

In the development process, this study adopts the Waterfall method, which is a structured and sequential approach to software development. This method was selected because it aligns well with projects that have clearly defined requirements and workflows from the initial stage. Each phase of the Waterfall method must be completed before proceeding to the next, including requirement analysis, system design, implementation, testing, and maintenance. This approach ensures that the development process remains systematic, well-documented, and capable of producing a system that meets user requirements.

Furthermore, the application development utilizes a relational database design consisting of three main entities: Users, Schedules, and Tasks. These entities are interconnected to ensure effective data integration. For instance, each user can have multiple class schedules and tasks, while each task can be linked to a specific schedule. This design helps maintain data accuracy and consistency while preventing redundancy within the database.

The application developed in this study also focuses on user experience and interface design. The interface is designed to be simple, intuitive, and responsive, allowing students with varying levels of technological proficiency to use the system without difficulty. Users can quickly add new class schedules, update unfinished tasks, and view all academic activities through a centralized dashboard. Reminder features are included to ensure that users do not miss important deadlines. With these capabilities, the system functions not only as a recording tool but also as a digital assistant that supports students in managing their academic routines.

This study is expected to contribute to the educational sector, particularly in utilizing technology as a means of supporting learning activities. Through a web-based class schedule and task reminder application, students can manage their time more effectively, improve efficiency, and maintain

consistency in completing academic tasks. Additionally, the application is expected to serve as a foundation for future system development, such as the integration of academic calendars and advanced reminder features.

Several previous studies indicate that web-based information systems play an important role in helping users manage activities and time more efficiently. Indryani and Yahfizham (2023) developed a web-based To-Do List application using the Waterfall method and found that the system improved daily task management effectiveness and helped users organize work priorities more systematically. A similar study by Niesviantika, Marcos, and Riyanto (2023) designed an Android-based activity reminder application that facilitated activity recording, deadline management, and automatic notification delivery.

Additionally, research conducted by Sepriana, Sefriani, and Jafnihidra (2021) on a web-based student learning reminder system showed that online systems enable users to manage their learning time independently through simple and accessible interfaces. Meanwhile, Santos, Permatasari, and Purwanto (2025) reported that web-based schedule and task reminder systems developed using the Waterfall model can improve administrative efficiency, data transparency, and user engagement through automated processes and easily accessible online reports.

Moreover, Fauziyah and Komalasari (2025) explained that computer network-based systems and centralized data infrastructures play a crucial role in supporting the performance of task management applications, enabling them to operate quickly, reliably, and securely. This finding is particularly relevant to web-based To-Do List applications that require real-time data connectivity to display task and schedule updates instantly.

The web, or global network, can be viewed as an accessible gateway that users enter through digital tools such as web browsers. Elgamar (2020) defines a website as a medium consisting of interconnected pages that function to deliver information in the form of text, images, videos, audio, animations, or a combination of these elements. When users access a website, their devices request content from the server, which is then displayed on their screens.

Web-based tools offer several advantages over traditional tools. One major advantage is accessibility, as users only require an internet connection and a browser to use the system. In addition, web applications function across multiple operating systems, including Windows, Linux, and mobile platforms. For developers, system updates are relatively simple because changes can be implemented centrally without modifying individual user devices. Therefore, developing web-based scheduling and notification tools is highly beneficial for students who need to access information from anywhere.

Schedule and notification management tools function similarly to digital assistants that track daily activities, record event times, and provide alerts as deadlines approach. Maulana et al. (2024) stated that digital scheduling reminders significantly improve time management by centralizing all relevant information in a single platform. These systems typically consist of two main components: schedule tracking and task notification, where schedules record class times, events, or meetings, and notifications alert users before deadlines expire.

Task and notification applications are designed to assist users in planning daily activities, recording schedules, and receiving alerts for upcoming deadlines. As demonstrated by Maulana et al. (2024), such online tools support effective time management by organizing all event-related information within a single interconnected system. Generally, these applications consist of two core features: schedule management and task notification, where schedules document time-based activities and notifications function as reminders before deadlines are reached.

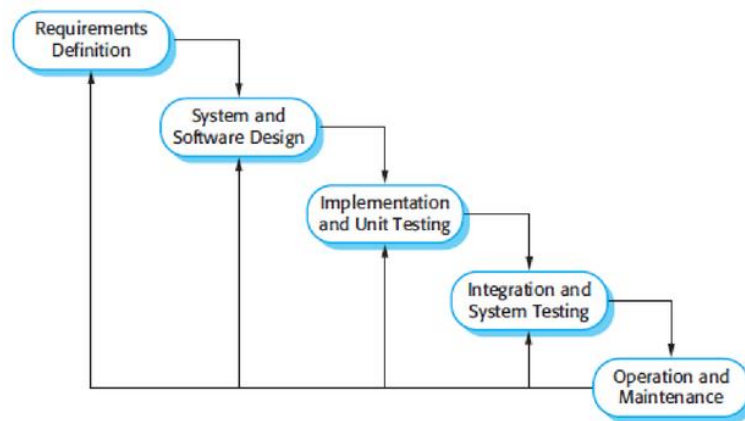


Figure 1. Waterfall Method System Design Diagram

The Waterfall method is one of the oldest and most widely recognized approaches in software development. Introduced by Royce, this method follows a sequential and linear process that progresses step by step from the initial phase to the final stage, similar to the downward flow of a waterfall. According to Murdiani and Sobirin (2022), the Waterfall model consists of five main phases: requirements determination, system planning and design, system implementation, system testing, and system maintenance. Each phase must be completed before moving on to the next to ensure that the development process remains well-structured, systematic, and thoroughly documented.

Blackbox testing is a software testing technique that focuses on evaluating system functionality without considering the internal structure or implementation of the program code. As stated by Wicaksono (2021), the primary objective of this testing method is to verify that the system operates in accordance with user requirements based on the input provided and the output produced. Testers are not required to understand how the internal processes work; instead, they assess whether the resulting outputs match the expected outcomes for given inputs.

Methodology

This study employs the Waterfall software development methodology, which is a systematic and sequential approach to system development. The Waterfall model was selected because each development phase produces clear and well-documented outputs, facilitating the processes of analysis, system design, implementation, and testing. The main stages of this methodology consist of requirement analysis, system design, implementation, testing, and maintenance. Each stage is described in detail in the following sections.

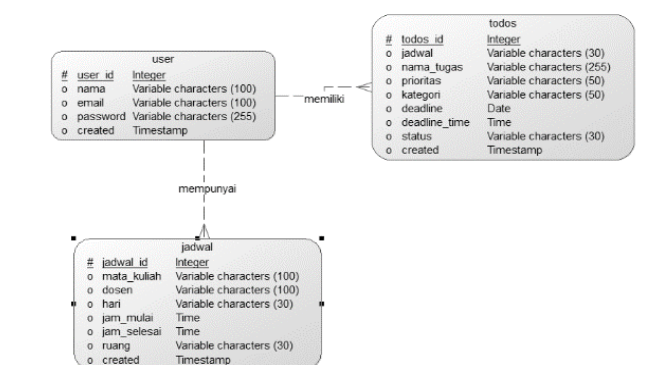


Figure 2. Application System CDM

The first stage in the system development process is requirement analysis, which aims to identify the functions and characteristics that the application must possess in order to meet the design objectives. Based on document analysis and observations of user needs, the application is designed to assist students in recording course schedules and providing reminders for assignment deadlines.

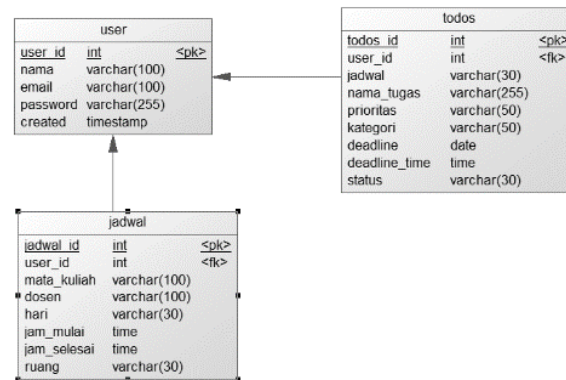


Figure 3. Application System PDM

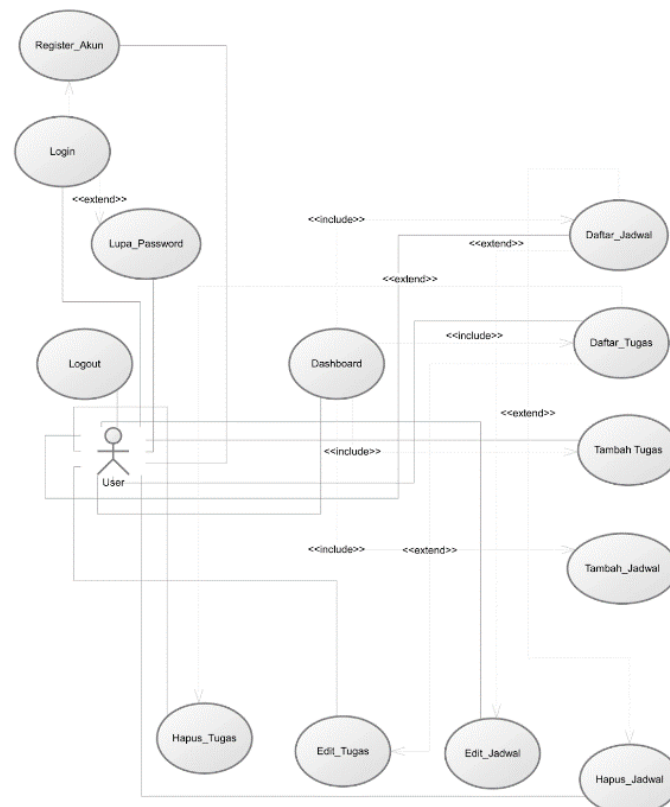


Figure 4. Application User Use Case Diagram

The functional requirements of the system include user registration and authentication, the ability to add and modify course schedule data, and the management of task lists that are linked to specific class schedules. Meanwhile, the non-functional requirements focus on data security, ease of use, a responsive user interface, and efficient data access performance. The requirement analysis stage is visualized through a research flowchart that illustrates the system development process from problem identification to evaluation, in accordance with the principles of the Waterfall methodology.

Results and Discussion

Results

This section presents the implementation results of the web-based Course Schedule and Task Reminder application developed using the Waterfall method. The application is designed to assist students in managing course schedules and assignment deadlines to ensure more organized academic activities. The implementation process was carried out based on the results of system analysis and design, including database structure, system workflow, and user interface design.

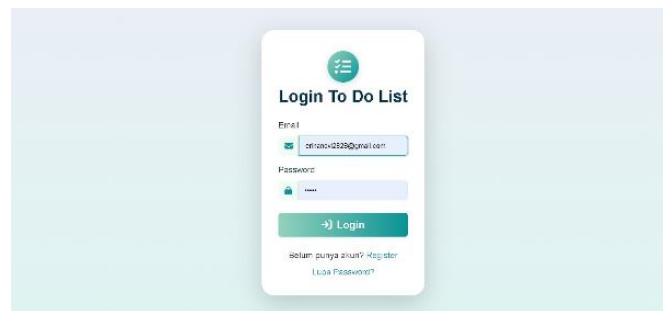


Figure 5. Login Page Interface

The login page serves as the entry point for registered users to access the application. Users are required to enter a valid email address and password to gain access to the main features of the system. If the provided credentials match the data stored in the database, the system redirects the user to the dashboard page. The interface is designed to be simple and user-friendly to ensure accessibility across various devices.



Figure 6. Dashboard Interface

The dashboard is the main interface displayed after a successful login. This page presents a summary of course schedules and active tasks. Users can view the status of each task, mark completed tasks, and navigate to the menus for adding schedules or tasks. The responsive and intuitive design enables users to quickly monitor their academic activities.

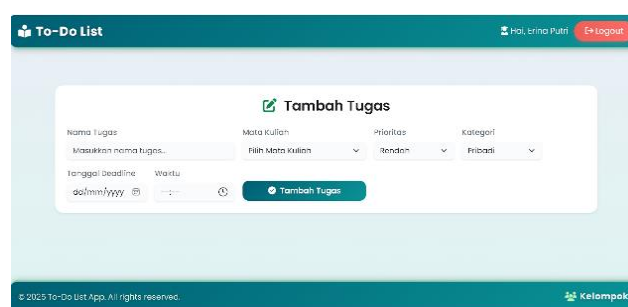


Figure 7. Add Task Page Interface

The add task page allows users to create new tasks by entering task names, deadlines, and additional descriptions. Once saved, the task data are stored in the todos table within the database and automatically displayed on the task list page.

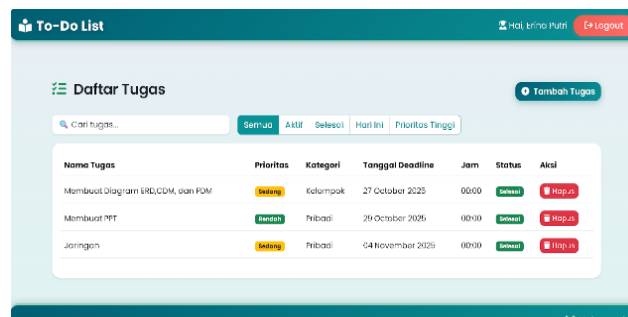


Figure 8. Task List Page Interface

This page displays all tasks created by the user. Tasks can be edited, deleted, or marked as completed using the action buttons provided in each data row. This interface helps users manage their task lists efficiently according to their respective priorities.

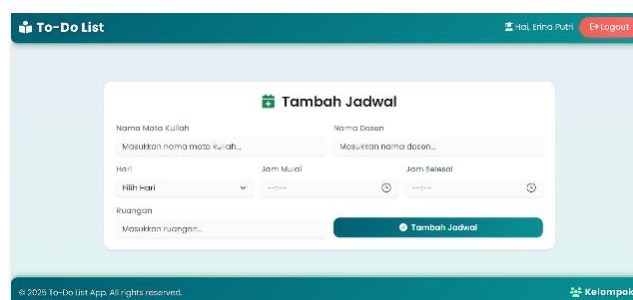


Figure 9. Add Schedule Page Interface

The add schedule page is used to input course schedule information. Users can enter course names, days, times, and classroom locations. After saving, the schedule data are stored in the schedule table and directly integrated with the task reminder feature on the dashboard.

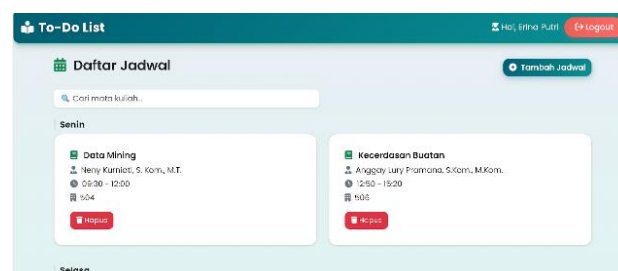


Figure 10. Schedule List Page Interface

This page displays all course schedules that have been entered by the user. Users can update or delete schedules using the edit and delete buttons provided. Through this feature, users are able to monitor and manage their academic schedules in a more structured and organized manner.

Discussion

Based on the results of the Blackbox Testing presented in the table above, all primary functionalities of the application operate in accordance with the system design. Each input produces the expected

output, and no logical errors were identified during the testing process. These results indicate that the system successfully fulfills the users' functional requirements, particularly in managing course schedules and providing task reminders.

Table 1. Blackbox Testing

No	Test Scenario	Input	Expected Output	Test Result
1	Login with valid credentials	Valid email and password	User successfully accesses the main dashboard	Successful
2	Login with invalid credentials	Invalid email or password	System displays an error message "Invalid email or password"	Successful
3	Register a new account	Valid name, email, and password	Account is saved and can be used to log in	Successful
4	Register with an already registered email	Email already exists	System displays a warning message "Email already registered"	Successful
5	Add course schedule	Course name, day, time, and room	New schedule is stored in the schedule table	Successful
6	Edit course schedule	Modified schedule data	Schedule data are updated in the schedule table	Successful
7	Delete course schedule	Click delete button on schedule data	Schedule data are removed from the schedule table	Successful
8	Add new task	Task name, description, and deadline	Task is stored in the task table and displayed on the dashboard	Successful
9	Edit task	Modified task data (deadline/status)	Task data are updated in the task table	Successful
10	Delete task	Click delete button on task	Task data are removed from the task table	Successful
11	Change task status to completed	Click check/status button	Task status changes to "Completed" and is highlighted in green	Successful
12	Filter tasks by schedule	Select a specific course	Displayed tasks match the selected schedule	Successful
13	Logout	Click logout button	System terminates the session and redirects to the login page	Successful

No	Test Scenario	Input	Expected Output	Test Result
14	Interface responsiveness	Access via different devices (laptop, smartphone)	Interface remains proportional and navigation functions properly	Successful

Conclusion

Based on the analysis and discussion conducted in this study, it can be concluded that the web-based Course Schedule and Task Reminder application has been successfully developed using the Waterfall methodology and meets user expectations. The application effectively supports students in organizing course schedules and monitoring assignments in a more structured and efficient manner. The system features an intuitive and user-friendly interface and allows real-time data updates. Through the integration of scheduling and task reminder features, users are able to manage their study time and academic responsibilities more effectively.

For future development, it is recommended to incorporate automated notification features delivered via email or mobile notifications, enabling users to receive reminders without the need to manually access the application. In addition, the system could be expanded into a hybrid mobile platform to provide greater flexibility and accessibility for users at any time. The development of collaborative features among users may also be considered to support group-based academic activities, such as shared task management and collective reminders.

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