Design and Development of a Learning Management System Information System using the Waterfall Method with the Laravel Framework

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Abstract
Learning Management System (LMS) is a technology-based system designed to support online learning processes. This study aims to design and develop a web-based LMS information system using the Waterfall method and the Laravel framework as an effort to enhance internship training at PT. Kodinglab Integrasi Indonesia. The research method involves several stages, including requirements analysis, system design, implementation, and testing. The objective of this study is to demonstrate that the developed LMS can assist mentors and interns in managing training materials, monitoring progress, and assessing learning outcomes digitally. This system facilitates the learning process and supports self-directed learning.

Keywords: Learning Management System, Waterfall Method, Laravel Framework, PT. Kodinglab Integrasi Indonesia

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Introduction

A Learning Management System (LMS) is a system designed to support online learning so that it can be accessed anytime and anywhere [1]. PT. Kodinglab Integrasi Indonesia is an information technology company that has a need to improve the training of internship participants. The Waterfall method is used because of its systematic and sequential approach [2]. The Laravel framework is chosen because it supports web application development with authentication features through Laravel Breeze [3].

Literature Review

A Learning Management System (LMS) is an information technology–based system used to manage online learning activities. An LMS provides convenience in managing content, communication, evaluation, and tracking the learning outcomes of internship participants. The use of an LMS in learning is able to improve the teaching and learning process because it can be accessed anytime and anywhere [1]. In addition, an LMS also enables educational institutions to monitor the learning activities of internship participants directly.

In information system development, various methods and frameworks are used to improve software quality [2]. One of the most commonly used methods is the Waterfall model. The Waterfall method has structured stages starting from requirements analysis to system maintenance, thereby minimizing the risk of errors during development. However, this method has limitations in terms of flexibility, as each stage must be completed before proceeding to the next stage.

The Laravel framework is a PHP-based framework that provides various features to accelerate and simplify the web application development process [3]. Laravel implements an MVC (Model–View–Controller) architecture that separates program logic, presentation, and data control, making code management more efficient [4]. In addition, Laravel has good integration with frontend frameworks such as Bootstrap, which supports responsive and modern user interface design.

Several other studies have also discussed the development of web-based information systems using similar approaches and environments. Lubis, Hariyanto, and Hardinata (2023) [6] conducted a study on the development of an Agile-based electronic document archiving system, which emphasizes iterative processes and user involvement. The study shows the importance of utilizing web technology to facilitate administration and document management.\.

Yanti, Hariyanto, and Hardinata (2023) [7] developed an online assignment letter information system using the Prototype method. Their study demonstrates how web technology can be utilized to digitalize corporate administrative processes, while also showing that webbased approaches can improve work efficiency.

In addition, Hariyanto and Hardinata (2023) [9], in their study on a web-based learning–based community reading education system, emphasized that the application of information technology can enhance independent learning in society. This is in line with the objective of this study, which is to develop a web-based learning system that can support the internship training process digitally.

Based on the various studies reviewed, it can be concluded that web-based development approaches using structured methods such as the Waterfall method and the Laravel framework are highly relevant for implementation in a Learning Management System. Both provide a balance between development efficiency, system stability, and ease of long-term maintenance.

Research Methodology

The Waterfall model, also known as the waterfall development model, is a software development life cycle. It is a framework or process used by software development teams. This

system development flow is structured and sequential, starting from planning and analysis, design, implementation, operation, and maintenance, including the stages of analysis, design, coding, testing, and support [8].

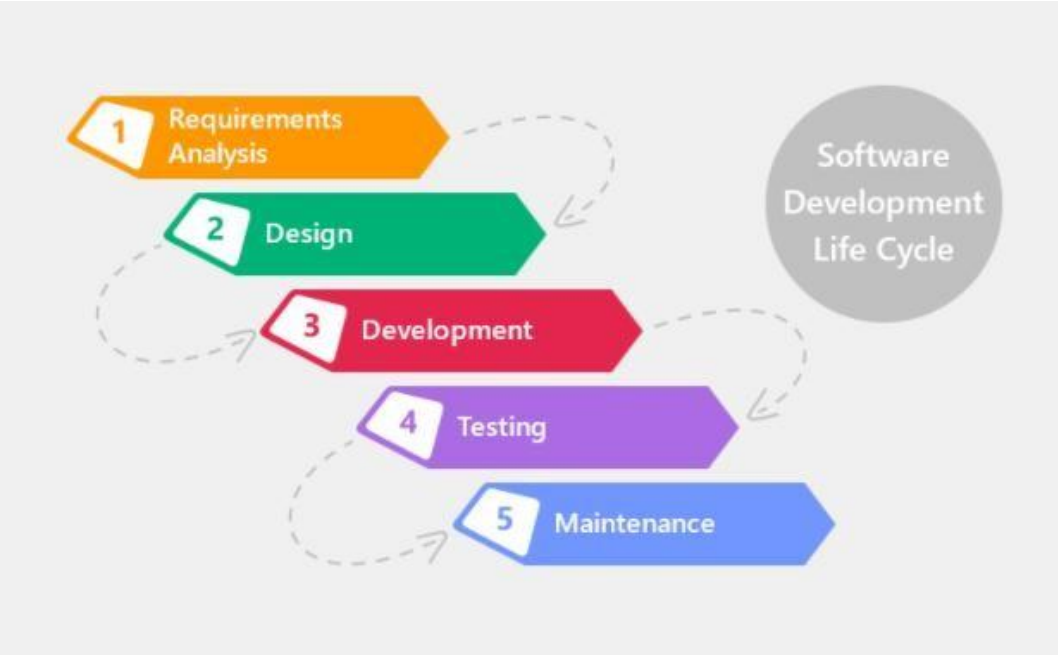


Figure 1. Research Methodology Flow

1. Requirements Analysis: At this stage, the process of identifying system requirements is carried out through direct observation and interviews with representatives of PT. Kodinglab Integrasi Indonesia to obtain the data and information needed for system development.
2. System Design: This stage aims to design the system workflow and illustrate the interactions between users and the system using use case diagrams as a reference in the development process.
3. Implementation (Coding): At the implementation stage, the system is developed based on the results of the use case design using the Laravel framework along with several supporting libraries required to build the application's functionality.
4. Testing: Testing is conducted to ensure that all system features operate according to functional requirements. The testing process is carried out in collaboration with PT. Kodinglab Integrasi Indonesia to ensure alignment between the system and user requirements..
5. Maintenance: At the maintenance stage, the system is fully handed over to PT. Kodinglab Integrasi Indonesia to be managed and further developed according to the company's internal needs..

These stages are applied in the development of a Laravel-based LMS system used for internship training at PT. Kodinglab Integrasi Indonesia.

Results

The results and discussion of this study indicate that the implementation of a Learning Management System (LMS) is an appropriate solution to facilitate the learning process of internship participants at PT. Kodinglab Integrasi Indonesia. This system helps address the constraints in allocating teaching time that have previously disrupted the focus and work productivity of employees acting as mentors.

A use case is a model that describes the interaction between actors and a system to achieve a specific goal. Use cases are used to identify the functions contained within an information system as well as to determine which users are authorized to use these functions [9].

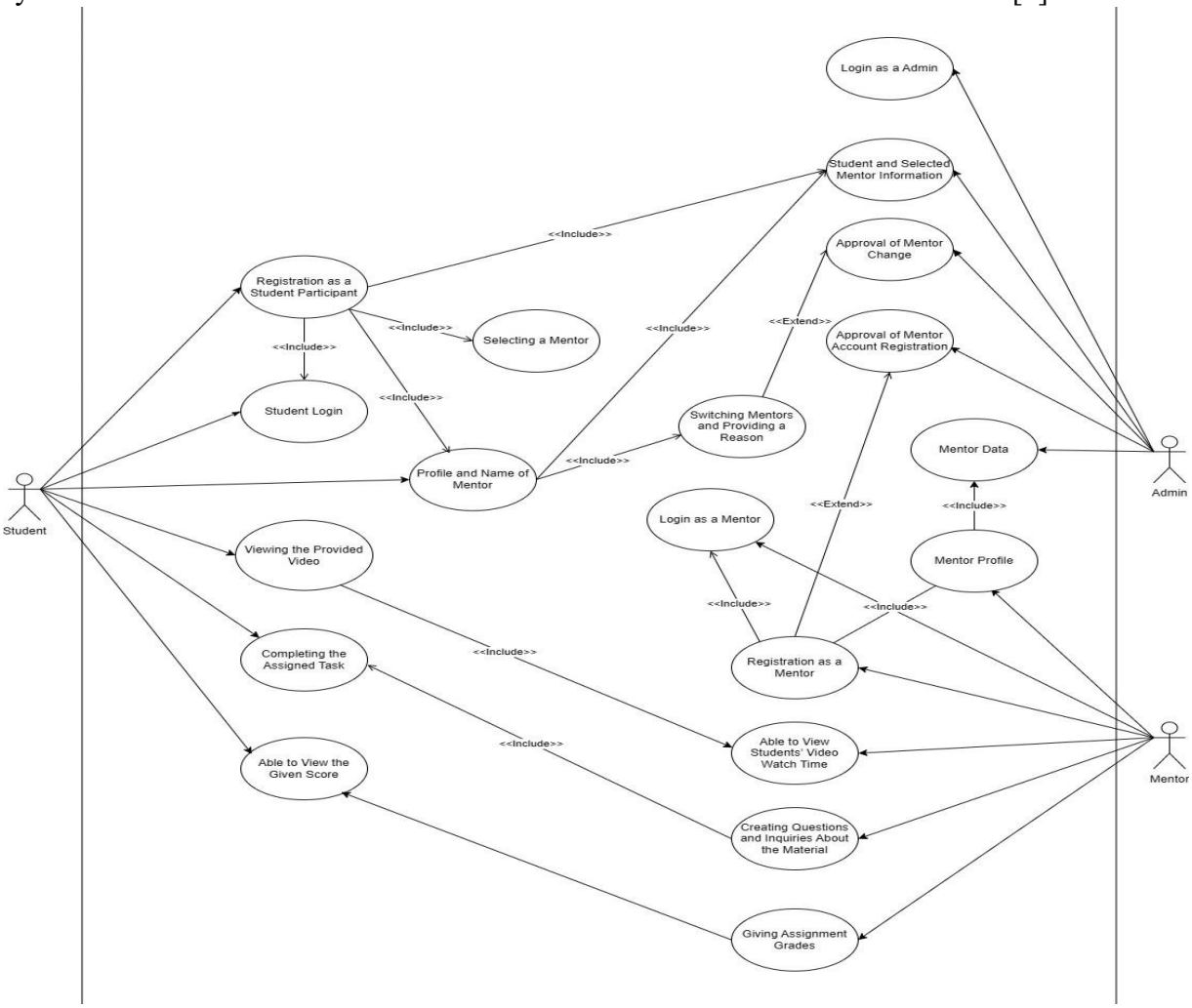


Figure 2. Usecase

In the design of this Learning Management System, a use case diagram is used to illustrate all activities that can be performed by the three main actors, namely Admin, Mentor, and Internship Participant. The use case diagram shown in Figure 2 illustrates the relationship between each actor and the relevant system functions.

The Admin actor has full access rights to the system, including logging in as an administrator, managing data of learners and mentors, approving mentor account registrations, and organizing learning materials in the form of instructional videos and assignments. The Admin is also able to verify user data and ensure the smooth operation of learning activities within the system. The Mentor actor plays a role in delivering learning materials to learners in the form of videos and assigning tasks as a form of evaluation. The Mentor can register and log in to the system, manage a personal profile, and monitor learners' learning progress through features such as video watch-time tracking and the submission of uploaded assignments. Through these features, the Mentor can assess the extent to which learners understand the provided materials.

Meanwhile, the Internship Participant is the primary user who directly interacts with the learning materials. Internship participants register as new users, log in to the system, select their preferred mentor, and access the profile of the selected mentor. After registration, participants can view the provided learning videos and upload their assignment results through the system.

Table 1. Use Case Diagram Description

No.	Use case	Description	Actor
1	Login	The login process is applied to all with the purpose of distinguishing the roles selected by each user.	Internship Participant, Mentor, and Admin
2	Select Mentor	It aims to allow users to select a mentor according to their preferences.	Internship Participant
3	View Videos and Assignments	Internship participants can view the videos provided by the Admin and the assignments given by the Mentor.	Internship Participant
4	Learning Videos needed.	The learning videos viewed by internship participants can be edited as	Provide Admin
5	Assign Tasks	The assignments received by internship participants can be directly assigned by their respective mentors	Admin and Mentor and the Admin.
6	Monitoring	The Mentor can monitor the viewing progress to determine how far internship participants have watched the provided videos.	Mentor
7	Provide Scores	The Mentor and the Admin can assign grades to the given assignments.	Admin and Mentor

Conclusion

Based on the research conducted, it can be concluded that a web-based Learning Management System (LMS) developed using the Waterfall method and the Laravel framework is an appropriate solution for the internship training process at PT. Kodinglab Integrasi Indonesia.. The research results indicate that the implementation of the LMS is able to:

1. Facilitate the learning and training process for internship participants, as all materials can be accessed online anytime and anywhere.

2. Support independent learning, where internship participants can study without having to wait for face-to-face schedules with mentors.
3. Improve mentors' time efficiency and productivity, as this system reduces constraints in allocating time between teaching activities and primary job responsibilities.
4. Provide convenience for mentors and the Admin in monitoring internship participants' learning progress through activity tracking features, assignment submission, and digital grading.
5. Organize all learning data effectively, including user management (Admin, Mentor, and Internship Participants), learning videos, and evaluation results.

Thus, the LMS developed using the Laravel framework and the Waterfall model can optimize the digital-based internship training process in a technology company environment such as PT. Kodinglab Integrasi Indonesia. This system also has the potential for further development by adding interactive features such as discussion forums, online quizzes, and automatic certification to enhance the user learning experience.

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