Research Article

Designing a Web-Based Digital Certificate Application Using the Waterfall Method

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Abstract: In the digital era that continues to develop, information technology has brought many aspects of life, including managing activity certificates in educational and professional environments. Activity certificates have an essential role in recognizing participants. Built using the Laravel framework and the PHP programming language, this application features easy public access to certificates via online links. Thus, this research aims to design a digital certificate application that is effective and easy to use, hoping that it can positively contribute to DIGITAL-ID AKADEMI in improving the quality of services and management of activities. The issuance and distribution of certificates will positively impact digital's reputation. ID AKADEMI is an innovative educational institution that is responsive to technological developments.

Keywords: e-certificate; web; waterfall method; laravel; MySQL; structured analysis and design

1. Introduction

In the ever-growing digital era, information technology has become integral to almost every aspect of our lives. Along with technological developments, various processes and tasks carried out manually or conventionally have been transformed into more efficient and effective processes through web-based applications. One area that has significantly impacted this development is the management of activity certificates in educational and professional environments.

Activity certificates are essential in recognizing and rewarding individual participation and achievements in various activities, training, seminars, and other events. As written evidence, this certificate provides added value for participants in carrying out their professional and educational careers—however, it is DIGITAL-ID AKADEMI wants innovation in data management and documentation, especially regarding activity certificates. Therefore, a digital certificate application was designed using a desktop website operating system to become a relevant solution for improving the efficiency and quality of educational services at AKADEMI DIGITAL.ID.

Making activity certificates in educational institutions often experiences problems, ranging from manual processes that take a long time to the risk of errors in managing participant data at AKADEMI DIGITAL.ID, we provide modern and integrated solutions to increase productivity, speed, and accuracy in issuing and distributing certificates.

In this understanding, this research designs an application using the Laravel framework and the PHP programming language to build this application. Excellence in database management and feature development is expected to make a significant contribution to creating digital certificate applications that are effective and easy to use.
This research aims to design a digital certificate application at AKADEMI DIGITAL.ID has several superior features, such as easy access to certificates via online links. We hope to make a positive contribution to DIGITAL.ID ACADEMI in improving the quality of service and management of activities. Efficiency in issuing and distributing certificates will positively impact DIGITAL’s reputation. ID ACADEMI is an innovative educational institution that is responsive to technological developments.

2. **Theory**

In previous research, the e-certificate application has the potential to simplify and improve the efficiency of the administrative process [1]. Performance testing on applications through black box testing is essential in supporting application effectiveness [2]. According to previous research, the Web-based Academy Information System brings significant benefits in delivering information, data management efficiency, and the availability of grade information for students [3]. Information systems have an essential role and are the basis for forming relevant details; eight main components in information systems involve aspects of input, model, output, technology, hardware, software, database, and control [4].

2.1 **Certificate**

The certificate is for legalizing documents involving parties outside the campus; a Digital Signature Algorithm scheme with a digital certificate or a SaaS-based scheme with a QR Code and barcode on the document can be optimized. Meanwhile, to legalize documents involving internal campus parties, using the PKCS scheme by generating digital signatures via a PDF file reader application such as Adobe Reader or Foxit Reader is an alternative that is simple, easy to implement, and does not require additional infrastructure. [5].

2.2 **PHP (Hyper Text PreProcessor)**

PHP is a programming language that is often embedded into HTML. PHP itself comes from the words Hypertext Preprocessor. This programming language uses a server-side system. Server-side programming is a programming language where the script/program will later be executed/processed by the server. The advantages are that it is easy to use, simple, and easy to understand and learn. The PHP programming language helps you develop web-based applications that are quite complex, reliable, and fast.[6]

2.3 **Waterfall Method**

The waterfall method is popular in information systems and software development. The advantage of the method is that it is done gradually. The disadvantage of this method is that it takes quite a long time, so the costs required increase. Nevertheless, the Waterfall Method is suitable for creating new systems and developing software.[7]

2.4 **HTML, CSS, JavaScript**

HTML is a language format used to create website pages. However, to create a website, it is not enough to use HTML; you need the help of CSS, JavaScript, and PHP to create a dynamic website. [8]
2.5 Bootstrap
Bootstrap is an extraordinary framework that prioritizes appearance to speed up and facilitate website development. The web display created by Bootstrap will adjust the browser’s layer size, whether on a desktop, tablet, or mobile.[9]

2.6 Database
A database is a collection of data that is integrated and carefully structured, allowing the data to be manipulated, retrieved, and searched quickly. This database is essential in supporting various applications and business processes by providing a container for storing, managing, and processing MYSQL data [10].

2.7 XAMPP
XAMPP is a popular choice among web developers and beginners in building and testing web applications locally before publishing them online, as well as configuration and support for various components, as an effective tool for web application development and testing [11].

3. Method
This research method explains the process or stages of the WEB-BASED DIGITAL CERTIFICATE APPLICATION. This research design uses a methodology, namely waterfall. The following are the steps for using the Waterfall Model to design and build a Web-Based Digital Certificate Application. Moreover, the Waterfall methodology can be seen in Figure 1.

![Figure 1. Waterfall Methodology](image)

3.1 Planning
Identify the needs and objectives of the digital certificate application, then design a project plan and schedule.

3.2 Requirements
Conduct in-depth analysis, such as preparing the required features and identifying user needs, such as participant data input and certificate management.

3.3 Implementation
I am using the selected programming language and technology.

3.4 Testing
Testing the application includes data input testing, certificate management, public links, and conducting work tests to ensure the application can handle the expected load.
3.5 Deployment
Ensure the application runs smoothly in production and can be accessed by users, fixing bugs and problems found during testing. The use of the Waterfall method in project implementation is not new; previous research has been carried out in research in references [15-23].

4. Result and Analysis
This chapter describes the results carried out by researchers using the methods described in the previous chapter.

4.1 Certificate Application Design

![Flowchart System](image)

**Figure 2. Flowchart System**
At this stage, we are designing a web-based digital certificate application at AKADEMI DIGITAL.ID as shown in Figure 2. The process starts on the entry page, registers, lists activities, and prints certificates. The overall flowchart provides an overview of how this application efficiently manages the process from registration to certificate creation in the Digital Academy environment.

4.2 Certificate Application System Design

Figure 3 shows the ERD diagram in the application, and Figure 4 shows the context diagram. These two images are essential in designing web-based digital certificate applications at AKADEMI DIGITAL.ID. These two diagrams become an essential foundation in understanding the structure and workflow that exists in the application, as well as ensuring efficient integration in managing digital certificates.
The Context diagram in Figure 5 shows that the digital academy certificate system has three types of users: admin, company, and ordinary. These three user entities are the main focus of the digital certificate application, with the admin having full access rights to manage and oversee various aspects, including user data. The company has a unique role in issuing participant certificates and activities related to Company information. Ordinary users use the system to access and manage their certificates.
The diagram in Figure 5 is a level 1 DFD view. Participants fill in their data after registration, starting with the participants’ registration stage. Furthermore, participants choose activities according to the list of activities available, up to the distribution of certificates as a result of the activities that each participant has participated in through the shared link. Furthermore, The results of designing a web-based digital certificate application at AKADEMI DIGITAL.ID is as follows:

4.3 Login Page

The login page on the web-based digital certificate application has a function for users to enter login information, such as username and password, to access the user’s area. First, fill out the list page as shown in Figure 6 for users who have not registered.
In Figure 7, the admin has full access rights to manage and monitor all aspects of the application. From here, the admin can easily view and collect user data and perform other administrative tasks. The admin page display is designed to provide ease of functionality to ensure the management of digital certificates runs smoothly and efficiently.

4.5 Company Page

Figure 8. Company Page
Users can manage Company information related to activity certificates on the company page in the digital certificate application. This page has features for entering and editing Company data, uploading Company logos, and adding activities. The design of this company page provides convenience in managing company details and ensures that information about activity certificates is current and accurate. Figures 6, 7, and 8 show more detailed images of the login, admin, and company page.

4.6 Programming language

In this digital certificate application system, we use Laravel programming language, PHP, CSS, and JavaScript using the VS code editor. Laravel is a PHP-based web framework that is open-source and unpaid and is intended for web application development. [12]. For the database, we use PhpMyadmin to handle MySQL database administration through the Web interface; PhpMyadmin supports various operations on MySQL and MariaDB databases [13].

4.7 Testing

In the application testing stage using black box testing, Black box testing targets the functional specifications of the software created [14]. To find the program errors in the application and test with the review testing method to find out the features and appearance of the web application following the needs of the application, such as detailed application display functions.

4.8 Deployment

at this stage, the researcher ensures that the application meets the functional requirements. In addition, at this stage, researchers also ensure that features are well integrated, and testing will be carried out continuously to ensure quality, smoothness, success, and consistency in each stage of development.

5. Conclusions

In this chapter, it can be concluded that web-based digital certificate applications are developed at AKADEMI DIGITAL.ID will make it easier for people who want to develop their potential expertise and increase efficiency, speed, and accuracy in creating, managing, and distributing activity certificates. With this, it is expected to positively impact the Institute as an innovative and responsive educational entity to technological developments.

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