



Design of a Website -Based Student E-Certificate System using the User Centered Design (UCD) Method

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Abstract

An e-certificate is a digital document used to certify that someone has completed a course, training, or specific activity. However, a number of higher education institutions still use manual systems for certificate management, resulting in a slow and error prone process. This study aims to design a website -based e-certificate system that can improve efficiency and ease of access for students. The method used in designing this system is User-Centered Design (UCD), which emphasizes user involvement at every stage of development. The design process begins with an analysis of user needs through observation or observing student activities at the higher education institution, followed by the creation of a prototype that is tested by users to obtain feedback. The result of this study is a user-friendly e-certificate system, allowing students to register, access, and download certificates directly. In addition, this system is equipped with a QR Code feature for certificate ownership validation. This research is expected to contribute to educational institutions in improving administrative services and making it easier for students to manage their academic documents.

Keywords: E-certificate, Higher Education Institution, User Centered Design, QR Code

1. Introduction

Information technology has developed rapidly, profoundly impacting human activities at the personal, communal, organizational, and institutional levels. A significant benefit of using information technology is the simplicity and effectiveness in carrying out human operations. In higher education institutions, participation in various academic or non-academic activities is a prerequisite for student graduation, for which a certificate of participation is awarded. A certificate is a formal statement by an authorized entity that verifies ownership or occurrence [1].

The manual certificate issuance process is lengthy, and there is no method to verify certificate ownership, which facilitates forgery. As a higher education institution focused on information technology, improving and advancing the lecture system is crucial [2]. E-certificate technology improves the efficiency of the certificate issuance process. An established e-certificate system simplifies the issuance procedure and authenticates the validity of electronic certificate ownership to reduce the incidence of certificate forgery [3]. In an e-certificate system, certificates may incorporate security features, such as serial numbers converted into symbols or images using a specific methodology. This significantly enhances the certificate's security, making it difficult to counterfeit. Electronic certificates are managed digitally, with their information stored in a database that can be accessed quickly, easily, and accurately online by authorized individuals.

Developing a student e-certificate system requires a series of procedures or stages. Therefore, the author uses the User Centered Design (UCD) method. User Centered Design (UCD) is a design process that relies on product customer data [4]. The advantages of the UCD method lie in its efficacy and user-friendliness, as it involves consumers throughout the design process [5]. The study entitled "Implementation of the User Centered Design (UCD) Method in an Android Mobile-Based Indonesian Culinary Menu Ordering System" investigates the design and implementation of the UCD methodology within an Indonesian culinary menu ordering system. This study seeks to provide insights for local and international audiences to improve the sales framework of Indonesian processed food goods. The study findings indicate that 76.62% of visitors strongly support this approach, while 12.26% reject it. Conversely, 94.44% of international visitors support this application, while 5.55% oppose it. The findings from the alpha testing of this Indonesian gourmet menu ordering application indicate that this application is user-friendly [6]. Research on the use of User Centered Design (UCD) methodology to improve online menu product marketing at Alfa Lesehan Restaurant in Blitar Regency, entitled "Implementation of User Centered Design (UCD) Method on Web-Based Online Catalog." This research attempts to overcome the obstacles experienced by users in using the functionality of the Alfa 1 application. Lesehan. The results obtained from Usability Testing using the System Usability Scale showed that the application obtained a satisfactory score of 6.8%, indicating its effectiveness in creating a user-friendly interface with a satisfying user experience. The User Acceptance Test (UAT) produced an average score of 81.8%, indicating that the application was approved and met customer expectations. A/B testing of two User Interface (UI) designs showed that the first UI design was superior, with a suitability level of 90.9% [4]. Pratama, Probayakti, and Wijana (2021) conducted research on the need for boarding house furniture among students from several locations in Yogyakarta, while also meeting the needs of graduates who wanted to sell the furniture. This study was entitled "Application

of the User-Centered Design (UCD) Method in Developing Online Services for Buying and Selling Secondhand Goods." This study sought to connect sellers and buyers of antique boarding house furniture. The research findings showed a usability level of 93% for buyers and 92% for sellers, thus validating the website's performance [7]. The use of UCD methodology is expected to increase the clarity of findings for users, thereby encouraging optimal utilization, because UCD emphasizes user centered design.

In this research, the system was designed to be easily accessible on various devices, including desktops and smartphones. The user interface was designed to be responsive and adaptive, allowing for seamless access. Certificates can be downloaded as Portable Network Graphic (PNG) files equipped with Quick Response. Code (QR Code) for validating certificate ownership. User satisfaction is expected to reach 90%, with positive feedback regarding ease of use. This research seeks to develop an e-certificate system. Using the UCD method, the system ensures it meets functional requirements while providing a positive user experience. It is hoped that this system will be an effective solution for certificate management in educational settings, increasing user satisfaction and facilitating certificate accessibility for students.

2. Literature Review

2.1. Information Systems

An information system is a system that includes components that can be converted into data, which can then be used to can be reprocessed into information [8].

2.1.1. Website

A website is a collection of pages that convey information through text, graphics, animation, sound, video, and combinations thereof, which create a series of interdependent structures, both static and dynamic, which are connected to each other through hyperlinks [9].

Website Based System

The website-based system is built by the following important components.

1. PHP (Hypertext Preprocessor)
PHP is known as a programming language that dynamically generates HTML (Hypertext Markup Language) pages that run on a web server. The resulting HTML pages are not created using a text editor. PHP is classified as a server-side programming language [10].
2. Database
A database is a computerized system designed to store processed data and provide access to information as needed [11].
3. Laravel framework
The Laravel framework is a PHP-MVC web development framework that improves software quality by increasing developer productivity with intuitive syntax and a set of capabilities that cut development and maintenance costs, while significantly reducing implementation duration [12].

2.2. E-Certificate

An e-certificate is an electronic certificate issued digitally and accessible through an online platform. The use of e-certificates is becoming increasingly popular in various educational institutions and organizations due to their ease of issuance and distribution. E-certificate applications simplify the issuance procedure and authenticate ownership of electronic certificates to reduce the occurrence of counterfeit certificates [3].

2.3. QR Code (Quick Response Code)

QR Code is a two-dimensional symbol that encodes data in textual format, including numeric, alphanumeric, or binary information. QR Code is widely used for commercial purposes, especially in Japan, which includes URL connections to specific destinations or plain text [13].

User Centered Design (UCD)

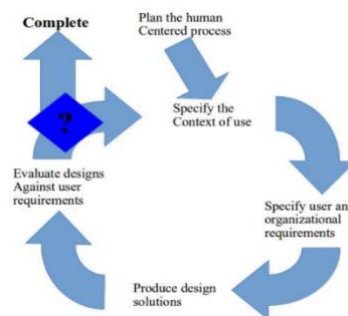


Fig. 1: Stages of the UCD Method
Source: Saputri, Fadhi, and Surya, 2017

The stages of the UCD method will be shown according to Figure 2, which includes [14]:

1. Specify the context of use
This stage requires searching for potential application users to gather information using observation methods and short dialogues with potential users.
2. Specify user and organizational requirements
This stage involves identifying user needs for the application.
3. Product design solution

This stage actualizes the design idea by developing a prototype for evaluation with potential customers to address application issues.

4. Evaluate design

This stage requires design evaluation, where testing is conducted to see whether the previous design aligns with user preferences.

2.4. Related Research

A study entitled "Implementation of the User Centered Design (UCD) Method in an Android Mobile-Based Indonesian Culinary Menu Ordering System" examines the design and implementation of the User Centered Design method. (UCD) in the Indonesian culinary menu ordering system. This study aims to improve the sales framework of Indonesian processed food products for both local and international markets. The results showed that 76.62% of local visitors strongly supported the system created, while 12.26% disagreed. In contrast, 94.44% of international visitors supported the application, while 5.55% disagreed. The results of the alpha testing procedure showed that the Indonesian culinary menu ordering application was user-friendly [6].

Research on the use of User Centered Design (UCD) methodology to improve online menu product marketing in restaurants, entitled "Implementation of User Centered Design (UCD) Method for Web-Based Online Catalog at Alfa Lesehan Restaurant in Blitar Regency." This research aims to overcome the difficulties experienced by users in using the features of the Alfa Lesehan application. The results obtained from Usability Testing Using the System Usability Scale, the application obtained a commendable score of 6.8%, indicating its effectiveness in creating a user-friendly interface with a satisfying user experience. User Acceptance Test (UAT) testing resulted in an average score of 81.8%, indicating that the application was approved and met customer expectations. A/B testing of two User Interface (UI) designs showed that the first UI design was superior, with a conformity rate of 90.9% [4].

Pratama, Proboyekti, and Wijana (2021) conducted research on the need for boarding house furniture among students from several locations in Yogyakarta, while also addressing the needs of graduates who want to sell their used furniture. This study, entitled "Implementation of the UCD Method in Developing an Online Used Goods Buying and Selling Service," aimed to connect vendors and buyers of antique boarding house furniture. The results showed a usability rating of 93% for buyers and 92% for sellers, indicating that the developed website was considered useful [7].

3. Research methods

3.1. Method of collecting data

The data collection methods used in this study include the following:

- a. Observation Method
Currently, researchers are collecting data by observing academic and non-academic activities at institutions to guide the creation of a student e-certificate system.
- b. Literature Study Method
Collect data and reference materials from journals, print media, or other internet sources.

3.2. System Analysis

The system analysis in this study is divided into 2 process stages, namely:

1. Current system analysis, namely examining the existing system and designing the interface for the new system.
2. Analyze the proposed UCD methodology by explaining its straightforward approach to creating user interface designs.

3.3. System Design

The author uses a user-centered design paradigm in system design by emphasizing user requirements.

4. Research result

In this chapter, the author uses a method called User-Centered Design (UCD). In this stage, the author discusses the final appearance of the completed e-certificate system. The following are some images of the final e-certificate system:

a. Initial View

The initial display in Figure 3 is the display that appears first when the system is running e-certificate is executed.



Fig. 2: Initial View

In this view, there are the following buttons:

1. Login Button
The login button on this system is accessible to both admins and students. Admins and students already registered on this system can log in to their e-certificate accounts by re-entering their email address and password then select the enter button.
2. Register Button
The register button on this system can only be used by prospective student users who do not yet have an account. Currently, researchers are collecting data by observing academic and non-academic activities at institutions to guide the creation of a student e-certificate system. a. a. Current system analysis, namely examining the existing system and designing the interface for the new system. Prospective student users can register for a new account by entering their student ID number, full name, email address, and password, then selecting the register now button.
3. Learn More Button
This button contains information about the features contained in this system.

b. Admin Dashboard View

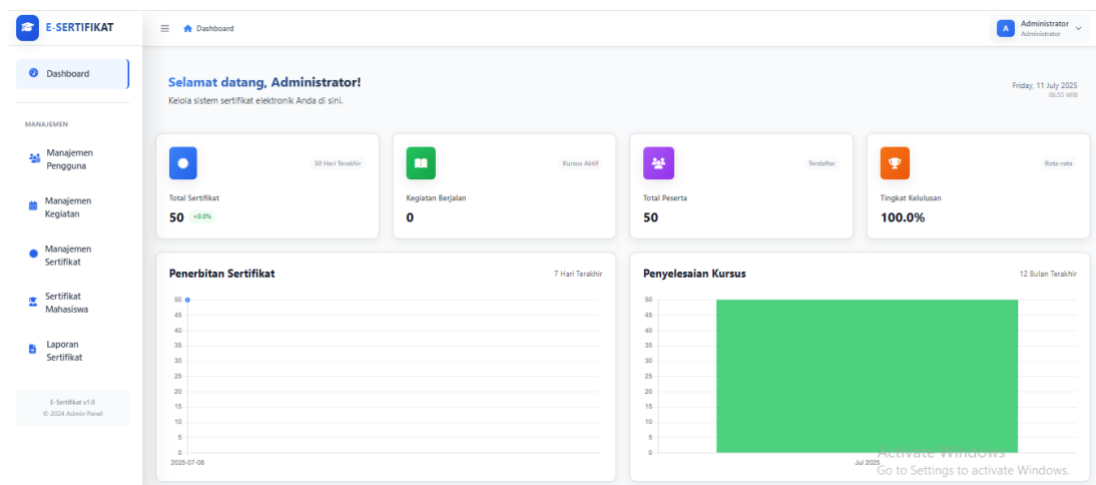


Fig. 3: Admin Dashboard View

On the admin dashboard, there are 5 menus as follows.

1. User Management
This menu contains the user's full name, user email, user's place and date of birth, user's date of birth, user's gender, agency name if the role is a user role (admin/user), registered date and actions (view details, edit and delete).
2. Activity Management
This menu contains the activity name, start date, end date, status (upcoming, ongoing, completed, or canceled), and actions (view details, edit, and delete). The activity status is automatically generated by the system based on the start and end dates.
3. Certificate Management
This menu contains the certificate name, certificate type (attendance, completion, participants, achievements and others), certificate template, status (active and inactive), activity record date and actions (view details, edit and delete).
4. Student Certificate
This menu contains the student's full name, student ID number, activity, certificate name, certificate serial number, QR Code, certificate status (pending/ generated), certificate generation date and also actions (view details, edit and delete).
5. Certificate Report
This menu contains certificate reports, certificate statistics, and student certificate detail reports. The certificate report is the total of activities, students, certificate templates, certificates issued, and pending certificates. Certificate statistics are the result of the total, the number of certificates issued, and the number of certificates with pending status per activity and per certificate template. The certificate detail report is a collection of student certificate summaries containing the student's full name, student ID number,

activities participated in, start and end dates of the activity, certificate name, certificate status, certificate generation date, and certificate serial number.

c. Student Dashboard View

The student dashboard features the latest activities and certificates. Students can view the activities they've participated in, view details, view certificates, print certificates, and download them.

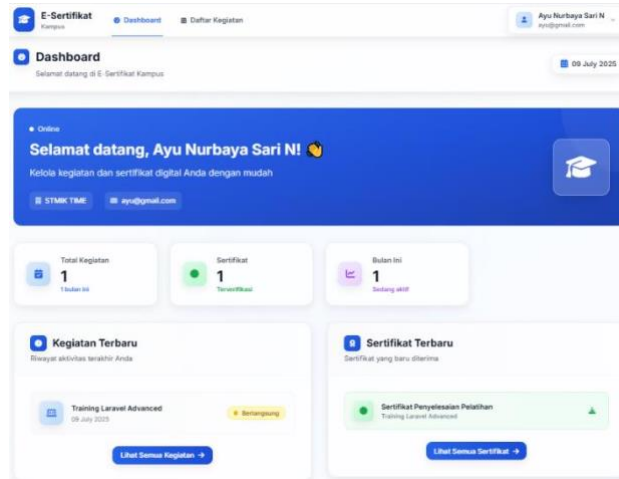


Fig. 4: Student Dashboard View



Fig. 5: Display of Certificate Download Results

Blackbox Testing

Testing admin and user login pages

Table 1: Testing of Admin and User Login Pages

No.	Test scenario	Test case	Expected results	Results	Conclusion
1.	Match email, password it is not in accordance with	Email = appropriate Password = does not match	Failed to log in	As expected	In accordance
2.	Email does not match, password in accordance	Email = does not match Password = appropriate	Failed to log in	As expected	In accordance
3.	Email and password in accordance	Email = appropriate Password = In accordance match	Login successfully	As expected	In accordance

Testing the certificate generation feature

Table 2: Testing the Generate Certificate Feature

No.	Certificate status	Test case	Expected results	Results	Conclusion
1.	Generated	Certificate generated	Certificate can be seen	As expected	In accordance
2.	Pending	Certificate pending	Certificate cannot be viewed	As expected	In accordance

Advantages of the Proposed System

- a. This system has a QR Code feature to validate certificate ownership per individual student.
- b. This system has a download feature to save certificate results which can be done multiple times.
- c. This system can calculate the total number of students, the number of certificates generated, and the number of certificates pending.
- d. In each menu in the system, there is a filter to search for the desired results according to the criteria.

Weaknesses of the Proposed System

- a. This system does not yet have a feature to upload campus logos, activity logos, or passport photos on certificates.
- b. This system cannot yet implement the digital signature of the activity organizing team on the certificate.
- c. This system is not yet directly connected to social media such as LinkedIn.
- d. This system does not yet have a feature for adding templates and changing certificate templates system.

5. Conclusion

Several conclusions can be drawn as the final result of designing the student e-certificate system, are as follows:

- a. A website-based student e-certificate system can assist higher education institutions and increase effectiveness and efficiency in terms of issuing, distributing, and validating certificate ownership.
- b. The student e-certificate system is designed to help students access their certificates online via the website.
- c. The User Centered Design (UCD) method applied to the student e-certificate system plays a role in the design and functionality of the system according to user needs which can increase user satisfaction and improve system efficiency.

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