

Research Article

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

Lucy Susannaiyah ¹, Cahyo Darujati ^{2*} 

^{1,2} Informatics Engineering, Computer Science, Narotama University Surabaya, Indonesia

* Corresponding Author: cahyo.darujati@narotama.ac.id

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.



Citation: L.Susannaiyah & C.Darujati, " Designing a Web-Based Digital Certificate Application Using the Waterfall Method". *Iota*, **2024**, ISSN 2774-4353, Vol.04, 01.
<https://doi.org/10.31763/iota.v4i1.704>

Academic Editor : Adi, P.D.P

Received : January, 05 2024

Accepted : January, 16 2024

Published : February, 05 2024

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.

Publisher's Note: ASCEE stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2024 by authors.
Licensee ASCEE, Indonesia. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution Share Alike (CC BY SA) license(<https://creativecommons.org/licenses/by-sa/4.0/>)

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 AKADEMI in improving the quality of service and management of activities. Efficiency in issuing and distributing certificates will positively impact DIGITAL's reputation. ID AKADEMI 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.

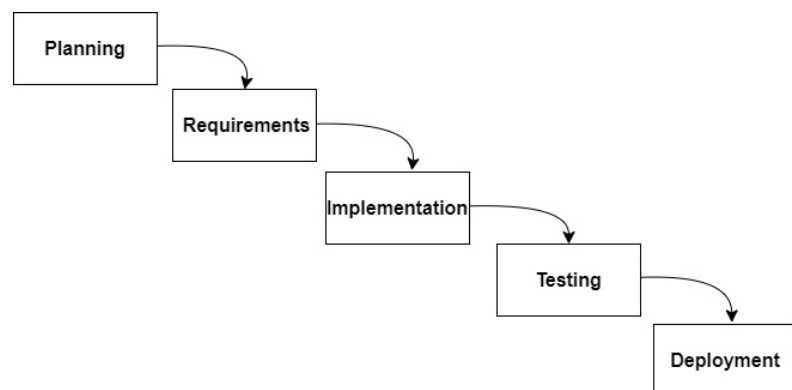


Figure 1. Waterfall Methodology

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

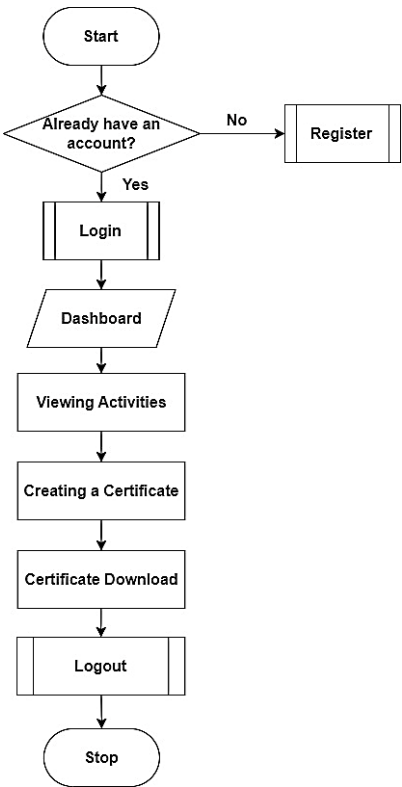


Figure 2. Flowchart System

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.

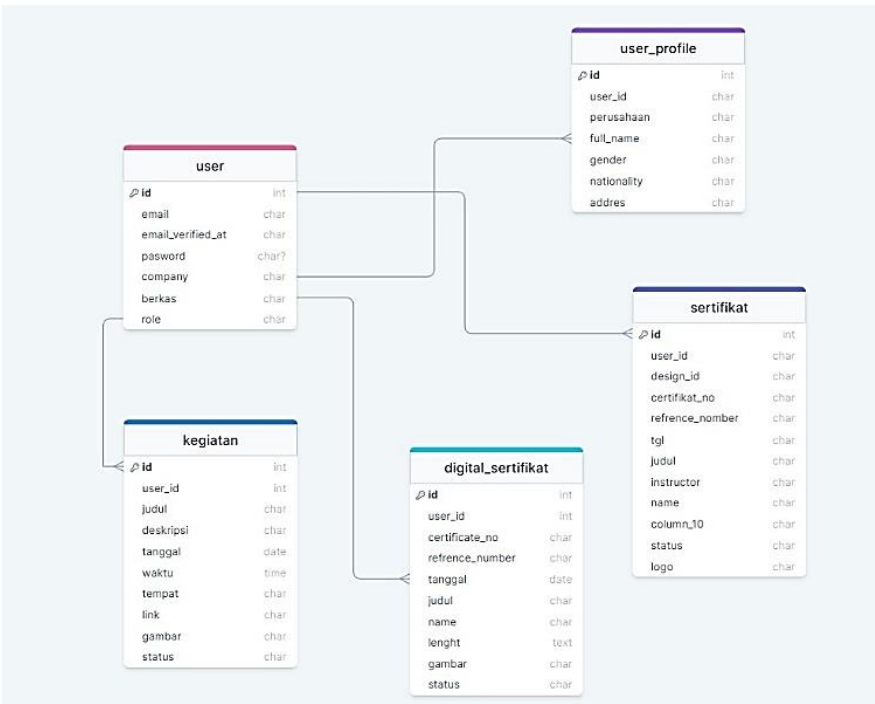


Figure 3. ERD (Entity Relationship Diagram)

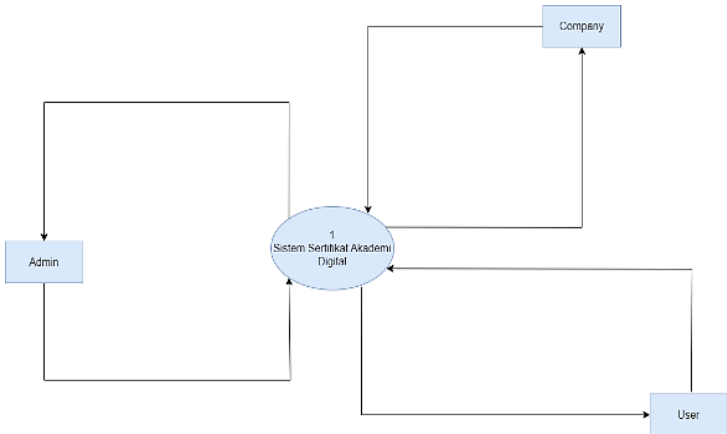


Figure 4. Context Diagram

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.

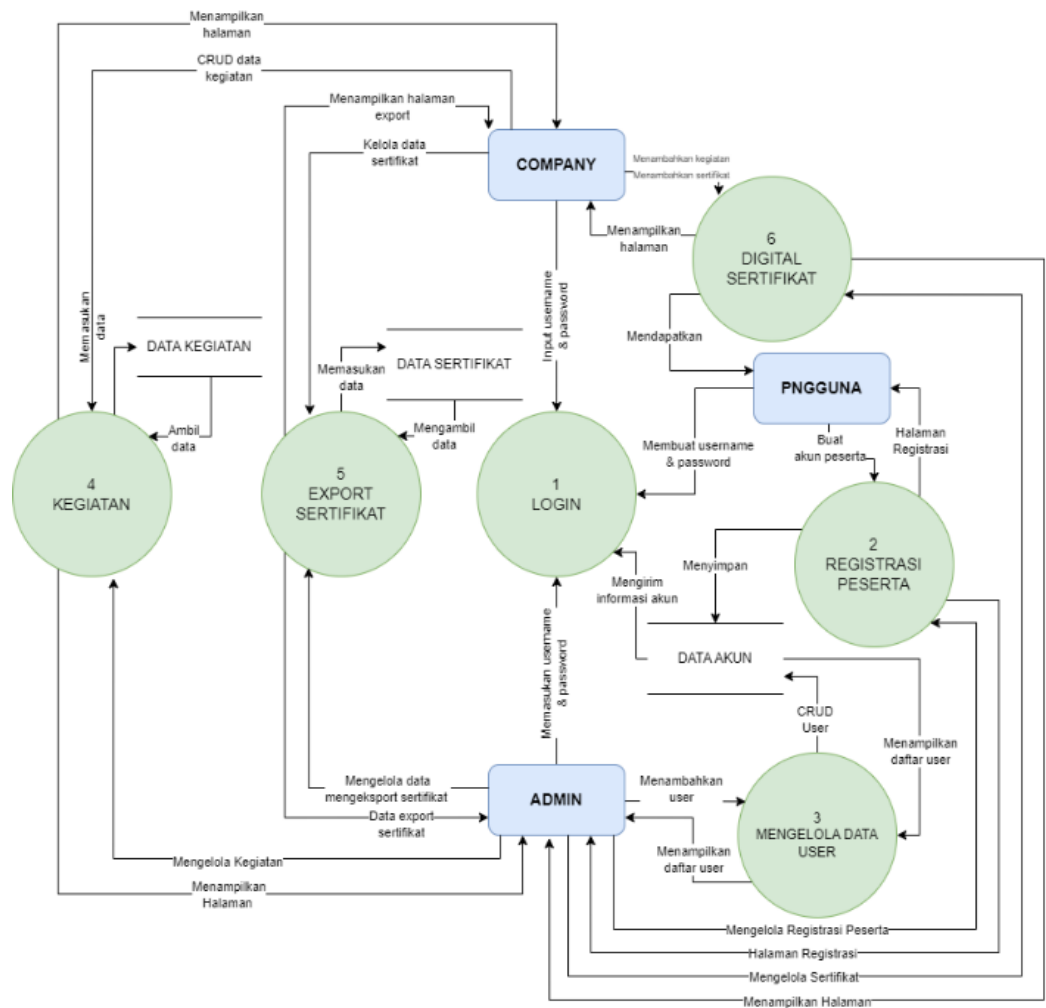


Figure 5. DFD (Data Flow Diagram) level 1

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.

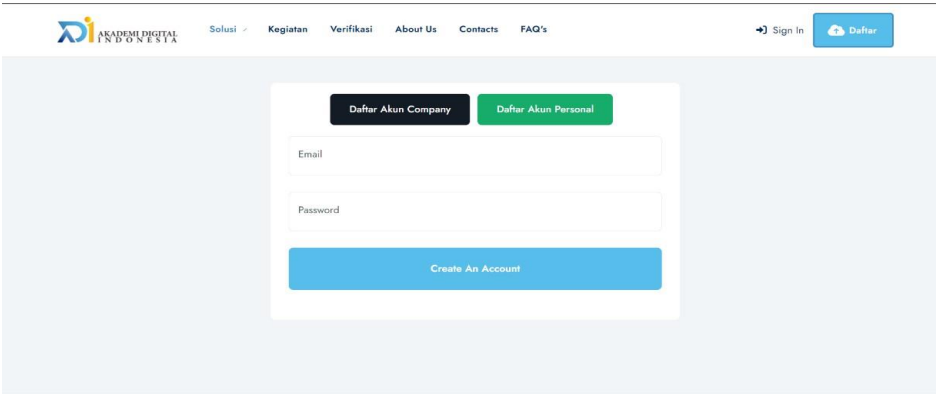


Figure 6. Login Page
4.4 Admin page

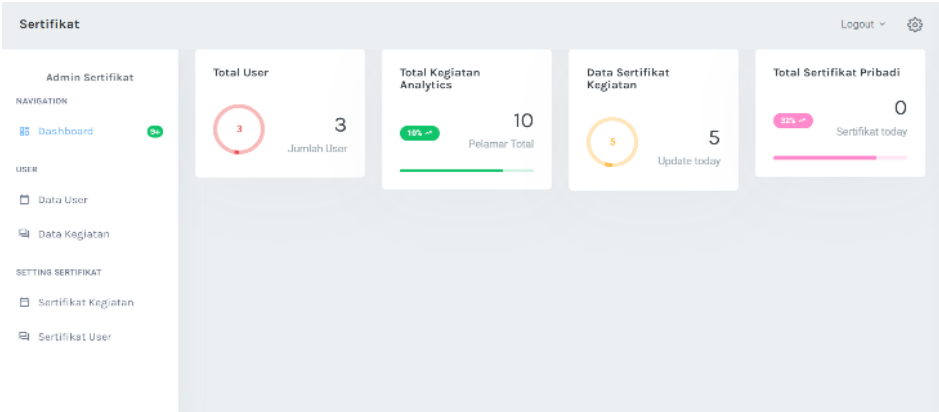


Figure 7. Admin Page

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

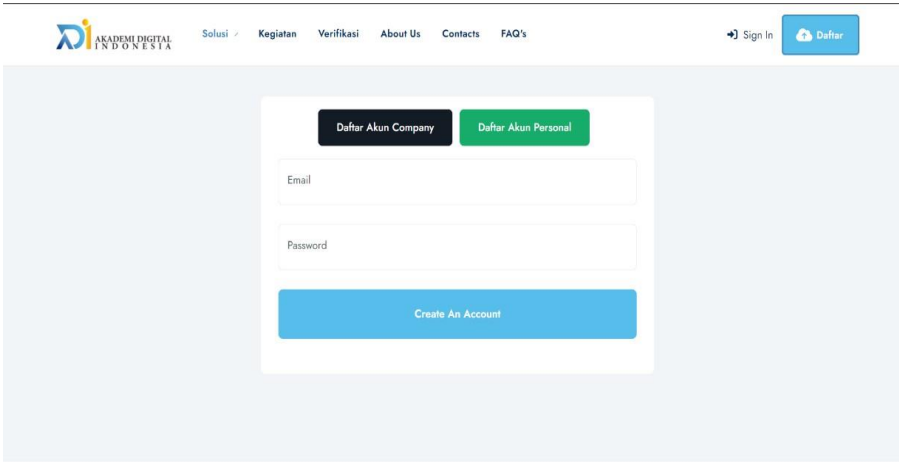


Figure 8. Company Page

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.

Acknowledgments: We would like to thank Dr. Cahyo Darujati S.T., M.T., as Dean of the Faculty of Computer Science and Supervisor I, and Made Kamisutara, S.T, M.Kom., Head of the Informatics Engineering Study Program for their support and guidance. Our thanks also go to the family, Narotama University Surabaya Lecturers, Examiners, and friends, whom I cannot mention individually, for supporting the smooth running of this research process. Thank you for all the help and support that has been given.

Author contributions: All Authors are responsible for building Conceptualization, Methodology, analysis, investigation, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision of project administration, funding acquisition, and have read and agreed to the published version of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. A. D. Samala and B. R. Fajri, "Rancang Bangun Aplikasi E-Sertifikat Berbasis Web Menggunakan Metode Pengembangan Waterfall," *Jurnal Teknik Informatika*, vol. 13, no. 2, pp. 147–156, 2021. [\[CrossRef\]](#)
2. R. Saepul Rohman, D. A. Firmansah, and E. Ermawati, "Rancang Bangun Aplikasi E-Sertifikat Berbasis Web Menggunakan Metode User Centered Design," *Jurnal Responsif : Riset Sains dan Informatika*, vol. 4, no. 1, pp. 1–11, 2022. [\[CrossRef\]](#)
3. M. B. W. & Endry Prayoga, "Sistem Informasi Akademik Berbasis WEB di SMA Tamansiswa Sukabumi" *Journal Teknik dan Ilmu Komputer*, 2018. [\[CrossRef\]](#)
4. G. Oktavia, "Pengantar Sistem Informasi," *Igarss* 2017, no. March, pp. 1–30, 2019, [Online]. Available: https://www.google.co.id/books/edition/Pengantar_Sistem_Informasi/8VNLDwAAQBAJ?hl=id&gbpv=1
5. T. Yuniati and M. F. Sidiq, "Legalitas Dokumen Elektronik Menggunakan Tanda Tangan Digita Sebagai Alternatif Pengesahan Dokumen di Masa Pandemi," *Jurnal Resti*, vol. 4, no. 10, 2021. [\[CrossRef\]](#)
6. H. M. Tabrani, Suhardi and Priyandaru, "Sistem Informasi Manajemen Berbasis Website Pada Unl Studio Dengan Menggunakan Framework Codeigniter," *Jurnal Ilmiah M-Progress*, vol. 11, no. 1, pp. 13–21, 2021, doi: 10.35968/m-pu.v11i1.598. [\[CrossRef\]](#)
7. A. Wahid Abdul, "Analisis Metode Waterfall Untuk Pengembangan Sistem Informasi," *Jurnal Ilmu-ilmu Informatika dan Manajemen STMIK*, no. November, pp. 1–5, 2020. [\[CrossRef\]](#)
8. M. Dr.Wahyudi, S.T., "Pemograman WEB HTML dan CSS", Penerbit CV. Eureka Media Aksara, ISBN: 978-623-487-353-5 [\[CrossRef\]](#)
9. B. Suprayogi and A. Rahmanesa, "Penerapan Framework Bootstrap dalam Sistem Informasi Pendidikan SMA Negeri 1 Pacet Cianjur Jawa Barat," *Tematik*, vol. 6, no. 2, pp. 119–127, 2019, doi: 10.38204/tematik.v6i2.244. [\[CrossRef\]](#)
10. Ismai, "Evolusi : Jurnal Sains dan Manajemen Vol 7 No . 2 September 2019 ISSN : 2338-8161 E-ISSN : 2657-0793," *Jurnal Sains dan Manajemen*, vol. 7, no. 2, pp. 6–14, 2019. [\[CrossRef\]](#)
11. T. M. Eka wida Fridayanthie, "Rancang Bangun Sistem Informasi Permintaan ATK Berbasis Internet (Studi Kasus: Kejaksaaan Negeri Rangkasbitung)," *Jurnal Khatulistiwa Informatika*, VOL. IV, NO. 2 Desember 2016, vol. 제 13 집 1 호, no. May, pp. 31–48, 2016. [\[CrossRef\]](#)
12. D. Purnama Sari and R. Wijanarko, "Implementasi Framework Laravel pada Sistem Informasi Penyewaan Kamera (Studi Kasus di Rumah Kamera Semarang)," *Jurnal Informatika dan Rekayasa Perangkat Lunak*, vol. 2, no. 1, p. 32, 2020, doi: 10.36499/jinrpl.v2i1.3190. [\[CrossRef\]](#)
13. Ery Hartati, "Sistem Informasi Transaksi Gudang Berbasis Website Pada Cv. Asyura," *Klik - Jurnal Ilmu Komputer*, vol. 3, no. 1, pp. 12–18, 2022, doi: 10.56869/klik.v3i1.323. [\[CrossRef\]](#)
14. D. B. Muslimin, D. Kusmanto, K. F. Amilia, M. S. Ariffin, S. Mardiana, and Y. Yulianti, "Pengujian Black Box pada Aplikasi Sistem Informasi Akademik Menggunakan Teknik Equivalence Partitioning," *Jurnal Informatika Universitas Pamulang*, vol. 5, no. 1, p. 19, 2020, doi: 10.32493/informatika.v5i1.3778. [\[CrossRef\]](#)
15. Ethan, C. Daphne, M. Stanley, V. Augustine, M. S. Anggreainy and A. S. Setiawan, "Developing an Application to Recommend Major Based on Personality Test using Waterfall Method," 2022 5th International Conference of Computer and Informatics Engineering (IC2IE), Jakarta, Indonesia, 2022, pp. 220–224, doi: 10.1109/IC2IE56416.2022.9970189. [\[CrossRef\]](#)
16. M. Abdurrahman, T. N. Adi, M. Lubis and D. W. Jacob, "E-Ticketing System to Accelerate Car Terminal Indonesia Port of Tanjung Priok Activities Using Waterfall Method," 2023 International Conference on Converging Technology in Electrical and Information Engineering (ICCTEIE), Bandar Lampung, Indonesia, 2023, pp. 79–84, doi: 10.1109/ICCTEIE60099.2023.10366547. [\[CrossRef\]](#)
17. A. L. Santonanda, R. Nathaniel, W. L. Putra, M. S. Anggreainy, M. Danaparamita and A. Elok Amalia, "Online Craftsman Ordering Application Development using Waterfall Methodology," 2022 5th International Conference of Computer and Informatics Engineering (IC2IE), Jakarta, Indonesia, 2022, pp. 150–155, doi: 10.1109/IC2IE56416.2022.9970021. [\[CrossRef\]](#)
18. N. Yahya and S. S. Maidin, "The Waterfall Model with Agile Scrum as the Hybrid Agile Model for the Software Engineering Team," 2022 10th International Conference on Cyber and IT Service Management (CITSM), Yogyakarta, Indonesia, 2022, pp. 1–5, doi: 10.1109/CITSM56380.2022.9936036. [\[CrossRef\]](#)
19. A. Y. Ardiansyah, D. L. S. Putra, J. S. Kristanto, N. P. Budhianto and F. I. Maulana, "Waterfall Model for Design and Development Coffee Shop Website at Malang," 2022 International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS), Jakarta, Indonesia, 2022, pp. 230–234, doi: 10.1109/ICIMCIS56303.2022.10017450. [\[CrossRef\]](#)
20. J. Imanuel, L. Kintanswari, Vincent, M. S. Anggreainy, S. Yusuf and S. Y. Sembiring Kembaren, "Development of Financial Planner Application Software Based on Waterfall Model," 2022 International Conference on ICT for Smart Society (ICISS), Bandung, Indonesia, 2022, pp. 01–06, doi: 10.1109/ICISS55894.2022.9915039. [\[CrossRef\]](#)

-
21. W. Kartika, M. A. H. M, and S. Widadi, "*Simple Patient Registration with The Waterfall Method*," 2022 2nd International Conference on Electronic and Electrical Engineering and Intelligent Systems (ICE3IS), Yogyakarta, Indonesia, 2022, pp. 237-241, doi: 10.1109/ICE3IS56585.2022.10010117. [[CrossRef](#)]
 22. E. M. M. Alzeyani and C. Szabó, "*A study on the methodology of Software Project Management used by students whether they are using an Agile or Waterfall methodology*," 2022 20th International Conference on Emerging eLearning Technologies and Applications (ICETA), Sary Smokovec, Slovakia, 2022, pp. 22-27, doi: 10.1109/ICETA57911.2022.9974749. [[CrossRef](#)]
 23. F. Nurprihatin, A. A. N. P. Redi, M. N. Young, W. Septiawan, R. Djajasoepena and S. D. Liman, "*Digital Dashboards to Track Performances of Order Management Division Using SCOR and Waterfall Model*," 2023 2nd International Conference on Computational Modelling, Simulation and Optimization (ICCMO), Bali, Indonesia, 2023, pp. 142-152, doi: 10.1109/ICCMO59960.2023.00037. [[CrossRef](#)]