JURNAL TEKNOLOGI DAN OPEN SOURCE
Vol. 6, No. 1, June 2023, pp. 72~85
e-ISSN: 2622-1659, accredited Four Grade by Kemenristekdikti, Decree No: 36/E/KPT/2019
DOI: 10.36378/jtos.v6i1.3065

Application of Waterfall Method In Design Of Web-Based Library Information System Program Case Study at Elementary School Warungnangka Kabupaten Subang

Muhammad Faittullah Akbar[1], Ahmad Fauzi[2]
[1, 2]Fakultas Teknik Dan Informatika, Universitas Bina Sarana Informatika

Article Info

Article history:

Received 05 31, 2023
Revised 06 11, 2023
Accepted 06 22, 2023

Keywords:

Information Systems
Library
Book lending
Waterfalls
CodeIgniters

ABSTRACT

Management of an effective and representative library information system is a necessity for educational units to use a library information system design not only as a requirement but also as a necessity. Elementary School Warungnangka Kabupaten Subang is the focus of research on building a web-based library information system. The data collection methods used are observation, interviews, and case studies. It can be concluded that library management is still not computerized. The design of this information system is carried out using the waterfall method, with the stages of needs analysis, design, implementation of program code using CodeIgniter, and testing using Blackbox so that all processes are running well and as needed. With this library information system, it can simplify the process of borrowing and returning books, speed up library reports, and create added value for the School Accreditation Visitation Program (BAN SM) and School Quality Fulfillment Program (ANBK). This information system will later be able to make information system updates that have been implemented previously, namely the library information system, which is still manual, into a computerized information system.

Corresponding Author:

Muhammad Faittullah Akbar
Fakultas Teknik dan Informatika
Universitas Bina Sarana Informatika
Email: Muhammad.mtl@bsi.ac.id

1. Introduction

Information technology is incredibly important to human activity, making it the primary enabler of business activities. As a result, information technology has fundamentally changed how organizations are managed, operated, and structured in order to better serve their functions, which include gathering, processing, generating, storing, retrieving, and transmitting information [1]. One of them involves integrating the school library's section with this information technology so that it can analyze data and information in real time. Information systems for libraries are thought to play a crucial role in streamlining operating procedures [2]. Libraries are typically seen as a work unit that consists of a location to gather, store, and examine a library collection of books or other readings that are governed and managed in a specific manner to provide convenience for the user to utilize as information.[3]. An organization's information system combines daily transaction processing requirements, operational support, managerial, and strategic activities, and the provision of required reports to certain external parties.[4]. Utilizing information technologies is a viable alternative or the best course of action in an endeavor to enhance the performance of library services. A comprehensive, integrated data and information management strategy, the generation of timely and accurate information, cost savings, and improved security are some of the benefits of employing an

information system. [5]. Additionally, the availability of this information system has advantages for students and librarians in addition to the library itself. To enhance the teaching and learning process in schools, libraries must make effective use of information systems. Utilizing information technology can enhance the quality of the information offered to manage or operate library operations, as well as its speed.

Law Number 20 of 2003 concerning the National Education System and Law Number 43 of 2007 concerning Libraries Article 23 paragraph (1) Law Number 43 of 2007 mandates that every school/madrasah maintain a library that meets national library standards by taking into account the standards national education. Library national standards are a reference in the administration of libraries in school/madrasah education units, both public and private. The library's national standards consist of: (1) Library Collection Standards; (2) Library Facilities and Infrastructure Standards; (3) Library Service Standards; (4) Library Staff Standards; (5) Library Administration Standards; and (6) Library Management Standards [6].

The management of an effective and representative library information system is inseparable from the existence of adequate facilities and infrastructure, the necessity for educational units to use a library information system design is not only a requirement but has become a necessity, including programs that are already running, namely: the 5 (five) School Accreditation Program annually by the National Accreditation Board for Schools/Madrasahs (BAN SM), the Education Quality Assurance Program (PMP) which has now changed to ANBK (Computer-Based National Assessment) which is being implemented in 2021 by the Ministry of Education and Culture at the elementary school level, where library standards are part of filling in the questionnaire in order to fulfill the quality of the education unit as a parameter and self-evaluation by issuing quality report cards at the end of each academic year [7].

The role of information systems for libraries is considered very important to facilitate the process library operations[2]. The existing library system at elementary school Warungnangka, Subang District currently still has many deficiencies, namely still using sheets of paper as a medium for recording borrowed books, collecting data on library books and making library reports. So that it can cause data to be lost and damaged, thereby hampering library services and management. Therefore it needs the support of science and technology that can facilitate library management. From the existing problems, the author designed a web-based library information system so that it can facilitate library management, such as managing book loans faster, saving space and costs, and making reports more precise and accurate.

2. Research Method

The waterfall method was utilized to create this program, which offers a sequential or sequential software life-flow approach beginning with Analysis, Design, Implementation, Testing, and Maintenance [8]. Other research claiming that the waterfall technique is an organized methodology for the creation of information systems supports this. [9]

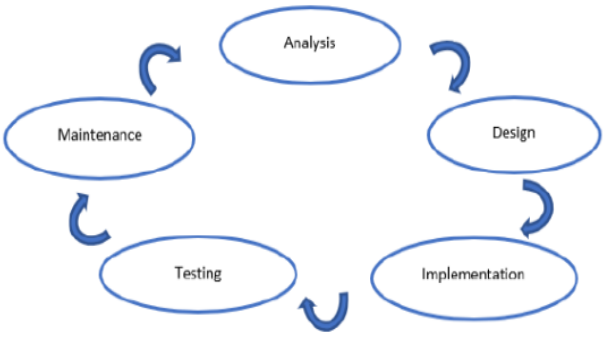

Figure 1. The stages in the waterfall method

The stages in the waterfall method are [8]:

1) Analysis

At this stage, the author made observations and conducted interviews directly with elementary school Warungnangka Kecamatan Ciasem to find out the system requirements needed, and the results will be analyzed. Analysis is the deep ability to investigate or identify the relationship between statements, data facts, or concepts and draw conclusions[10].

a. Observation

Observation is usually used in descriptive research and is also used to measure individual behavior or the process by which something can be observed, either in natural or artificial situations. [11]. Observations on the current library system at elementary school Warungnangka Kecamatan Ciasem with the aim of obtaining the information needed to create a library information system.

b. Interview

An interview is a method of collecting data by having a dialogue with the person being observed and asking questions that have been prepared beforehand for the person being observed [12]. The interview method was carried out at the elementary school Warungnangka Kecamatan Ciasem.

c. Literature Study

Case studies are an appropriate strategy to use in research using research questions [13]. To complete the data so that it is more detailed, the author also uses books that are connected to the preparation of research reports, notes, or other sources to support this report.

2) Design

Design is the stage of making a flow or process and displaying the features of the system that will be applied at this stage based on observations from the analysis stage. At this stage, the design of the library information system is complete.

3) Implementation

Implementation is the stage of writing program code to create interface designs and work processes on the web library based on the designs that have been made. At the system implementation stage, using Code Igniter coding as the basis for writing the program While the MySQL database is used to accommodate all the information summarized in the library data management program, The database is the main component in building a system concerning the documentation of data in a database. The form of the database is a rule that solves the problem. The database has a very important role in managing the data in it [14]. At this stage, it is divided into several processes.:

a. Design Review: Check each element of the code igniter used and pay attention to the font used in each article in application development..
b. Selection of hardware and software resources: this process relates to the technology to be used in writing program code and installation. And of course, this selection is based on the scope and support of other sources.

4) Testing

Feature Testing is system testing to test the performance of features that have been completed and look for deficiencies in features that have just been implemented. The testing method used is the Blackbox Testing Method. The blackbox testing method is one that is easy to use because it only requires the lower and upper bounds of the expected data. Estimation of the number of test cases can be done through the number of data entry fields to be tested, the rules entries that must be met, and the upper and lower bound cases that are met. And with this method, it can be seen if the functionality can still receive input data unexpectedly, which causes the stored data to be less valid [15]. The use of black box testing as a method of testing the system in this study is based on the box testing function, which acts as a system tester that is more focused on functionality [16]. In this phase, the late library program is finished and will be tested in terms of functionality. This phase will determine the next process. If there is an error in the system during the trial process, the next process will be carried back to the previous phase. It is the system implementation phase that evaluates failed processes. Conversely, if the testing process is without errors on the system, then the library program can be implemented in Elementary School Warungnangka Kecamatan Ciasem Kabupaten Subang.

5) Maintenance

After the library program was confirmed to be broadcast at Elementary School Warungnangka Kecamatan Ciasem Kabupaten Subang, the next step was to perform regular system maintenance. This maintenance stage in general can be done by backing up the system code and taking care of malware, viruses, or other hazards that will disrupt the running of the system. The system maintenance stage is carried out periodically when the system is started to be used [17]. The goal is to make sure the feature can work properly and is always updated.

3. Result and Discussion

In the results and discussion section of the implementation of a web-based information system with a case study at the Elementary School Warungnangka Kecamatan Ciasem Kabupaten Subang, it is necessary to carry out phases designing a Web-based information system according to the software development method used in this research using the waterfall method. Stages of the waterfall method in designing a web-based information system on this research are as follows.

3.1. Software Requirements Analysis

Librarian Needs Scenario:

A1. Librarians can log in.

A2. Librarians can see the introductory menu.

A3. Librarians Can manage school profiles.

A4. Librarians can manage the stock and number of books.

A5. Librarians Can manage members of the library

A6. Librarians can log out.

Admin requirement scenario.

B1. Admin can log in.

B2. Admin Can see the introductory menu.

B3. Admin Can manage all activities on the website

B4. Admin Can add librarian data.

B5. Admin Can Log Out.

3.2. Design

After the software requirements analysis stage, the web-based library information system is designed in accordance with the software requirements analysis that has been described in the system needs analysis stage above. As for the distribution of access rights in the design of a web-based library information system, there are two types of access rights: access rights for librarians and admins. At the design stage, this study uses several tools: case diagrams, activity diagrams, and database design. Use case diagrams are used to describe interactions between system users (actors) and use cases based on a particular scenario. Use cases only describe the flow of actors when interacting with the system. Therefore, use cases can be connected with other use cases through several interdependencies: include, extend, alternative or specialization, and exception [18]. The following is a use case diagram for designing a web-based library information system according to their respective access rights:

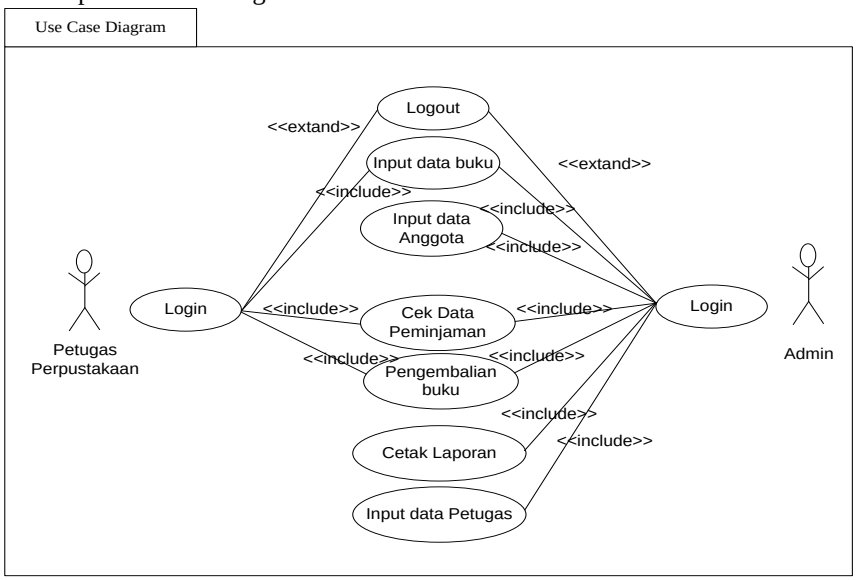

Figure 2. Diagram Use Case *Librarian and Admin*

Use case or use case diagram is a model for behavior information system to be created. The use case describes an interaction between one or more actors with the information system to be created. Roughly speaking, use cases used to find out what functions are in an information system and who is entitled to use those functions.[19] After analyzing the use case diagram, the next step is to design a web-based library information system. Activity diagram for Librarian and Admin access rights in web-based library information system is as follows:
The following is an activity diagram for inputting book data

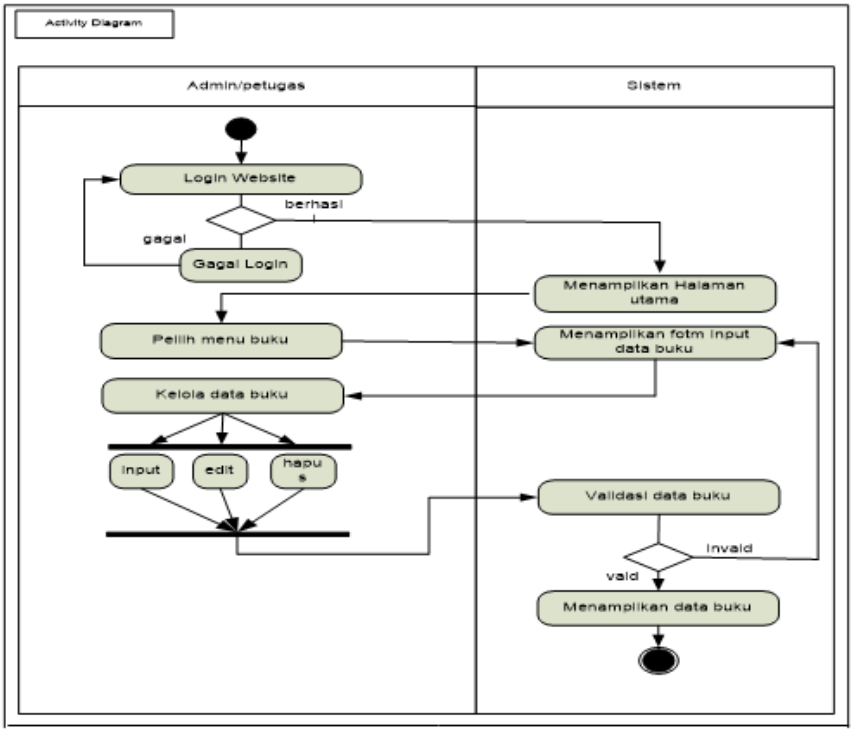

Figure 3. Diagram Activity *Librarian and Admin Input Book Data*

The picture above is an activity diagram for inputting book data by librarians and admins.

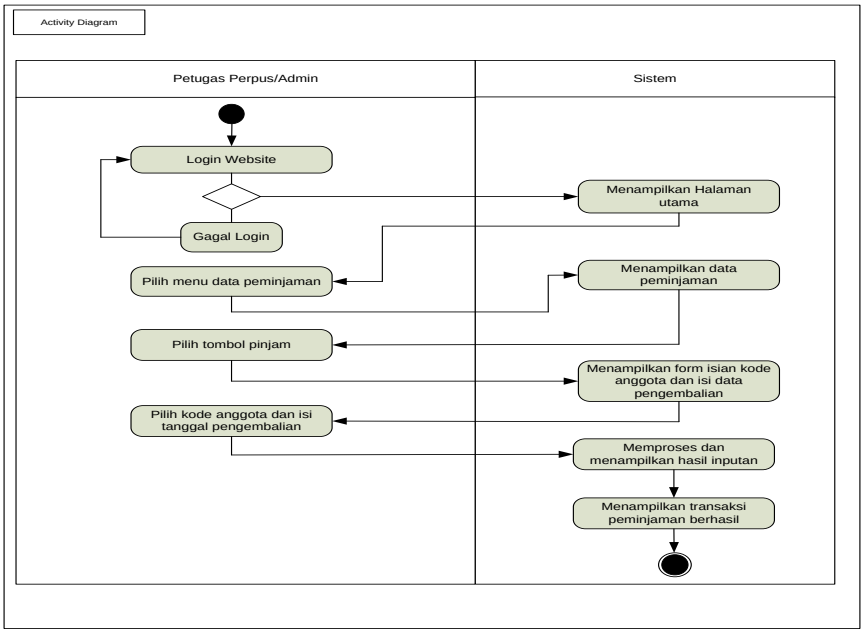

Figure 4. Diagram Activity Librarian and Admin check the book loan data

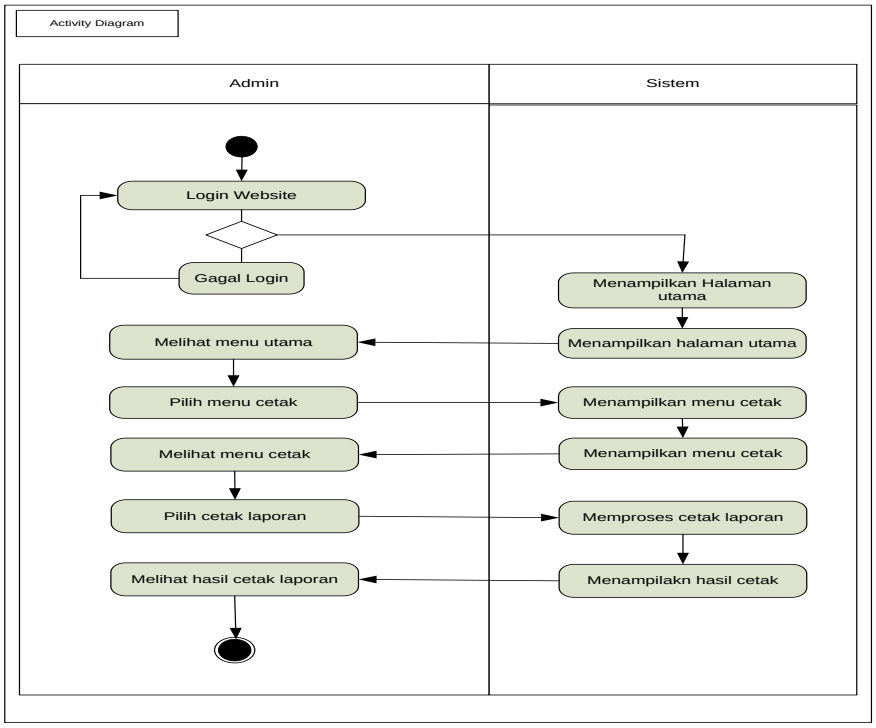

Figure 5. Diagram Activity Admin Print Library Report

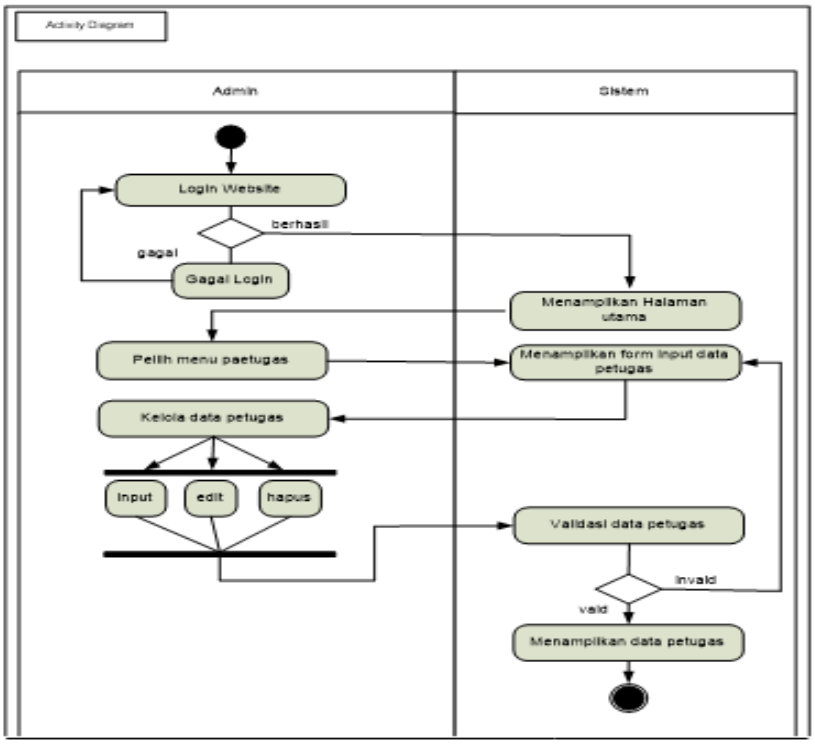

Figure 6. Diagram Activity Admin Input Librarian Data

The picture above explains that inputting library data can only be done by the administrator because the librarian is not just one person. After describing the design of a web-based library information system using use case diagrams and activity diagrams, the next step is to design an Entity Relationship Diagram. ERD (Entity Relationship Diagram) or entity relationship diagram is a diagram that is used to design a database and shows the relationship between objects or entities and their attributes in detail [20]. Another

study explained that the ERD function is used to describe the data model from the database into the system [21]. The following is an Entity Relationship Diagram in the library information system:

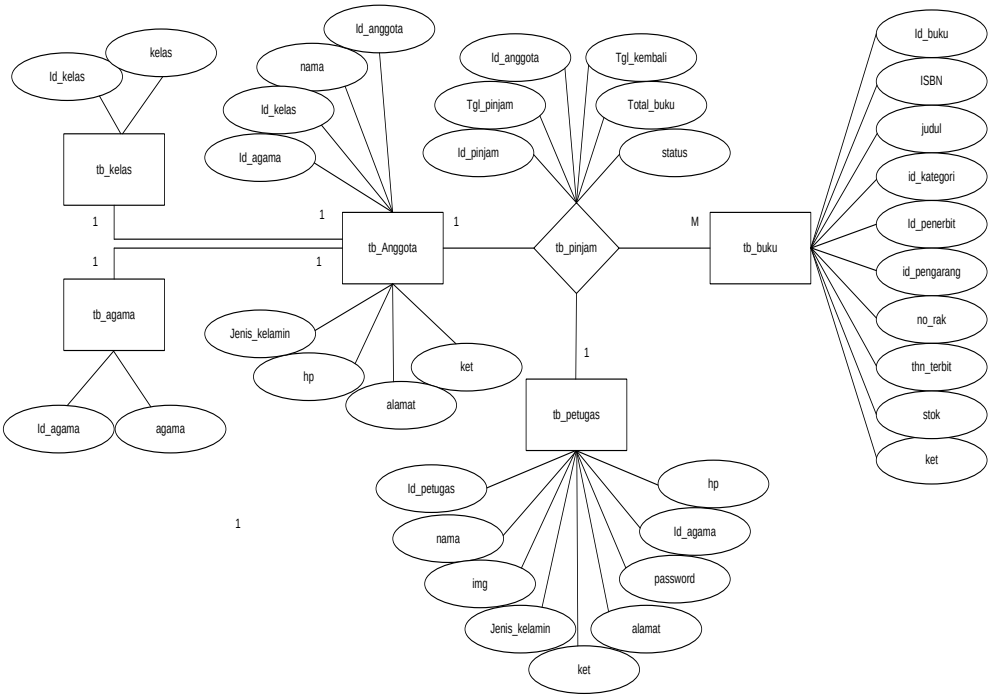

Figure 7. Web-Based Library Information System Entity Relation Diagram

Furthermore, the database design uses an LRS (Logical Record Structure) diagram. A logical record structure is a collection of record structures in a table that is formed as a result of processing between entity sets [22]. The following is a database design for a web-based library information system using the LRS diagram.

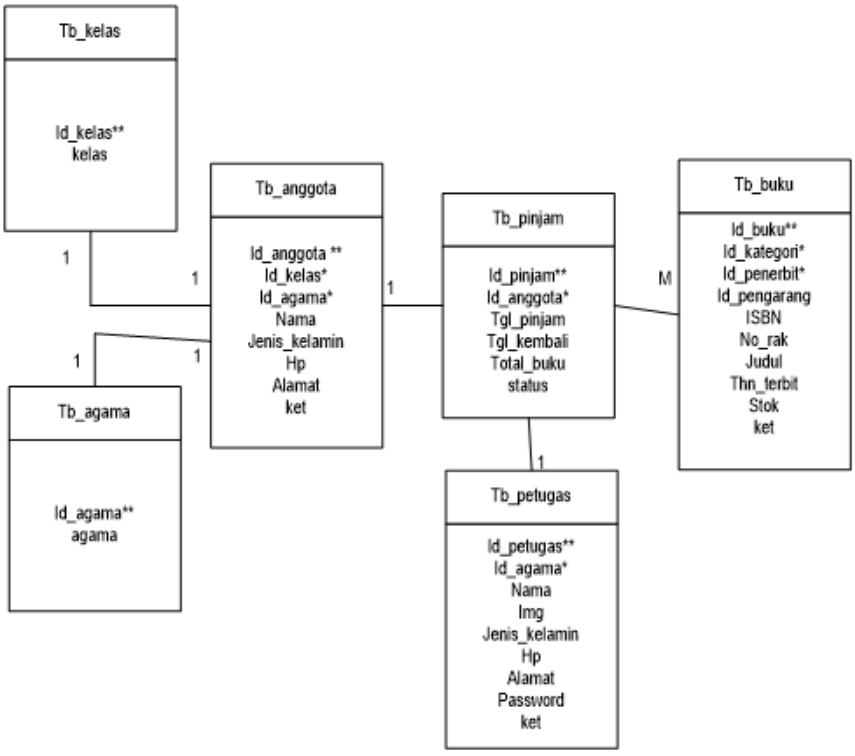

Figure 8. Web-Based Library Information System Logical Record Structure Diagram

Furthermore, database design uses sequence diagrams. Sequence Diagrams are used as an explanation of the behavior in the scenario and describe through entities and systems interact with each other, and also the messages used when interacting[23]. The following is a sequence diagram for librarians and administrators in a web-based library information system:

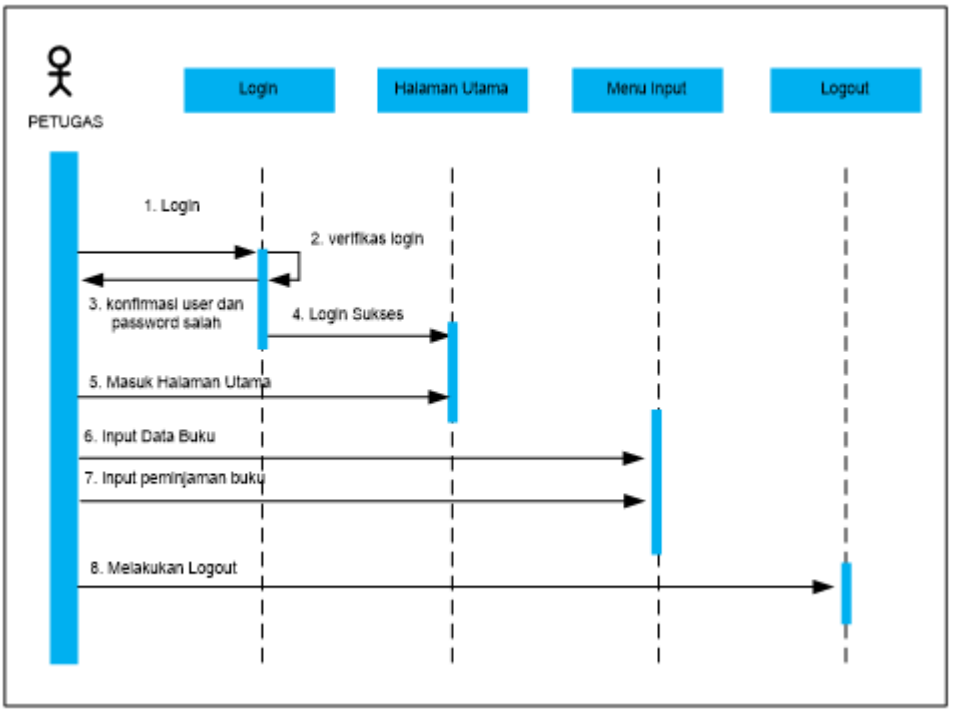

Figure 9. Librarian Sequence Diagram

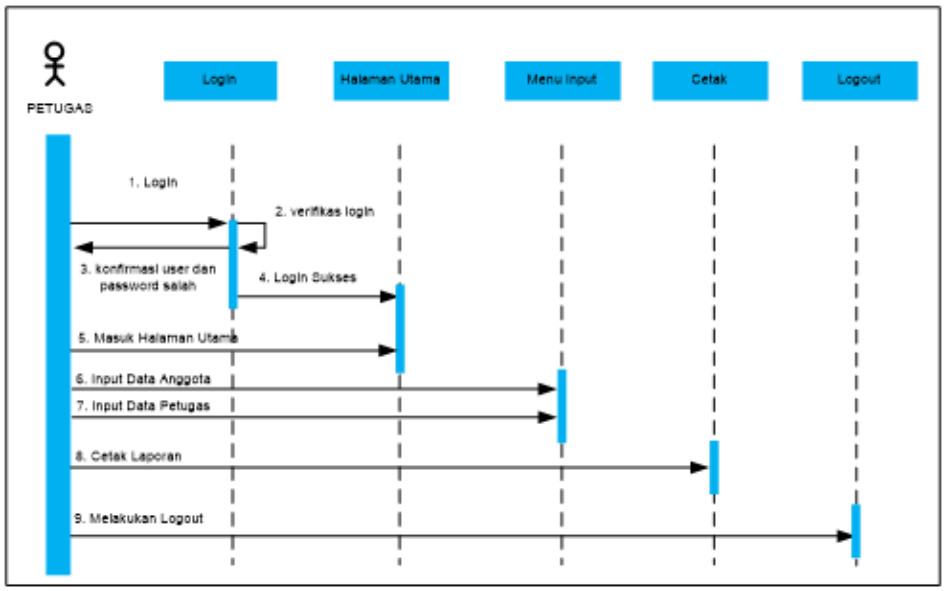

Figure 10. Admin Sequence Diagram

3.3. Coding

The next stage after the design stage in the waterfall method is coding. The coding stage in this study was translated into a program using a programming language. In this study, the program that will be made web-based is Code Igniter. Codeigniter is a framework that is widely used by various well-known companies and agencies [24]. By implementing the MVC Model (Model View Controller), it will be possible to reduce the

complexity of coding in the application. MVC is an expected programming technique that programmers are disciplined to divide into three parts, namely model-view-controller [25].

3.4. Implementation

The image below is the result of the user interface displayed on the menus of the web-based library information system at Elementary School Warungnangka. The home view is the initial appearance of the web-based library information system at Elementary School Warungnangka. In this view, there are menus such as a list of books and school profiles and a login menu for librarians.

Figure 11. Home Page User Interface On A Web-Based Library Information System

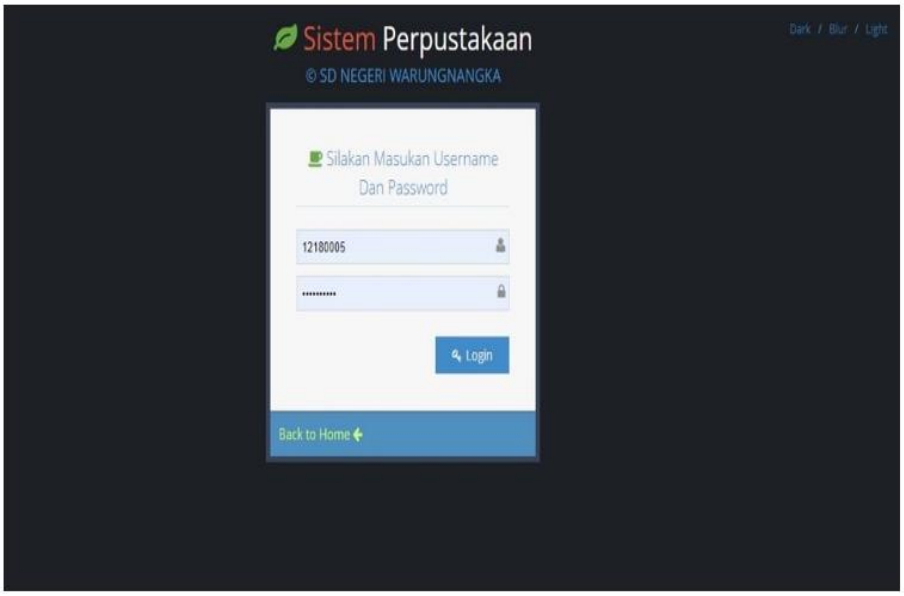

Figure 12. User Interface Log-In Page On A Web-Based Library Information System

Next is the login display for librarians to enter the web-based library information system. To enter this web-based library information system, librarians use the provided username and password.

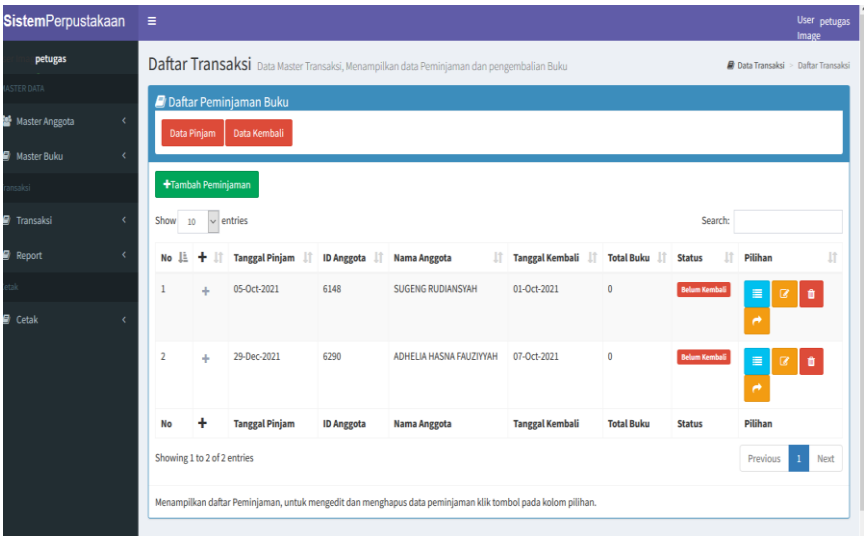

Figure 12. User Interface For Borrowing Books On A Web-Based Library Information System

The Transaction data menu is a display that is used for borrowing books and returning books. This menu displays details of borrowing books by students.

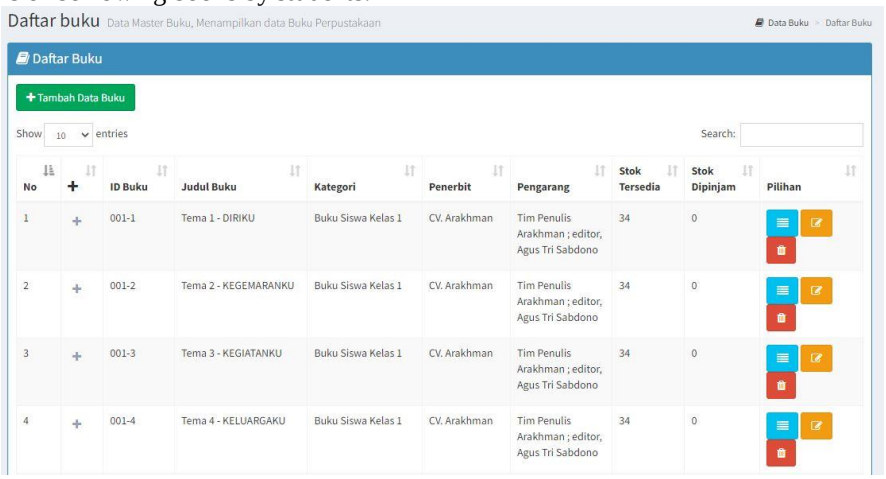

Figure 13. User Interface for list of books on a web-based library information system

This menu contains a list of books inputted by librarians into a web-based library information system

3.5. Testing

At this stage the test uses a testing approach with a black box testing method that focuses on system functionality.

Table 1.Testing of Login Menu

No	Testing Scenario	Test Case	Expecting Result	Testing Result	Conclusion
1.	Click login without type data	Username: (blank) Password:(blank)	System denied user access and display " fill in username and password "	As expectation	Valid

2.	Click login after type in user code, and password is not filled	Username: User1 (valid) Password:(blank)	System denied user access and display "enter the password correctly"	As expectation	Valid
3.	Click login by emptying the username but filling in the password	Username:(blank) Password: pass_user1 (valid)	System denied user access and display " fill in the username correctly"	As expectation	Valid
4.	Enter the username correctly, the password does not match, then click login	Username:User1 (valid) Password: 12345 (invalid)	System denied user access and display " enter the password correctly "	As expectation	Valid
5.	Type username and passwords, or one of them, then click cancel	Username: User1 Password: pass_user1	No display input data	As expectation	Valid
6.	Type the username and password correctly, then click login	Username: User1 (valid) Password: pass_user1 (valid)	System accepted login access and will display “Welcome”, then it will display main menu.	As expectation	Valid

Table 2. Testing of Add Member Data

No	Testing Scenario	Test Case	Expecting Result	Testing Resulr	Conclusion
1	Click add without type data	Name: (blank) Gender: (blank) Class: (blank)	System denied user access and display "fill in the data correctly"	As expectation	Valid
2	Click add by filling in the name, but the gender and class are empty	Name: Anggota1 (Valid) Gender: (blank) Class: (blank)	System denies user access and displays "fill in data gender"	As expectation	Valid
3	Click add by filling in the name gender and empty class	Name: Anggota1 (Valid) Gender: Male (Valid) Class: (blank)	System denied user access and display "fill in the data correctly"	As expectation	Valid
4	Click add by filling in gender and class,	Name: (blank) Gender: Male (Valid)	System accepted access and	As expectation	Valid

name is empty	Class: 6A (Valid)	will be shown Member List	

Table 3. Testing of Add Book Data

No	Testing Scenario	Test Case	Expecting Result	Testing Resulr	Conclusion
1	Click add book without type data	Book Id: (blank) Book Title: (blank) Category: (blank) Publisher: (blank) Author: (blank) Book Stok: (blank)	The system denies user access and displays "Complete Book Data Correctly"	As expectation	Valid
2	Click add book by filling in the book id and book title, but empty the category, publisher, author and book stock	Book Id: 001-01 (Valid) Book Title: My Favorite (Valid) Category: (blank) Publisher: (blank) Author: (blank) Book Stok: (blank)	The system denies user access and displays "Complete Book Data Correctly"	As expectation	Valid
3	Click add book by filling in the book id, book title, category, publisher by emptying the author and book stock	Book Id: 001-01 (Valid) Book Title: My Favorite (Valid) Category: First grade student book (Valid) Publisher: CV. Arakhman (Valid) Author: (blank) Book Stok: (blank)	The system denies user access and displays "Complete Book Data Correctly"	As expectation	Valid
4	Fill in the book id, book title, category, publisher, author and book stock correctly then click cancel	Book Id: 001-01 (Valid) Book Title: My Favorite (Valid) Category: First grade student book (Valid) Publisher: CV. Arakhman (Valid) Author: Arakhman Writing Team; Editor, Agus Tri Sabdono (Valid) Book Stok: 40 (Valid)	No display input data	As expectation	Valid
5	Click add book by filling in the book id, book title, category, publisher, author and	Book Id: 001-01 (Valid) Book Title: My Favorite (Valid)	The system accepts access and Book List will be displayed	As expectation	Valid

book stock correctly	Category: First grade student book (Valid)
	Publisher: CV. Arakhman (Valid)
	Author: Arakhman Writing Team; Editor, Agus Tri Sabdono (Valid)
	Book Stok: 40 (Valid)

4. Conclusion

Based on the results of the analysis, design, implementation, and testing carried out on the features of the web-based library information system, it can be concluded that:

1) A computerized system can get the results of making reports on time without re-recording and can be printed. One of the most precise and accurate data sets from this system.
2) This application makes the librarian's performance more efficient in terms of inputting book data and library report data compared to a manual system that requires a storage area such as a cupboard, but in the current system, it is sufficient in the database and hard drives.
3) By carrying out system maintenance and data backup on a regular basis, this system can be used properly, which can facilitate the agency or institution that uses it.

References

[1] S. Setiawansyah, Q. J. Adrian, and R. N. Devija, "Penerapan Sistem Informasi Administrasi Perpustakaan Menggunakan Model Desain User Experience," *J. Manaj. Inform.*, vol. 11, no. 1, pp. 24–36, 2021, doi: 10.34010/jamika.v11i1.3710.

[2] Y. Rahmanto, D. Alita, A. D. Putra, P. Permata, and S. Suaidah, "Penerapan Sistem Informasi Perpustakaan Berbasis Web Pada Smk Nurul Huda Pringsewu," *J. Soc. Sci. Technol. Community Serv.*, vol. 3, no. 2, p. 151, 2022, doi: 10.33365/jsstcs.v3i2.2009.

[3] S. Bakhri and A. Bani, "Sistem Informasi Perpustakaan Berbasis Web pada SMAN 1 Cibinong," *STRING (Satuan Tulisan Ris. dan Inov. Teknol.*, vol. 4, no. 2, p. 133, 2019, doi: 10.30998/string.v4i2.3047.

[4] D. Ardiansyah, A. Saepudin, R. Aryanti, and E. Fitriani, "Perancangan Sistem Informasi Akademik Madrasah Aliyah Negeri (Man) 4 Karawang Berbasis Web," *J. Teknol. Dan Open Source*, vol. 3, no. 2, pp. 187–201, 2020, doi: 10.36378/jtos.v3i2.783.

[5] N. Rohmah, Himawat Aryadita, and Adam Hendra Brata, "Pengembangan Sistem Informasi Perpustakaan Berbasis Web Pada Perpustakaan Kecamatan Bungah," *Pengemb. Teknol. Inf. dan Ilmu Komput.*, vol. 3, no. 3, pp. 2225–2234, 2019.

[6] Indonesia, *Peraturan Kepala Perpustakaan Nasional Republik Indonesia Nomor 12 Tahun 2017 Tentang Standar Nasional Perpustakaan Sekolah Menengah Atas/ Madrasah Aliyah*, vol. 44, no. 8. Jakarta, 2017. [Online]. Available: https://jdih.perpusnas.go.id/file_peraturan/Perka_12_2017_SNP_Perpustakaan_SMA_Salinan.pdf

[7] B. A. NASIONAL and SEKOLAH/MADRASAH, *Pedoman_Akreditasi_Sm_2022*. Jakarta: BADAN AKREDITASI NASIONAL SEKOLAH/MADRASAH, 2022. [Online]. Available: https://bansm.kemdikbud.go.id

[8] A. Suryadi, "Rancang Bangun Sistem Pengelolaan Arsip Surat Berbasis Web Menggunakan Metode Waterfall (Studi Kasus : Kantor Desa Karangrau Banyumas)," *J. Khatulistiwa Inform.*, vol. 7, no. 1, pp. 13–21, 2019, doi: 10.31294/jki.v7i1.36.

[9] O. Caesera, "Perancangan Sistem Informasi Rekam Medis Di Rs Keluarga Husada Batam Berbasis Web," *J. Teknol. Dan Open Source*, vol. 2, no. 2, pp. 74–86, 2019, doi: 10.36378/jtos.v2i2.368.

[10] D. N. Agnafia, "ANALISIS KEMAMPUAN BERPIKIR KRITIS SISWA DALAM PEMBELAJARAN BIOLOGI," *J. Biol. dan Pembelajarannya*, vol. 6, no. 3, pp. 45–53, 2019.

[11] R. Ridwan and A. F. Awaluddin, "Penerapan Metode Bernyanyi Dalam Meningkatkan Penguasaan Mufradat Dalam Pembelajaran Bahasa Arab Di Raodhatul Athfal," *Didakt. J. Kependidikan*, vol. 13, no. 1, pp. 56–67, 2019, doi: 10.30863/didaktika.v13i1.252.

[12] J. Radianza and I. Mashabai, "Analisa Pengendalian Kualitas Produksi Dengan Menggunakan Metode Seven Tools Quality Di PT. Borsya Cipta Communica," *JITSA J. Ind. Teknol. Samawa*, vol. 1, no. 1, pp. 17–21, 2020, [Online]. Available: https://jurnal.uts.ac.id/index.php/jitsa/article/view/583

[13] R. D. Nur'aini, "Penerapan Metode Studi Kasus Yin Dalam Penelitian Arsitektur Dan Perilaku," *INERSIA lNformasi dan Ekspose Has. Ris. Tek. SIpil dan Arsit.*, vol. 16, no. 1, pp. 92–104, 2020, doi: 10.21831/inersia.v16i1.31319.

[14] Y. Irawan, R. Wahyuni, S. Informasi, and T. Informatika, "APLIKASI PEMESANAN MAKANAN BERBASIS WEB I . PENDAHULUAN Teknologi dapat memberikan kemudahan bagi kehidupan masyarakat dalam

berbagai hal , sehingga menjadi lebih efektif dan efesien . Perkembangan teknologi khususnya teknologi komputer berdampak pula pad," vol. 2, no. 2, pp. 108–115, 2019.

[15] N. M. D. Febriyanti, A. A. K. O. Sudana, and I. N. Piarsa, "Implementasi Black Box Testing pada Sistem Informasi Manajemen Dosen," *J. Ilm. Teknol. dan Komput.*, vol. 2, no. 3, pp. 1–10, 2021.

[16] M. Yusman, "Aplikasi Sistem informasi Pengenalan Tanaman Obat Keluarga Berbasis Android," *J. Teknol. dan Inform.*, vol. 2, no. 1, pp. 2745–8911, 2021.

[17] N. Khaerunnisa, E. Maryanto, and N. Chasanah, "Sistem Informasi Pelayanan Administrasi Kependudukan Berbasis Web Menggunakan Metode Waterfall Di Desa Sidakangen Purbalingga," *J. Ilmu Komput. dan Inform.*, vol. 1, no. 2, pp. 99–108, 2021, doi: 10.54082/jiki.12.

[18] A. M. Putra, Y. Priyadi, and R. R. Riskiana, "Implementasi Metode Similaritas Pada Software Requirements Specification (srs) Pengembangan Startup Haylingo Berdasarkan Use Case Diagram Menggunakan Text Mining," *eProceedings Eng.*, vol. 8, no. 5, pp. 10498–10514, 2021.

[19] A. Fauzi, N. Indriyani, and A. B. Hasta Yanto, "Implementasi Sistem Informasi Inventory Berbasis Web (Studi Kasus: Cv. Sinar Abadi Cemerlang)," *J. Teknol. Dan Open Source*, vol. 3, no. 2, pp. 144–157, 2020, doi: 10.36378/jtos.v3i2.781.

[20] M. Tabrani and S. Suhardi, "Implementation of Prototype Method in School Payment Information System of SMP AL- Mushlis Karawang," *J. Teknol. Dan Open Source*, vol. 5, no. 1, pp. 64–72, 2022, doi: 10.36378/jtos.v5i1.2234.

[21] Indarti, D. Laraswati, and A. Supriyatna, "the Use of Waterfall Model in Application Design Web-Based Maryam Department Store," *J. Teknol. Dan Open Source*, vol. 4, no. 1, pp. 37–47, 2021, doi: 10.36378/jtos.v4i1.1364.

[22] M. H. Siregar, "Information System Design of Shahirah Rahmawati Dentist'S Practice Based on Web and Sms Gateway Using the Rational Unified Process Methodology," *J. Teknol. Dan Open Source*, vol. 4, no. 1, pp. 85–92, 2021, doi: 10.36378/jtos.v4i1.1393.

[23] Adi Nurseptaji, Arey, F. Andini, and Y. Ramdhani, "Implementasi Metode Waterfall Pada Perancangan Sistem Informasi Perpustakaan," *J. Dialekt. Inform.*, vol. 1, no. 2, pp. 49–57, 2021, doi: 10.24176/detika.v1i2.6101.

[24] P. dan Pembuatan Aplikasi Manajemen Peminjaman Kendaraan Berbasis Web Dengan, D. Wahyu Kurniawan, and F. Yasin Irsyadi, "Emitor: Jurnal Teknik Elektro Framework Codeigniter," vol. 21, no. 01, 2021.

[25] M. Ulfa, S. Suryayusra, and S. Hardini, "Penerapan Model View Controller (MVC) Untuk Perancangan Sistem Ruang Buku Indonesia," *CESS (Journal Comput. Eng. Syst. Sci.*, vol. 5, no. 1, p. 53, 2020, doi: 10.24114/cess.v5i1.15403.