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Designing Inventory Information System at ITSK Soepraoen Using the Waterfall Method

Nugroho Teguh Yuono*[1], M. Syauqi Haris[2], Risqy Siwi Pradini[3]
1,2,3 Institut Teknologi, Sains, dan Kesehatan RS. DR. Soepraoen Kesdam V/BRW, Indonesia

***Corresponding author**
E-mail address:
ngrhtgh@itsk-soepraoen.ac.id

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Abstract
In the current digital era, the utilization of informatiosn technology has become a pressing need for various institutions, including educational institutions. ITSK Soepraoen has integrated information systems in several units to improve operational efficiency. However, inventory data collection is still done manually using Microsoft Excel, whish has proven to be inefficient and often causes delay in data processing. This study aims to design a web-based inventory information system at ITSK Soepraoen using the Waterfall method. The system is expected to facilitate inventory data collection and management, as well as improve accuracy, transparency, and efficiency in data processing. The research method used is the Waterfall approach consisting of four stages: requirement definition, system and software design, implementation, and testing. The result of this study is a lo-fi mockup of the inventory system that was well received by users with an acceptance rate of 92.75%. This percentage is relatively high, indicating that users have accepted the design that has been created, and for the next stage, this inventory system can be fully implemented.

1. Introduction
In the current digital era, the utilization of information technology has become an urgent necessity for various institutions, including educational institutions [1]. ITSK Soepraoen is one of the educational institutions that has begun integrating information systems across several units or departments to enhance operational efficiency and effectiveness. However, the inventory data collection at this institution is still conducted manually using Microsoft Excel. This method has proven to be inefficient and often leads to delays in data processing. Manual inventory data collection has several drawbacks, including a high risk of human error, difficulty in searching and tracking items, and a lack of transparency and data accuracy. These issues negatively impact work effectiveness and efficiency and complicate the process of monitoring and managing inventory items [2][3].

The inventory at ITSK Soepraoen includes data collection on the items used, their condition, searching, and summary results. The large number of items that need to be recorded often causes some items to be overlooked by employees, complicating the monitoring process. Therefore, a system is needed to address these issues. The design of a web-based inventory information system at ITSK Soepraoen is expected to be an effective solution. This system will not only facilitate the recording and management of inventory items but also improve accuracy, transparency, and efficiency in data processing. With the web-based information system, employees can easily and quickly access and update inventory data, making the monitoring and management process more effective.

Several previous studies on the design of inventory systems include the research conducted by [4], which developed an inventory system for PTTA using the Scrum methodology. Additionally, there is research [5] that designed an inventory system for the procurement of personal protective equipment and therapy tools to combat the COVID-19 pandemic. Another study designed a UXD inventory system for implementation in a school [6], and another designed a company inventory system's UI/UX using Design Thinking [7]. The commonality among these studies is their focus on designing inventory systems for various needs and usage contexts. Despite using different approaches and methods such as Scrum, UXD, and Design Thinking, their primary goal remains to improve efficiency, accuracy, and inventory management in specific environments such as PTTA, the procurement of personal protective equipment and therapy tools, as well as school or company settings.

Based on the background problems faced by ITSK Soepraoen and the previous studies, this research aims to design a web-based inventory information system for ITSK Soepraoen. The design will utilize the Waterfall method, which is a linear and structured approach used in software development [8]. In the Waterfall method, the software development process flows from one stage to the next without returning to the previous stage, like a waterfall flowing downward sequentially [9]. This research chooses the Waterfall method for the inventory system design because it is well-suited

for projects with clear requirements, not overly complex, and with minimal expected changes [10]. It is hoped that this system will enable more efficient and effective inventory management at ITSK Soepraoen and support the overall operational success of the institution.

2. Research Method

This research adopts the Waterfall approach, which systematically flows through a series of structured stages [8]. The Waterfall method provides a clear and organized structure, allowing researchers to manage the research efficiently and effectively in line with the set objectives [11]. Figure 1 illustrates the Waterfall method to be used in this research. The Waterfall flow consists of four stages: requirement definition, system and software design, implementation, and testing. The four stages are carried out to produce a system that meets the needs and expectations of users.

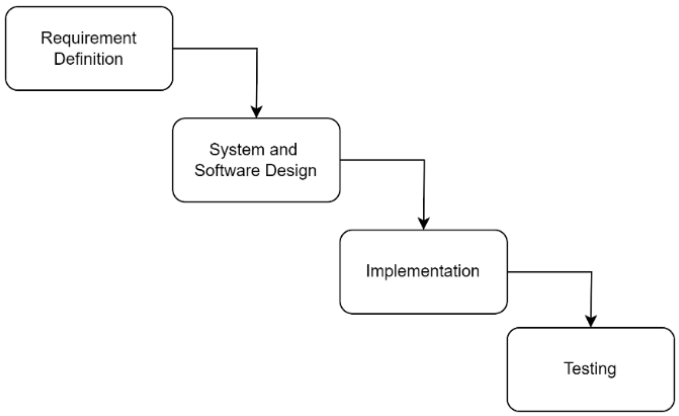

Figure 1. Waterfall method flow

The first stage is the requirement definition, which is the initial step in the software development process. In this stage, researchers collaborate with stakeholders, specifically employees in the General Affairs Department, to define in detail the needs and requirements of the inventory system to be developed. The main activities include user needs analysis and system functionality mapping. The goal of this stage is to ensure that all parties involved have a common understanding of the objectives and functions of the system to be built. Once the system requirements are clearly defined, the second stage is system and software design, which aims to design the system structure in detail. This design includes technical planning to meet the established requirements. Activities conducted include the creation of swimlane diagrams and class diagrams. At this stage, it is essential to ensure how each system component will work together and how the system will interact with users and other systems. The next stage is implementation. In this stage, the researchers will carry out the implementation based on the previously created technical specifications and design. However, at this stage, the researchers will only implement a low-fidelity version of the inventory system. Once the implementation is complete, testing is conducted to ensure that each part of the system functions as expected. This unit testing will use User Acceptance Testing (UAT) to ensure that the developed system or application meets the needs and expectations of the stakeholders before full deployment [12].

3. Results and Discussion

3.1. Requirement Definition Stage

The main activity at this stage is an in-depth analysis of user needs and system functionality mapping through interviews with employees in the General Affairs Department. Since the inventory system will be used by these employees, the researchers conducted thorough interviews with them. The goal is to ensure that all necessary and desired aspects by the users are accurately addressed. Based on the interviews, the following menu items were identified as essential for the inventory system: Master Data Menu, Inventory List Menu, Transaction Menu, and User Management Menu. The required features for the inventory list menu are: Maintenance feature for items, Item summary feature, Inventory management feature that includes edit, delete, detail, and search functions, and Print label feature for items. It is expected that with these menus and features, the inventory system can be used for online item data recording, better data archiving, quick data summarization, and enabling effective monitoring of inventory items.

3.2. System and Software Design Stage

The activities in this stage involves creating a swimlane diagram and a class diagram for the inventory system. The swimlane diagram illustrates the workflow or process of the inventory system, while the class diagram depicts the system's structure by showing the classes present in the system and their relationships.

3.2.1. Swimlane Diagram

The swimlane diagram demonstrates how information moves between various units or entities involved in inventory management [13]. The detailed swimlane diagram for the " inventaris barang" menu is shown in Figure 2. This diagram maps the interactions between the General Affairs Department and the System in managing inventory data. It covers the entire process from maintenance, resume, editing, deletion, searching, to label printing. With this diagram, the workflow is clearly visible, and it shows how each task is performed and the system's response.

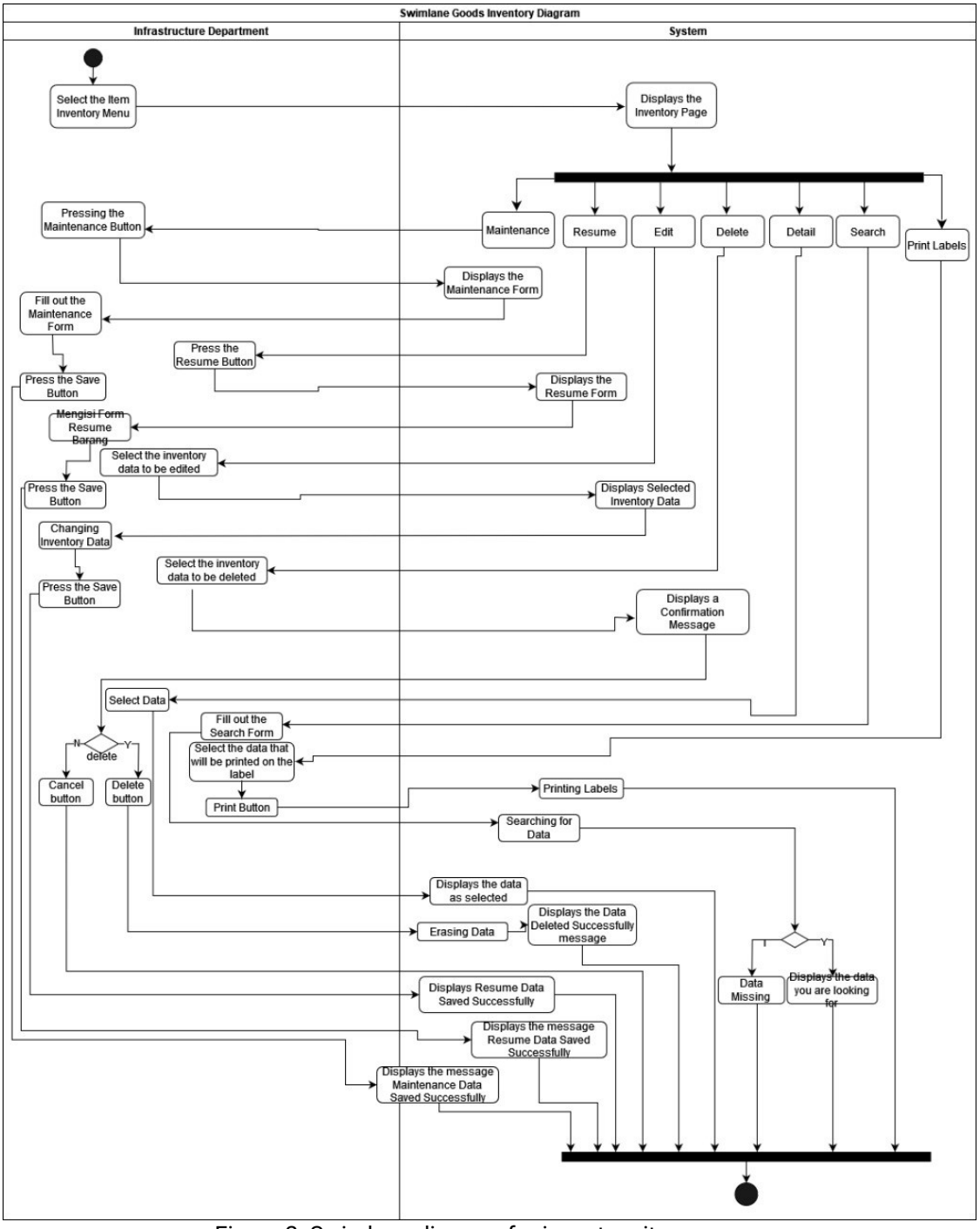

Figure 2. Swimlane diagram for inventory items menu

3.2.2. Class Diagram

The class diagram serves as documentation of the design of the inventory system to be developed. The class diagram can be used as a reference during the development and maintenance of the system to ensure that the implementation aligns with the planned design [14]. The class diagram produced at this stage is shown in Figure 3.

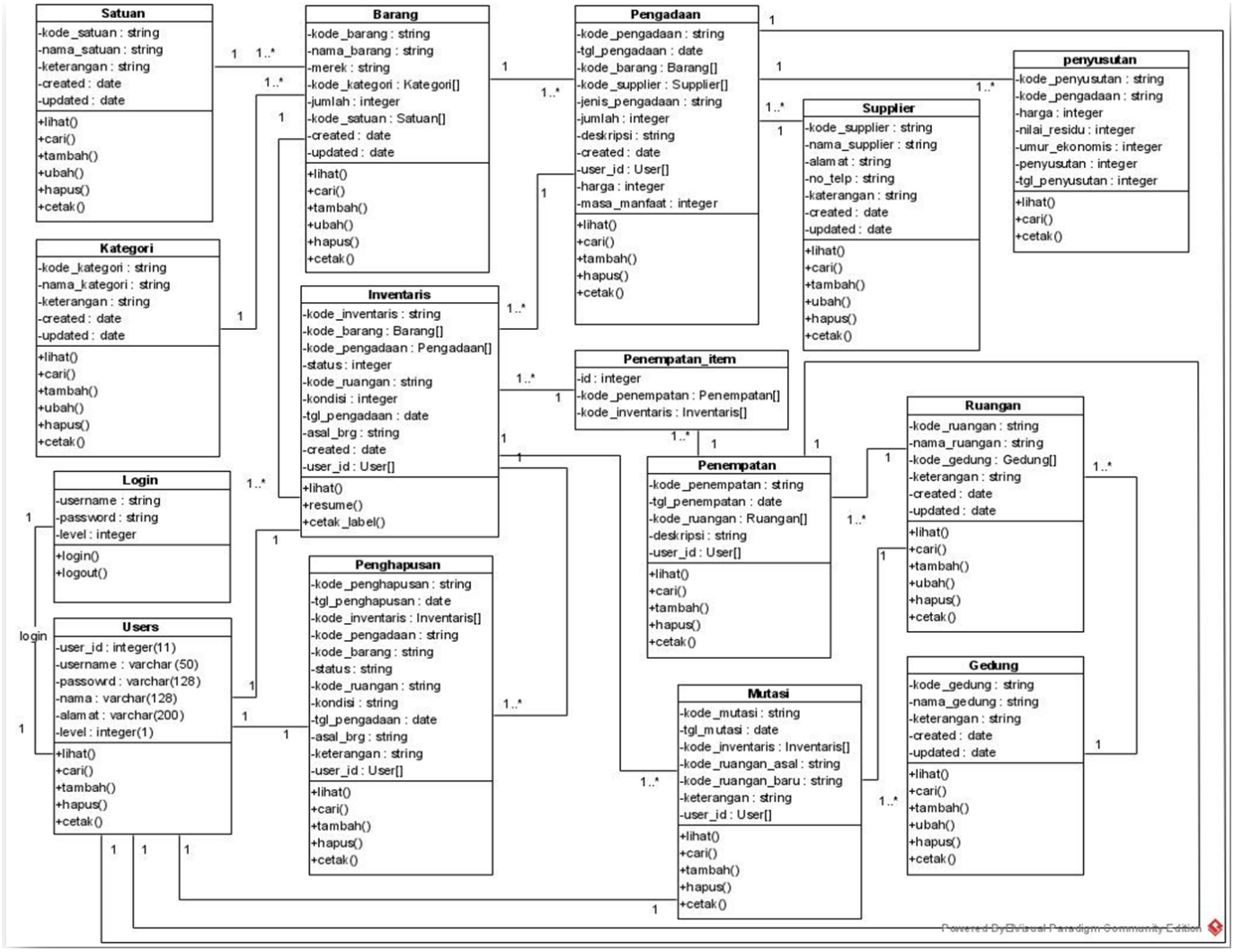

Figure 3. Class diagram of inventory system

3.3. Implementation Stage

During the implementation stage, a low-fidelity mockup is produced, representing the user interface of the inventory system. Figure 4 shows a low-fidelity mockup for the "Data Inventaris Barang" page, which displays the list of inventory items owned by ITSK Soepraoen. There is a search column feature at the top right to facilitate users in searching for inventory data. Additionally, there are columns for inventory item number, unique code for each inventory item, inventory item name, status (available/unavailable), room location where the item is placed, condition (good/damaged), and actions that can be taken on each item, such as viewing item summary and deleting the item.

Figure 5 depicts a low-fidelity mockup of the “Data Penyusutan” page, which displays a list of depreciation records for inventory items owned by ITSK Soepraoen. There is an 'Add Data' feature located at the top right to facilitate users in adding depreciation data. Additionally, there are columns for depreciation item number, unique code for each depreciation item, depreciation item name, year of purchase, purchase price, residual value, useful life, and actions that can be taken on each item, such as viewing item details.

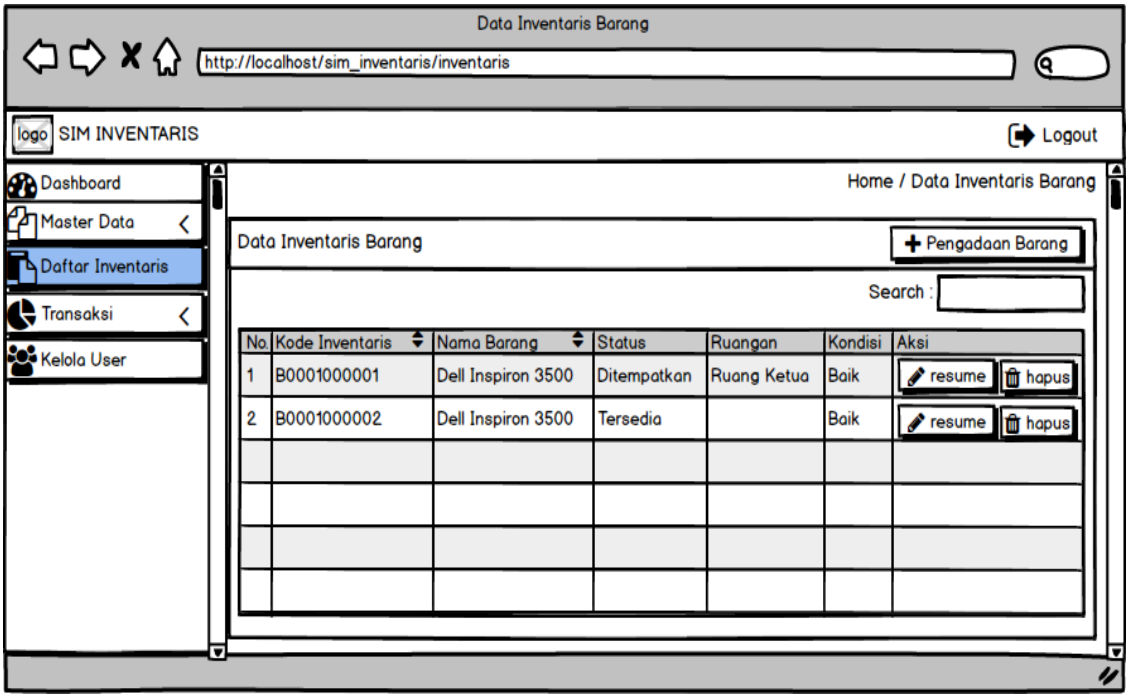

Figure 4. Low-fidelity mockup of the 'Data Inventaris Barang' page

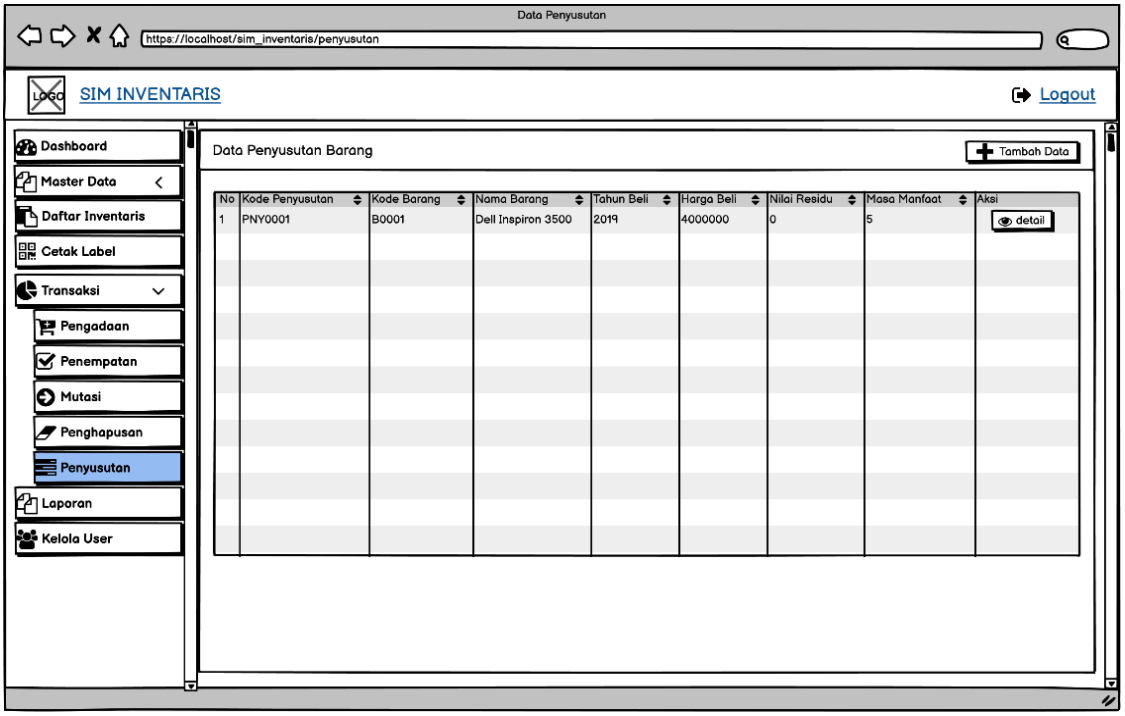

Figure 5. Low-fidelity mockup of the 'Data Penyusutan' page

3.4. Testing Stage

In this stage, User Acceptance Testing (UAT) is conducted to ensure that the inventory system developed so far meets the needs and expectations of users [12][15]. The testing involves 10 users of the inventory system selected from various departments at ITSK Soepraoen. Each user will review the previously created mockup designs and then complete a questionnaire to provide feedback. The questionnaire consists of 8 questions with responses on a Likert scale: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. Table 1 presents the summarized user response scores.

Tabel 1. User answers

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Q1	8	2	0	0	0
Q2	7	3	0	0	0
Q3	5	4	1	0	0
Q4	7	3	0	0	0
Q5	7	3	0	0	0
Q6	6	4	0	0	0
Q7	5	4	1	0	0
Q8	8	2	0	0	0
Total	53	25	2	0	0

Then the scores for the answers above are processed by multiplying the total Strongly Agree scores by 5, the total Agree scores multiplied by 4, and the total Neutral scores multiplied by 3 so that the total score for Strongly Agree, Agree and Somewhat Agree is 371. Next, calculations need to be carried out to find the highest score by means of as follows:

$$\text{Highest score} = \text{number of users } (10) \text{ x questionnaire questions } (8) \text{ x Strongly Agree value } (5) = 400 \quad (1)$$

After knowing the highest and lowest scores, the next step is to find the percentage of user acceptance level in the following way:

$$P = \frac{371}{400}\, x\, 100\% = 92.75\% \quad (2)$$

Based on the calculations above, it can be concluded that the level of user acceptance of the lo-fi mockup of the inventory system is 92.75%. This percentage is relatively high so it can be concluded that users accept the designs that have been created so far.

4. Conclusion

This study succesfully designed a web-based inventory information system for ITSK Soepraoen using the Waterfall method. The system is expected to address issues encountered in manual inventory data recording, such as human error risks, difficulty in item search and tracking, and lack of data transparency and accuracy. User Acceptance Testing results indicated that the low-fidelity mockup of the inventory system was well-received by users, with an acceptance rate of 92.75%. Thus, the developed inventory system has met user needs and expectations. Most users provided positive feedback on ease of use, functionality, performance, and overall user experience with the system. No respondents disagreed or strongly disagreed with the survey questions, indicating that the system is on the right track for broader implementation at ITSK Soepraoen. Feedback received from users will be used to further refine the inventory system. With the implementation of this system, it is expected that inventory management at ITSK Soepraoen will become more efficient and effective, thereby supporting overall institutional operational success. This research also contributes to the development of inventory information systems in educational environments and offers a solution that can be adapted by other institutions with similar needs.

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References

[1] D. A. Handel, et al., "Using information technology to improve the quality and safety of emergency care," Academic Emergency Medicine, vol. 18, no. 6, pp. e45-e51, 2011. DOI: https://doi.org/10.1111/j.1553-2712.2011.01070.x.
[2] S. B. De Arco, "Developing the Inventory System with the Inputs from Front-end Staff: analyzing inventory system challenges faced by the front-end staff to help in system development," 2024.
[3] A. Mamo, "Effectiveness of Inventory Management System (A Case Study of Ethiopian Roads Authority)," M.S. thesis, St. Mary's University, 2016
[4] I. F. Ashari, A. J. Aryani, and A. M. Ardhi, "Design and build inventory management information system using the scrum method," JSil (Jurnal Sistem Informasi), vol. 9, no. 1, pp. 27-35, 2022. DOI: https://doi.org/10.30656/jsii.v9i1.4050.
[5] A. Corominas, "A model for designing a procurement-inventory system as a defence against a recurring epidemic," International Journal of Production Research, vol. 60, no. 11, pp. 3305-3318, 2022. DOI: https://doi.org/10.1080/00207543.2021.1919779.
[6] N. F. Fahrudin, and A. D. Wahyudi, "Modeling Inventory Systems Using the User Experience Design Model Method," Journal of Data Science and Information Systems, vol. 1, no. 1, pp. 9-16, 2023. DOI: http://dx.doi.org/10.58602/dimis.v1i1.12.
[7] B. Huda, et al., "Implementation of UI/UX the Design Thinking Approach Method in Inventory Information System," in E3S Web of Conferences, vol. 448, EDP Sciences, 2023. DOI: https://doi.org/10.1051/e3sconf/202344802005.

[8] T. Cahyono, S. Setianingsih, and D. Iskandar, "Implementation of The Waterfall Method in The Design of a Website-Based Book Lending System," Jurnal Teknik Informatika (Jutif), vol. 3, no. 3, pp. 723-730, 2022. DOI:https://doi.org/10.20884/1.jutif.2022.3.3.285.
[9] R. A. Purba, "Application design to help predict market demand using the waterfall method," Matrix: Jurnal Manajemen Teknologi dan Informatika, vol. 11, no. 3, pp. 140-149, 2021. DOI: https://doi.org/10.31940/matrix.v11i3.140-149.
[10] Y. Bassil, "A simulation model for the waterfall software development life cycle," arXiv preprint arXiv:1205.6904, 2012
[11] A. A. Adenowo, and B. A. A. Adenowo, "Software engineering methodologies: a review of the waterfall model and object-oriented approach," International Journal of Scientific & Engineering Research, vol. 4, no. 7, pp. 427-434, 2013.
[12] N. A. N. Ahmad, and P. N. N. Megat Sazali, "Performing user acceptance test with system usability scale for graduation application," in 2021 International Conference on Software Engineering & Computer Systems and 4th International Conference on Computational Science and Information Management (ICSECS-ICOCSIM), IEEE, 2021. DOI: https://doi.org/10.1109/ICSECS52883.2021.00023.
[13] A. N. Ezeonwumelu, C. Kalu, and E. H. Johnson, "Development of swim lane workflow process map for sales and inventory workflow management information system: A case study of petrospan integrated services, Eket, Akwa Ibom State, Nigeria," Mathematical and Software Engineering, vol. 2, no. 2, pp. 57-65, 2016.
[14] H. Wu, "QMaxUSE: A new tool for verifying UML class diagrams and OCL invariants," Science of Computer Programming, vol. 228, pp. 102955, 2023. DOI: https://doi.org/10.1016/j.scico.2023.102955.
[15] N. S. R. Pillai, and R. H. Ranganathan, "Hybrid user acceptance test procedure to improve the software quality," Int. Arab J. Inf. Technol., vol. 19, no. 6, pp. 956-964, 2022. DOI: https://doi.org/10.34028/iajit/19/6/14.