Research Article

UI/UX Design of Web-based Software License Management System using User-Centered Design and System Usability Scale

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A B S T R A C T

PT Bukit Asam Tbk (PTBA), a state-owned coal mining company, must comply with government regulations regarding software licenses. They face difficulties monitoring and managing licenses that could lead to violations. To solve this problem, we try to design a website-based UI/UX for the Software License Management System. This research aims to provide an intuitive interface and a comfortable user experience employing the User-Centered Design (UCD) approach, which consists of three main stages: Needs Analysis, Design and Prototyping, and Evaluation. Evaluation is carried out through usability testing using the System Usability Scale (SUS). Test results indicate that UCD is effective in designing a system responsive to user needs with a high level of usability. With an effectiveness of 99%, efficiency of 96.67%, and an SUS score of 88.25, this system design receives an 'Acceptable' rating, a (B) grade, and falls into the 'Excellent' category. The designed system is deemed suitable for further development towards the implementation phase.

1. INTRODUCTION

The industrial world is experiencing rapid growth alongside advancements in science and information technology. Information technology is a crucial component in designing information systems. Information systems are key in managing data and providing accurate, timely, relevant, and comprehensive information [15,16].

PT Bukit Asam Tbk is one of the State-Owned Enterprises (SOEs) operating in the coal mining sector [12]. PTBA must comply with Intellectual Property Rights (IPR) for software licenses that each SOE must fulfill. It aligns with government regulations emphasizing the implementation of Good Corporate Governance (GCG) and Good Information Technology Governance (GIG) in SOEs. PTBA can meet this obligation by using open-source applications or purchasing licensed software.

Software plays a significant role in various operational aspects of PTBA, enhancing efficiency and achieving corporate excellence.

With increasing operational activities in each operational unit (SATKER), PTBA continues to acquire new software to enhance work quality. PTBA uses computers and Microsoft Excel applications to record acquired software license data and create reports. However, to monitor the status of active software, checks need to be made through the portal of each software product provider. It sometimes causes administrative difficulties in effectively monitoring active software, leading to delayed license renewals. Such delays could result in PTBA breaching compliance with GCG and GIG regulations, potentially resulting in fines.

The growing volume of data makes collecting and retrieving information related to software license data increasingly complex. It also impacts data searches and the detailed checking of future software requirements. Despite computer-based

approaches aiding in software license data storage, data management lacks a fully tailored solution matching the needs and challenges. Therefore, a website-based system is needed to accurately identify the number of software licenses and display comprehensive information within a single system.

A website system has a user interface that connects users and the system for interaction. Hence, the user interface in the Software License Management system is designed to be easily understood by users. In the use of websites, user experience sometimes indicates challenges in understanding the system's functioning. Therefore, the researcher's primary focus in designing the system is to provide comfortable service by implementing a good user experience [14].

To address the outlined issues, we will analyze and design the User Interface and User Experience of the Software License Management system using the User-Centered Design (UCD) approach and test its usability with the System Usability Scale (SUS) method. Through the UCD method, the researcher gathers

data on what users need since the UCD concept is fundamentally user-centered [9]. Usability refers to how users can use an application or system, measured through efficiency, effectiveness, and satisfaction levels [6].

This research aims to produce the design of a Software License Management system by applying User Interface and User Experience aspects. Another goal is to develop a solution that meets user needs and creates a more attractive and user-friendly interface.

2. METHOD

Research methodology includes an explanation of the framework to be applied. This study implements the User Centered Design (UCD) to analyze and determine user needs and test usability by applying the System Usability Scale (SUS). The research framework to be used in this study can be seen in Figure 1.
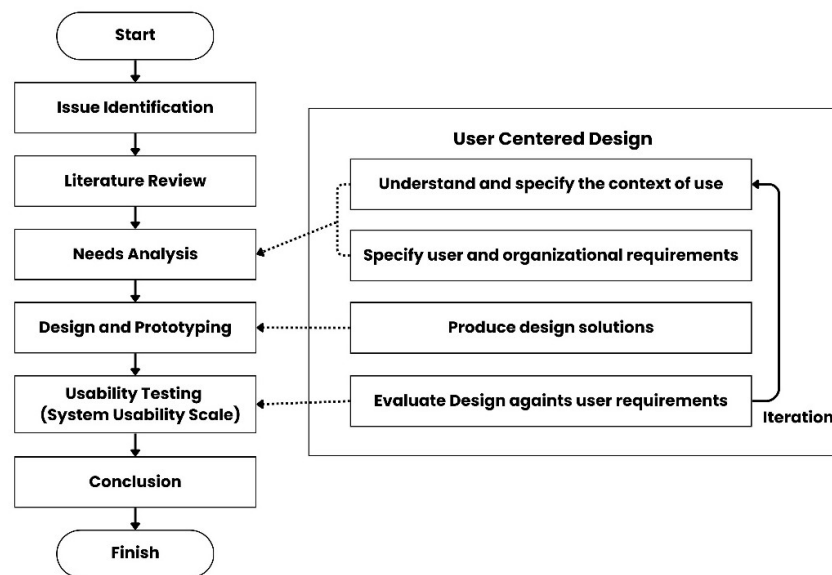

Figure 1. Research Method

As an initial step before delving into the methods used, the process commences by identifying issues through field research. It involves direct surveys at the study site and interviews and discussions with informants to gather necessary information, serving as the foundation of the research. Subsequently, a literature review is utilized to study UI/UX-related research from various sources such as books, journals, research reports, and theses. It includes findings from internet searches to reinforce the theoretical basis to be used in the research. The next stage involves applying the user-centered design method and testing usability using the system usability scale.

2.1. User-Centered Design (UCD)

The User-Centered Design (UCD) approach is a design method that places users at the center of attention in developing a product or system [13]. User-centered design is divided into four stages, which include the following steps.

Stage 1 - Understand and Specify The Context of Use: This stage involves interviewing and observing the relevant company personnel (Information Technology SATKER of PTBA). The steps in this stage include User Identification, which is a deep understanding of users and the purpose of system use. Then, a User Persona representing user groups will be created to help understand user needs [2].

Stage 2 - Specify User and Organizational Requirements: This stage focuses on determining user and organizational needs. It involves identifying issues related to software license management, analyzing needs based on previous interviews, brainstorming to generate design solution ideas, and creating a process metaphor to understand changes in the business process.

Stage 3 - Produce Design Solutions: This stage involves implementing the solutions into the design to be implemented. The process starts by creating a preliminary website layout (Low-

Fidelity Wireframe), including a menu layout, images, icons, and text. Then, the design is refined and enhanced by adding color, images, text, and other elements (High-Fidelity Wireframe). In the final stage, a Prototype is created, allowing for user interaction simulation and usability testing [4].

Stage 4 - Evaluate Design Against User Requirements: Evaluate the system design created for users. The evaluation process aims to determine whether the design meets user needs or requires adjustments and improvements. At this stage, the researcher will conduct an evaluation based on usability testing using the System Usability Scale (SUS) method.

2.2. Usability Testing

Usability testing is a stage in research where tasks related to the interface are given to users [11]. At this stage, task scenarios are provided that specify the actions respondents must take to test the interface. Usability success is measured by the users' ability to complete tasks and the frequency of errors.

The System Usability Scale (SUS) was introduced in the 1980s by John Brooke as a "quick and dirty" assessment method that allows usability practitioners to evaluate the usability of products or services quickly and simply [7]. It consists of 10 statements alternating between positive and negative (positive statements on odd numbers, negative statements on even numbers) with a five-point rating scale (Likert Scale) that includes strongly disagree, disagree, neutral, agree, and strongly agree. The list of questions or statements is provided in Table 1. The SUS has a final score ranging from 0 to 100, where a higher score indicates a better level of usability.

Table 1. System Usability Scale Questions

| No	Type
1	I would use this Software License Management System
2	I find this Software License Management System unnecessarily complex
3	I think this Software License Management System is easy to use
4	I find this Software License Management System challenging to use or confusing.
5	I feel the functions in this Software License Management System are well integrated.
6	I rate the inconsistency or lack of uniformity in features or menus in this Software License Management System.
7	I feel comfortable and have no obstacles when using this Software License Management System.
8	I must learn a lot before using this Software License Management System effectively.
9	A novice would quickly understand and use this Software License Management System.
10	I would use this Software License Management System
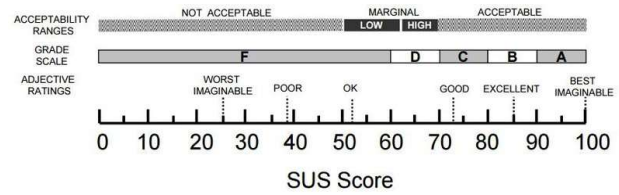
Figure 2. SUS Score (Bangor, Kortum & Miller, 2009) [5]

Scores above 68 indicate that the system is acceptable for use. In contrast, scores below 68 or below the minimum threshold set by the SUS score indicate the need for improvements in design and retesting [7].

3. RESULT AND DISCUSSION

3.1. Requirement Analysis

Determining the system's usage context is based on an interview with an employee responsible for software license data management at PTBA. In the identification phase, the results of interviews and observations regarding software license data management are used to establish users or stakeholders and the system's usage context. Table 2 shows the identification of users and their descriptions.

Table 2. User Identification

Stakeholder	Description
Admin	Employee managing software license data (Read, Create, Update, Delete).
Manager	Officers are at three levels: level 1, level 2, and level 3, with access (Read only) to the system.

The User Persona created provides a brief overview of the system user's profile that reflects an individual or a group of users. In software license data management, an example of the User Persona can be seen in Figure 3.

The interview results also revealed several issues related to the previous system, including time-consuming manual processes, difficulties in checking license renewals, less effective use of Microsoft Excel, challenges in identifying licenses and usage allocation, and manual software license data reporting. Identifying user needs in the UI/UX system design involves two main categories: functional and non-functional requirements.

Functional needs are related to the basic system specifications, including processes, necessary information, and required features.

Figure 3. User Persona

Table 3. Functional Requirement

ID	Description
FR-01	System Login (Login) - Users log in with their respective roles using usernames and passwords.
FR-02	Dashboard-Displays information about software license validity periods.
FR-03	License Data Management - Create, edit, and delete license data.
FR-04	License Data Details - Displays contracts, license users, and vendor data.
FR-05	Warning Notifications - Provides periodic interval alerts.
FR-06	Automatic Reporting - Generates reports in MS Excel, Word, and PDF formats for export.

Meanwhile, non-functional system requirements include a user-friendly interface, effectiveness, efficiency, and user satisfaction. Identifying these requirements is used in brainstorming to generate user interface design ideas, serving as the basis for design according to user needs. It is necessary to understand the differences between the workflow of the old system's business process and the proposed workflow in the new system. It helps understand the impact of changes on the existing business processes. The workflow of the old system includes the initial process of licensing software requests by the work units, checking software availability, making purchases if the software is unavailable, and recording software license usage. Monitoring active software license usage involves accessing the portal of each software product provider. Figure 5 illustrates the metaphorical process flow from the previous system's workflow.
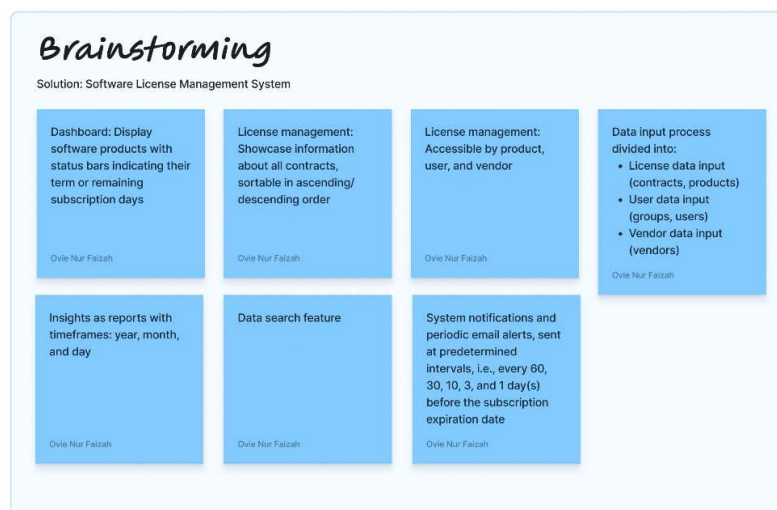

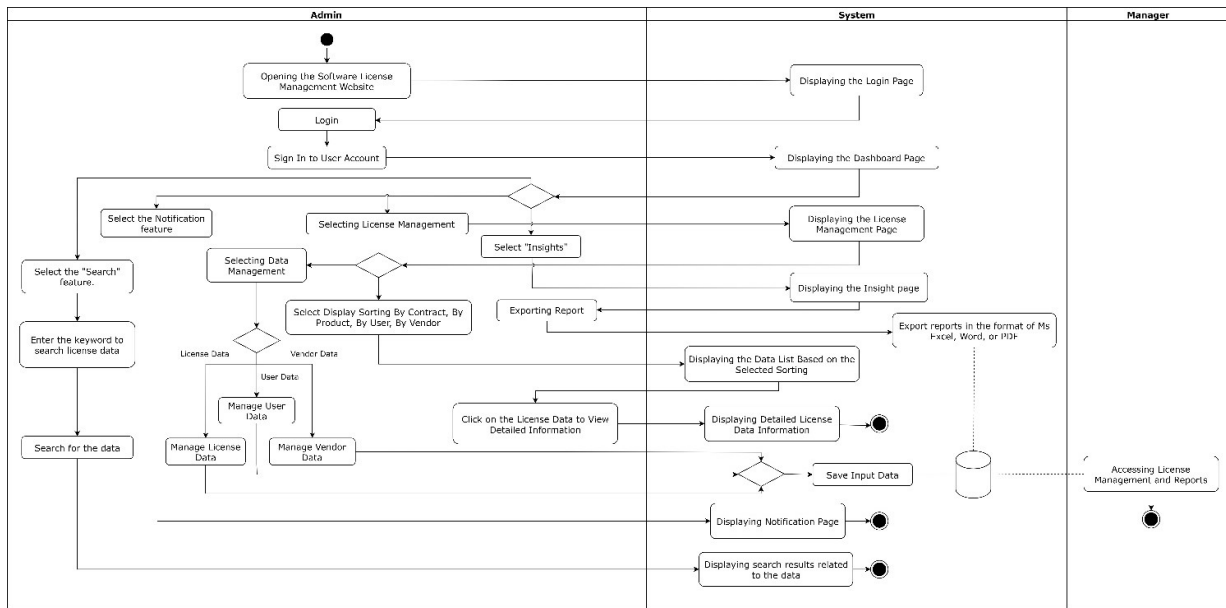
Figure 4. Brainstorming Result

Figure 5. Proposed System Business Process

3.2 Design and Prototype

In the design phase, solutions considered from the previous stage are implemented into a design to resolve identified issues. A style guideline is prepared before commencing the user interface design to align with PTBA's branding. Low-fidelity wireframes are the foundational design to determine layout, navigation, and content structure. Based on the existing solutions, this design focuses on placing elements like information, images, buttons, icons, and text. The low-fidelity wireframe for the software license management system aims to ease the implementation process for the high-fidelity wireframe. For instance, a low-fidelity wireframe for the dashboard interface can be observed in Figure 6. Following the creation of the low-fidelity wireframe, the next step involves developing the high-fidelity wireframe shown on Fir. This stage aims to provide a more precise design visualization by adding color, images, menus, and icons or refining the visual aspects from the low-fidelity wireframe.
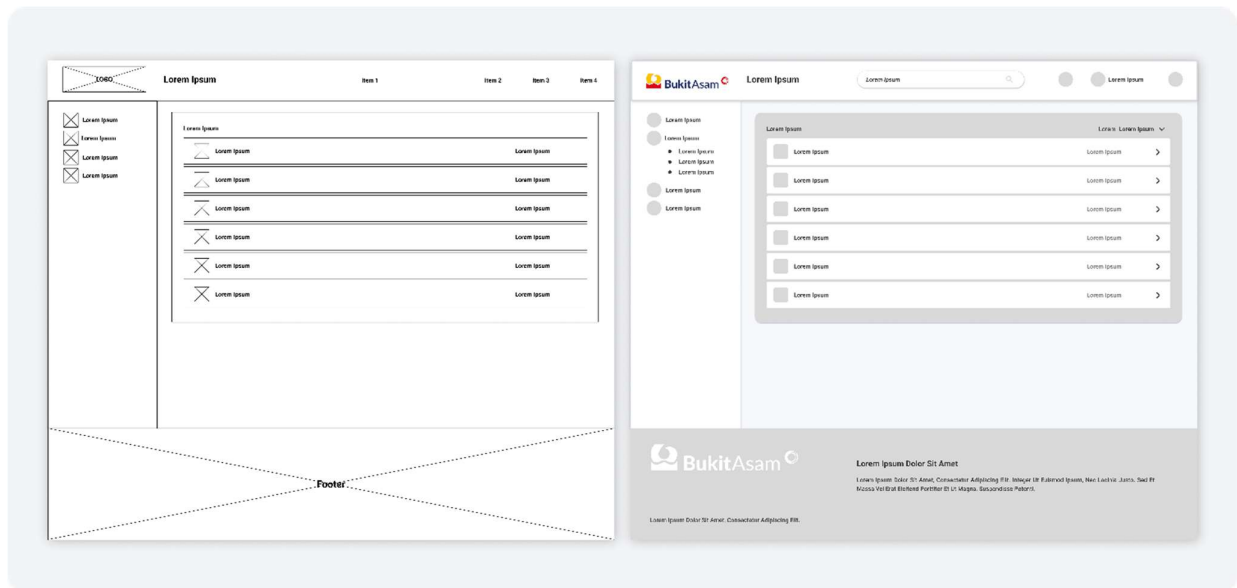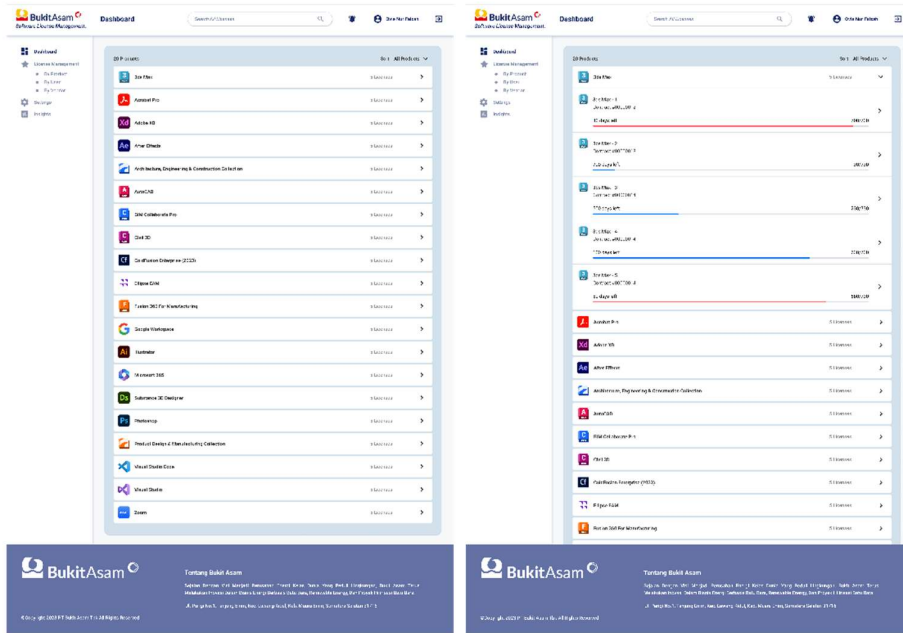

Figure 6. Low-Fidelity Wireframe – Dashboard

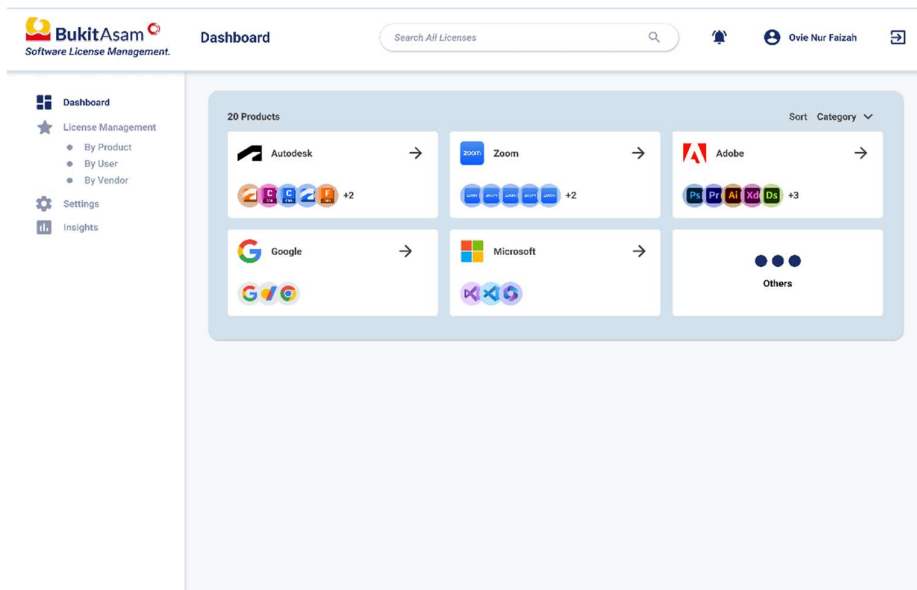Figure 7. High-Fidelity Wireframe - Dashboard (Sorting All Products)

Figure 8. High-Fidelity Wireframe - Dashboard (Sorting by Category)

On the software license monitoring dashboard, PTBA-acquired software products are listed and can be sorted by product category or displayed collectively. Each product is accompanied by an accordion menu, enabling quick access to additional information.

The status bar displays the remaining subscription days, providing information for users to monitor software product status, enabling subscription renewal actions or contract management. Detailed product contract information is available by clicking on a listed product. The License Management page allows users to sort license contracts and access detailed contract information effortlessly. Admin has special access to add and manage software license data, such as adding contracts, products, groups, users, and vendors. Under the License Management sidebar menu, users can access information based on three categories: By Product, By User, and By Vendor. The Notification page displays various alerts to users, including notifications about added data and subscription renewal alerts. Notifications are also emailed at specific schedules to ensure users do not miss essential subscription renewals.
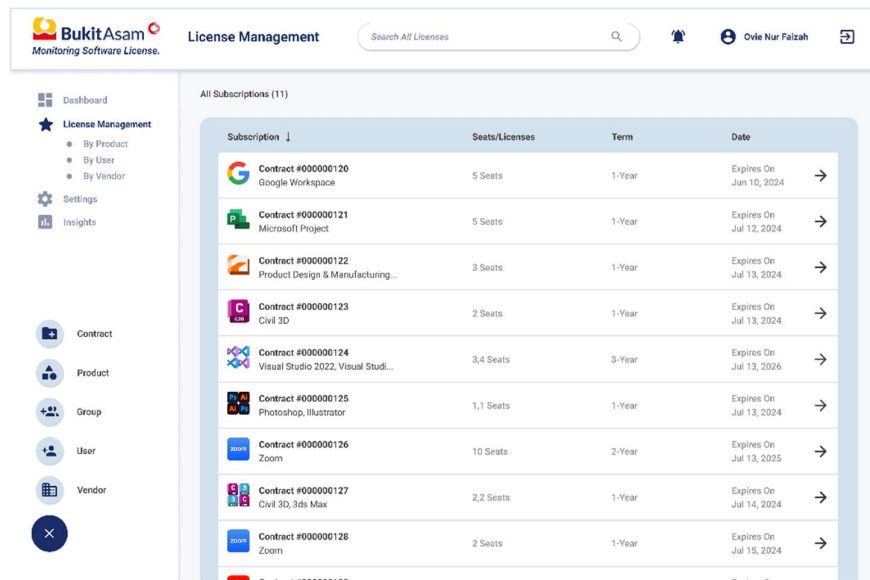
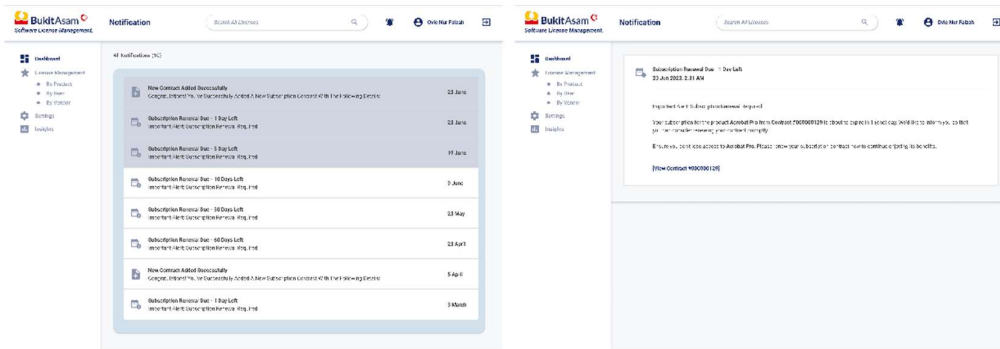Figure 9. High-Fidelity Wireframe - License Management

Figure 10. High-Fidelity Wireframe – Notification

The next step involves prototype testing with users to obtain responses and feedback on the created design, followed by completing the System Usability Scale questionnaire. In this testing phase, respondents will be asked to complete several tasks.

Ten respondents from the Information Technology Department at PTBA participated in the prototype testing, with an equal gender distribution (50% male and 50% female). The age range of the respondents varied, ranging from 20 to 50 years old. Respondents performed testing based on ten predefined task scenarios outlined in Table 4.

Table 4. Task Scenario

ID	Task Scenario
T-1	Login
T-2	View Dashboard
T-3	Access License Management by Contract
T-4	Access License Management by Product, User, and Vendor
T-5	Add User
T-6	Edit Group
T-7	Add Contract
T-8	Delete Contract
T-9	Access Search, Notifications, and Insights
T-10	Logout from the system

3.2. Usability Testing

According to Bevan, adapting from ISO 9241-11, an usability quality can be measured through three primary components: effectiveness, efficiency, and satisfaction [17]. In this research, to ascertain whether the UI/UX design of the Software License Management System is effective, a Success Rate calculation was employed using Equation (1).

$$success\ rate = \frac{(Success + (Partial\ Success\ x\ 0,5)}{total\ number\ of\ tasks\ x\ total\ number\ of\ respondents} x\ 100\% \quad (1)$$

Based on the prototype testing of the Software License Management System, the effectiveness aspect achieved a success rate of 99%. Out of 100 tasks given, 99 were completed, with only one task reported as a failure by the 3rd respondent (R3). The task that wasn't successful was when the respondent was asked to "Add Contract" (T7). The Overall Relative Efficiency was calculated using Equation (2) to determine whether the system is efficient.

$$Overall\ relative\ efficiency = \frac{\sum_{j=1}^{R} \sum_{i=1}^{N} n_{ij} t_{ij}}{\sum_{j=1}^{R} \sum_{i=1}^{N} t_{ij}} x\ 100\% \quad (2)$$

Based on Equation (2), the efficiency level reached 96.67%. The total time required by all respondents to complete all tasks successfully was 2154 seconds, while the whole time needed to complete all tasks was 2228 seconds. User satisfaction, or satisfaction level, can be determined using the System Usability Scale questionnaire. The SUS score is calculated using Equation (3):

$$\bar{x} = \frac{\sum x}{n}$$

(3)

Table 5. Average SUS Scores

Respondent	Score	SUS Score
R1	40	100
R2	40	100
R3	20	50
R4	36	90
R5	35	87.5
R6	35	87.5
R7	34	85
R8	40	100
R9	33	82.5
R10	40	100
Average		**88.25**

4. CONCLUSION

According to the UI/UX design conducted, it can be concluded that the User-Centered Design (UCD) approach is an effective method for designing the UI/UX of the Software License Management System. UCD focuses on users, ensuring that the resulting design meets their needs. Usability testing results indicate an effectiveness of 99%, an efficiency level of 96.67%, and a satisfaction level with an average System Usability Scale (SUS) score of 88.25. It falls within the Acceptability range as an "Acceptable" category, achieving a Grade Scale rating of (B), and for adjective ratings, it falls into the "Excellent" category. These values suggest the system is suitable for design and further development towards the system implementation phase.

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NOMENCLATUR

N	total numbers of tasks
R	toral numbers of users
Nij	value of task i by respondent j. if completed successfully Nij=1; if failed Nij=0
tij	time used by respondent j to complete task i; if failed, the time is measured until the respondent gives up or surpasses the task.
n	number of respondents
$\bar{x}$	average score
$\sum^x$	sum of SUS scores

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