UI/UX Design of the "PrintOn!" Printing Services Marketplace for UMKM Photocopying and Printing Businesses Using the User Centered Design Method

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Article Info	ABSTRACT
	UMKM in the photocopy and printing sector faced several obstacles when managing orders through messaging platforms. Customer messages were often difficult to identify due to the absence of names or profile photos, and lengthy, unclear texts further complicated communication. The use of multiple platforms such as social media and email required manual checking, which delayed response times. This study aimed to design a user interface and user experience (UI/UX) for a printing service marketplace application to improve the service process for UMKM. The design process followed a human-centered design approach, beginning with literature studies, user context identification through interviews with 15 respondents, and user needs analysis using empathy maps, personas, and affinity diagrams. Solutions were developed through user flow mapping, information architecture, and prototyping using Figma. Evaluation was conducted using usability testing via Maze, the System Usability Scale, and heuristic evaluation by five expert evaluators. The findings indicated issues in areas such as consistency and aesthetic minimalism, which received high severity ratings. After iterations, customer usability scores improved from 67.5 to 82.8 and provider scores from 78.5 to 80.5. These results demonstrated that the final "PrintOn!" application design met usability standards and enhanced user experience, making it ready for implementation.

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1. Introduction

Many activities and tasks in today's era have changed to take advantage of technological innovations. With these changes, people now want everything to be fast and accessible anywhere and anytime, especially when it comes to meeting their needs. It cannot be denied that technology has simplified many processes [1]. As a result, many internet platforms have emerged, including computers and mobile devices that make things easier [2]. Therefore, many people now rely on these two platforms. UI/UX design plays a crucial role in the success of an application [3]. A good user interface must be incorporated into the

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design process from the outset, as it can make a significant difference in training time, performance speed, error rates, user satisfaction, and user knowledge retention over time [4]. Therefore, it is important to develop UI and UX design based on user perception assessments before creating an application to ensure users receive the best possible visual experience and usability. In its development, services with high frequency of use are printing services, particularly in academic and office environments. For example, many printing service providers are located near universities or schools to meet students' printing needs. However, in fulfilling these needs, service providers have not optimally utilized technology. They typically manage services in a more conventional manner rather than through computerized systems, which could better meet customers' demands for speed and ease [5].

Based on interviews conducted with 5 photocopying and printing service owners, several issues and obstacles were identified, including the fact that most orders are placed via WhatsApp, which causes obstacles that result in missed orders and difficulties in management, especially when orders surge. For example, customer messages are difficult to identify because they do not include names or profile photos, and the text messages are long and confusing. The surge in orders makes older messages easy to overlook, making it difficult to search and verify them. The use of multiple platforms such as email and Instagram also complicates management, as each must be checked manually one by one. This leads to delays in responding to orders. Another challenge is that customers often complain about the lack of transparency regarding progress and processing time, misunderstandings with customers regarding file formats, and the lack of transparency regarding prices and available services, leading to many customers asking questions. Meanwhile, the next interview was conducted with 10 users of photocopying and printing services. It was found that 8 out of 10 users faced challenges and issues, including long queues and uncertainty about print time estimates, limited notifications about whether orders have been processed or not, some respondents expressed concerns about the security of personal files due to the lack of assurance that files would be processed securely and only for the intended purpose, and the lack of information on prices and service quality at photocopying and printing services, which are typically important considerations.

Therefore, this study aims to design the UI/UX for a website and mobile-based marketplace application for UMKM in the photocopying and printing industry using the User-Centered Design (UCD) method. In its development, User-Centered Design (UCD) was chosen as one of the approaches because it can address user issues, is popular in meeting user needs, and is iterative [6]. Design development using the User-Centered Design (UCD) approach always places the user at the center of each process to identify the core of the user's needs [7]. The evaluation conducted using SUS will provide a comprehensive overview of usability aspects [8]. Additionally, a heuristic evaluation method will be conducted, which can identify common and comprehensive usability issues based on Nielsen's ten usability principles and using an expert perspective [9].

2. Research Method

The method used in this study is User Centered Design. Based on ISO 9241-210, the steps of the User Centered Design method generally consist of four main iterative steps [10]. This stage begins with understanding the theory through literature study. The research process is illustrated in Figure 1.
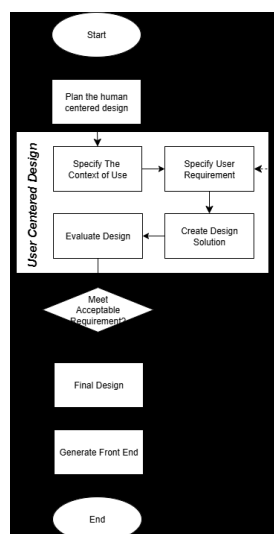

Figure 1. Research Process

2.1. Plan The Human Centered Design

In the early stages of the research, a literature study was conducted to plan the scope and resources by obtaining information and understanding theories relevant to the methods used to identify users. Literature studies typically use sources from similar research that has been conducted previously [11].

2.2. Specify The Context Of Use

At this stage, problem identification and user identification are carried out by involving observation and interviews following guidelines, and are conducted either directly or through certain communication tools [12]. This is used to gather an overview of the problems being faced and general information about user needs.

2.3. Specify User Requirement

Next, this stage will involve elaborating on the interview results to identify the needs of potential users in order to achieve the desired usability goals. The user needs collected and obtained from the interviews will be outlined in an Empathy Map to facilitate analysis, then directed to pain points for detailed classification of the problems faced by users, and ideas will be developed in an affinity diagram and user characteristics analyzed using user personas [6]. The affinity diagram focuses on broadly grouping ideas and can lead to team alignment, strong design ideas, and a series of next steps to advance the project or strategy [13].

2.4. Create Design Solution

At this stage, solutions are developed using two types of design: system design and interface design. System design includes the creation of user flows and application information architecture. Meanwhile, interface design is created using Figma through three prototyping stages: low fidelity (wireframe), middle fidelity (mockup), and high fidelity (interactive prototype with navigation and features). The design process will be carried out using Figma, which offers a wide range of design features, including prototyping, libraries, design elements, and grids. This tool enables users to create high-quality graphic designs for websites, applications, and other digital products [14].

2.5. Evaluate Design Against User Requirements

The methods used in the design evaluation included usability testing by observing heat maps and respondent performance, followed by a System Usability Scale (SUS) assessment and a Heuristic Evaluation assessment by five expert evaluators. In the usability testing, the final results of the prototype design were entered into Maze.co as the testing tool and Google Forms as the tool for filling out the SUS questionnaire. Usability testing was conducted on each type of user, with 5 users being photocopy and print service providers and 8 users being photocopy and print customers. According to ISO 9241-11, usability measurement must include Effectiveness, Efficiency, and Satisfaction [15]. In the SUS assessment, users must answer 10 questions as shown in Table 1 on a scale of 1 to 5. The questions asked in the System Usability Scale testing were developed by John Brooke in SUS - A quick and dirty usability scale, consisting of 10 questions [16].

Table 1. SUS question [16]

No	SUS
1	I think I want to use this system often.
2	I found the system to be uncomplicated.
3	I think the system is easy to use.
4	I think I will need support from technical personnel to be able to use this system.
5	I found the various functions in this system to be well integrated.
6	I think there are too many inconsistencies in this system.
7	I imagine that most people will learn to use this system very quickly.
8	I find this system very complicated to use.
9	I feel very confident using this system.

| 10 | I need to learn a lot before I can use this system. |

In the heuristic evaluation, 10 design aspects were assessed as shown in Table 2, with a total of 5 severity levels on a scale of 0 to 4 [9].

Table 2. Usability Principles Rules [9]

No	Usability Principles
1	Visibility of System Status
2	Match Between System and the Real World
3	User Control and Freedom
4	Consistency and Standards
5	Error Prevention
6	Recognition Rather than Recall
7	Flexibility and Efficiency of Use
8	Aesthetic and Minimalist Design
9	Help Users Recognize, Diagnose, and Recover from Errors
10	Help and Documentation

3. Result and Discussion

This chapter describes the results and discussion of the research that has been conducted. It covers the steps taken to find solutions to the problems that have been formulated.

3.1. Plan The Human-Centred Design Process

This stage involves gathering reading materials from several references such as books, journals, and websites relevant to the thesis being written. It begins with searching for theoretical foundations to support and clarify the User Centered Design method suitable for use in a user-centered thesis and the testing methods used to evaluate the resulting design.

3.2. Specify The Context of Use

During the user identification process at this stage, a comprehensive exploration of user needs and system requirements was carried out to ensure that the designed printing service application aligns with actual field conditions. The research team conducted both direct and indirect interviews through Google Meet, involving 10 service users and 5 service providers who actively utilize or manage printing services in their daily operations. These interviews aimed to capture detailed insights regarding user behavior, service expectations, recurring problems, and preferred features in a digital printing service platform. Through this approach, the data collected became more diverse and reflective of real user experiences, allowing the development team to map out challenges as well as opportunities for improvement within the existing workflow.

The results of the identification process revealed that the printing service application requires three main actors who interact within the system. The first actor is the customer or service user, who utilizes the mobile application to place orders, upload files, track order statuses, and manage transactions. Their role focuses on ensuring convenience, efficiency, and accessibility when accessing printing services remotely. The second actor is the service provider, who is responsible for receiving orders, processing printing tasks, updating service availability, and ensuring timely completion of each request. Their interactions within the system are crucial for maintaining operational accuracy and service quality. Finally, the super admin acts as the highest-level user within the web-based management application. The super admin oversees the overall platform functionality, manages user accounts, monitors service provider performance, and ensures that the system operates according to established standards and policies..

3.3. Specify User Requirements

The results of observations and interviews with previous users will be explained at this stage.

3.3.1. Empathy Map

The analysis of the interviews was then incorporated into an Empathy Map closely related to the users, which consisted of five elements, namely what the users said, thought, felt, did, and heard [17]. Figure 2 shows the Empathy Map for photocopying and printing business operators.
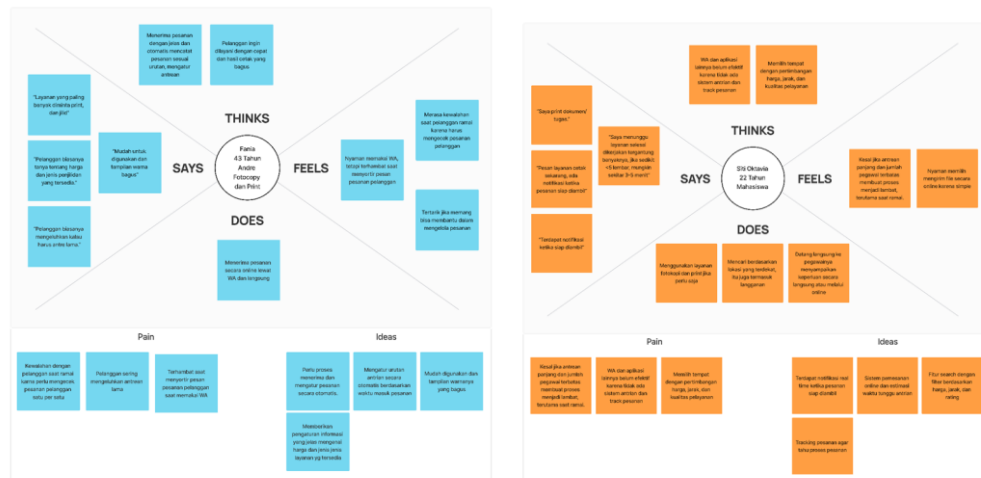

Figure 2. Empathy Map

3.3.2. User Persona

From the results of user observations and interviews, user personas were created to describe the types of users of the application to be designed. Users are targets based on facts and beliefs. Building personas provides a user perspective on the software [18]. Figure 3 shows the user persona that were created.

Figure 3. User Persona

3.3.3. Affinity Diagram

The interview results produced pain points and ideas that were grouped based on similarities among users. The grouping process yielded a total of 26 affinity diagrams. Simple affinity diagrams can help in thinking by sorting data and identifying embedded patterns (and sometimes breaking old patterns). Additionally, this can provide an overview of the focus of most people's thoughts [19]. The pain points and ideas are shown in Figure 4.

Figure 4. Pain Points and Ideas

3.4.   Create Design Solution

The next step will be to implement the system design and interface design as a solution to the problems that have arisen. User flow is used in this system design to ensure optimal application flow in providing a user experience. User flow is useful for studying the flow of website or application users with the aim of designing new products or improving old products [20]. The following is a design of the user flow for one of the processes, namely the print service checkout shown to users in the mobile application in Figure 5.

The process begins when the user opens the application and enters the home page. From there, the user selects a store, then browses the list of available services and selects the desired print service by clicking "order here." Then, the user selects the specifications for the desired custom order and clicks "order now." The user proceeds to the file upload process for the file to be printed, followed by a file preview. If the file is satisfactory, the user clicks the "Continue" button to proceed to the first order summary. Here, the user can view the file summary and print specifications. Next, the user selects the delivery option, such as self-pickup or shipping. After selecting, the user clicks "Apply" and is redirected back to the order summary. The next step is to choose the payment method, which is done by clicking the "Select Payment Method" button and applying the selected option. Once everything is confirmed, the user clicks the "Place Order Now" button, and the system displays the final order summary for confirmation. After the user confirms, the system processes the payment. If the payment is successful, a payment confirmation notification appears, and the checkout process is complete. If not, the user is redirected back to the order summary page.
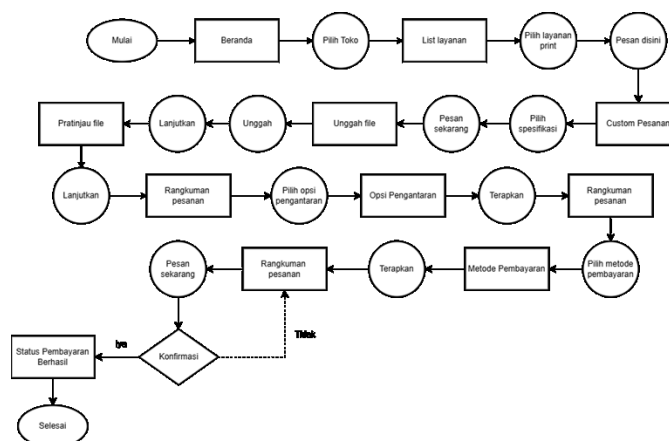

Figure 5. Userflow Checkout Print Services

Next is the user flow design for one of the processes on the website-based platform for photocopying and printing service providers, namely processing print services, as shown in Figure 5. The process begins on the dashboard page. Users then go to the order menu to view a list of print service order data. From this list, users select the order data they want to view the details of. After viewing the order details, users confirm the order. If the order is confirmed, a message will appear stating that the order has been successfully confirmed, and after pressing OK, the order status will be updated to order in process. At the order in progress stage, there are two possible workflows. Users can continue processing the order until it is complete. If it is complete, the status will change to order processed. After pressing OK, the final status becomes an order awaiting customer acceptance, and the workflow for that order is considered complete. However, if the order is still not complete (no), the workflow will return to the order in progress status.
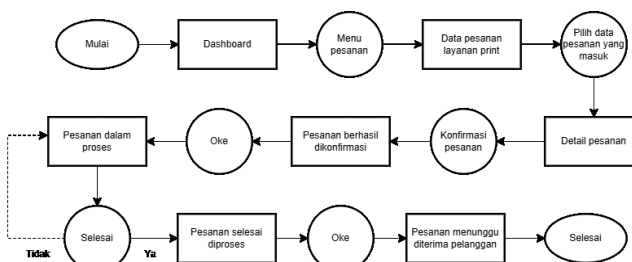

Figure 6. Userflow Processes Print Services

Furthermore, information architecture is useful for facilitating the layout of application content when designing an interface. Information architecture also refers to library science techniques for organizing

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information spaces to facilitate content search, navigation, and understanding [21]. The information architecture of the PrintOn! application can be seen in Figure 6. In the mobile information architecture, it generally starts with a splash screen, where users register (Sign Up) by entering their name, email, username, password, and password confirmation. After successfully logging in, users will interact with the main navigation, which consists of four core sections: Home, Orders, History, and Profile. In Figure 8, this website has several main features, namely: user and store registration process, profile management, dashboard, management of services offered by the store, customer review feature, periodic sales reports, as well as a help menu and application exit. Each main feature has more detailed sub-menus, such as customer data management, order status, service management, rating and review submission, and sales report analysis in the form of graphs and tables. This diagram provides a comprehensive overview of the navigation structure and available functions within the store application.
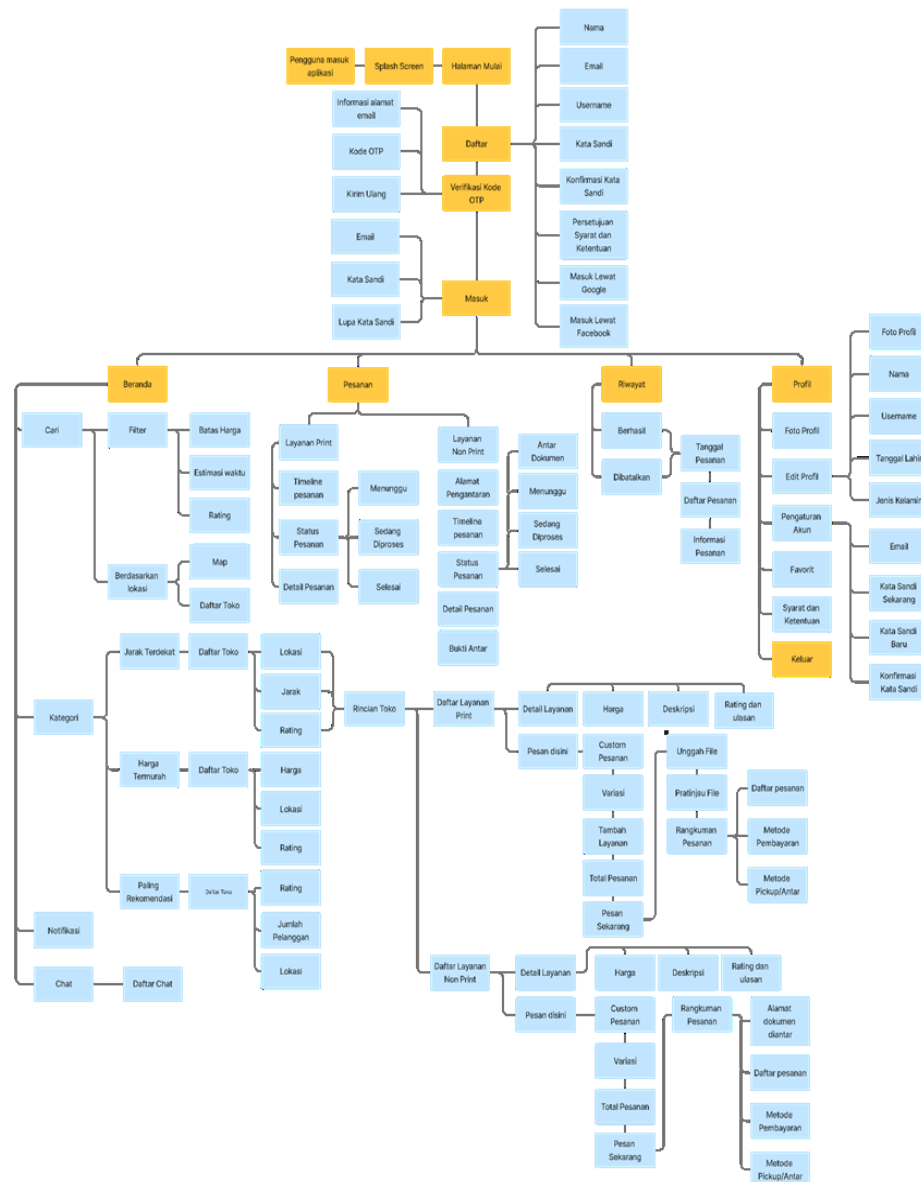

Figure 7. Information Architecture on Mobile

In Figure 8, this website has several main features, namely: user and store registration process, profile management, dashboard, management of services offered by the store, customer review feature, periodic sales reports, as well as a help menu and application exit. Each main feature has more detailed sub-menus, such as customer data management, order status, service management, rating and review submission, and sales report analysis in the form of graphs and tables. This diagram provides a comprehensive overview of the navigation structure and available functions within the store application.
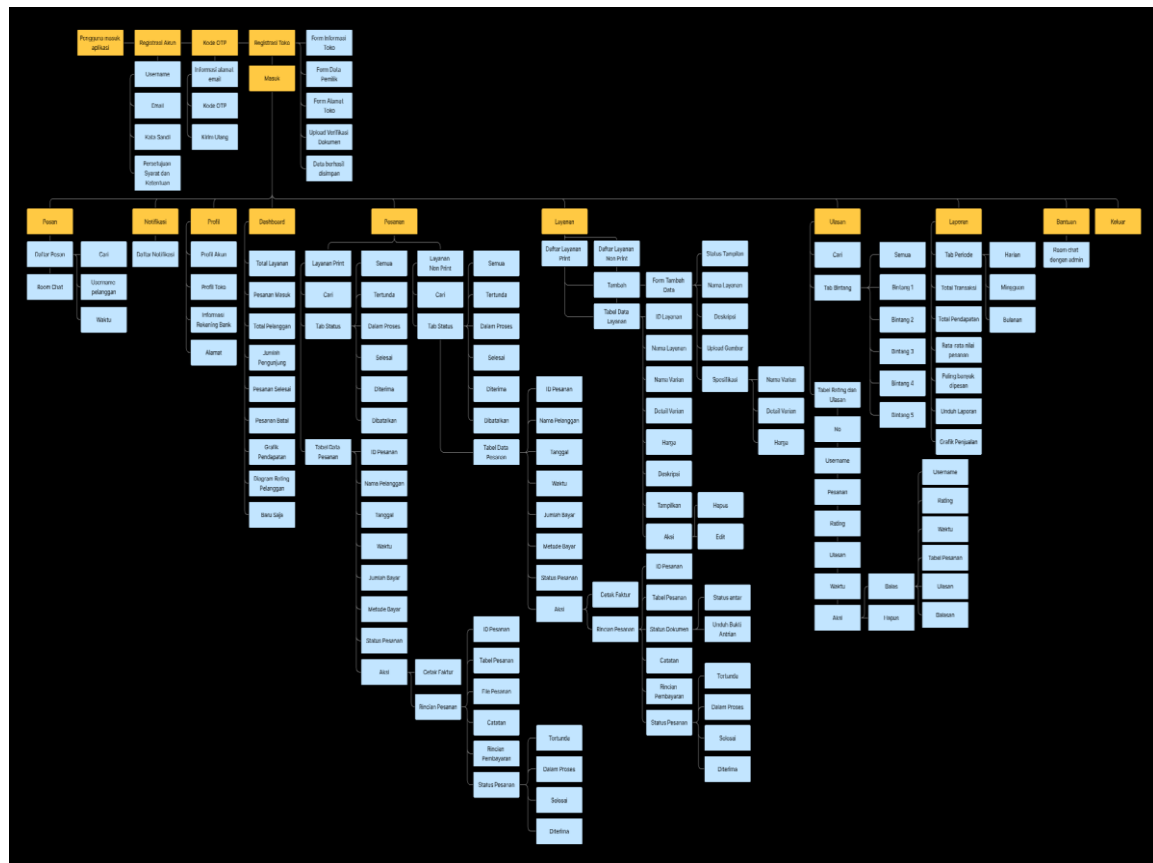
Figure 8. Information Architecture on Website

The level of a low-fidelity prototype, namely a wireframe, only contains the basics of the application or a rough outline to visualize the layout of the content of the information architecture that has been created. By using wireframes, developers, industrial and visual designers, copywriters, and business stakeholders can easily understand and build the product without being distracted by its physical or visual form [21]. Additionally, they are used to depict templates that are consistently applied across various pages, such as content pages [22].
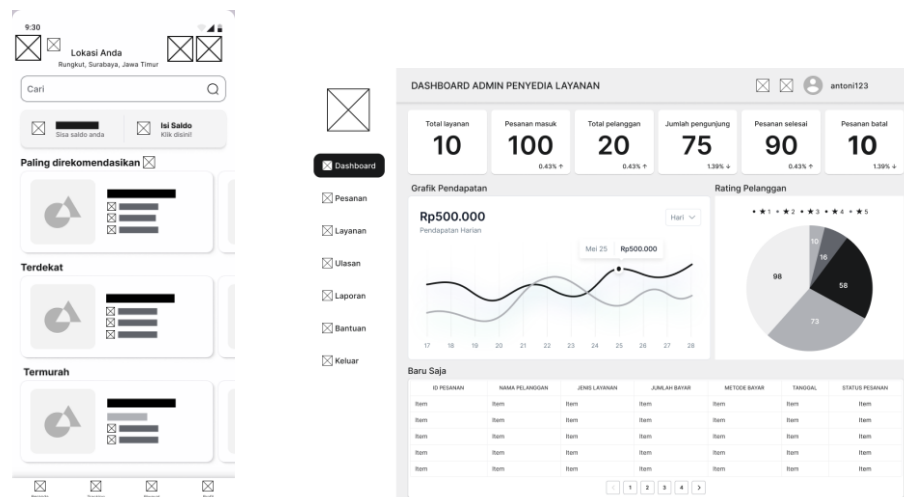

Figure 8. Wireframe

A mockup contains a design with visual details that already include the overall style and components such as colors, images or illustrations, fonts, and others. However, this mockup is not yet at the interactive implementation stage. A mockup provides a way to visualize the application model before development begins [23]. The PrintOn! application homepage mockup includes the logo, the user's current

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location, notification features, chat, a search bar, the PrintOn! wallet, and a list of stores with an interactive horizontal slider divided into three categories: most recommended, nearest, and cheapest. The dashboard page mockup includes information on total service statistics, incoming orders, total customers, number of visitors, completed orders, and canceled orders. Additionally, this page includes graphs and diagrams to monitor revenue and customer ratings. At the bottom, there is a table of recently received orders.
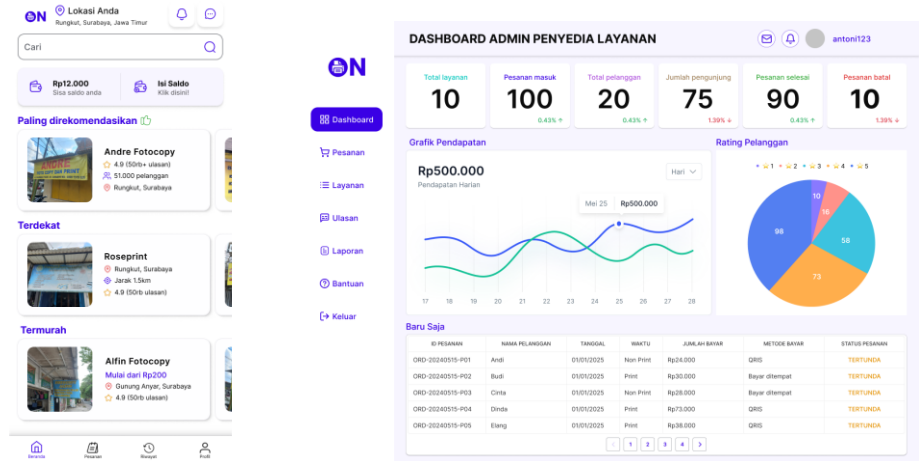

Figure 9. Mockup

3.5. Evaluate Design Against User Requirements

During the design evaluation stage, testing involving users is conducted on each application that has been given an interactive design. The results of usability evaluation often show areas where users experience difficulties in understanding and using the application, as well as areas where they are more likely to succeed [24]. Two testing methods will be conducted: usability testing by integrating the Figma prototype into Maze with the SUS (System Usability Scale) assessment via Google Forms, and a heuristic evaluation conducted by five evaluators. As stated by Jakob Nielsen and Robert L. Mack, three to five evaluators are sufficient to identify approximately 80 percent of all potential usability issues [25]. The results obtained from this design evaluation will be refined until the final design is achieved.

Table 3. Heuristic Assessment Results

Heuristic Points	Evaluator's Rating				
	E1	E2	E3	E4	E5
1. Visibility of System Status	2	-	2	3	-
2. Match Between System and the Real World	-	2	3	4	-
3. User Control and Freedom	-	-	-	-	
4. Consistency and Standards	4	-	-	-	4
5. Error Prevention	-	3	-	-	-
6. Recognition Rather than Recall	4	-	-	-	-
7. Flexibility and Efficiency of Use	-	3	-	-	-
8. Aesthetic and Minimalist Design	-	3	-	-	3
9. Help Users Recognize, Diagnose, and Recover from Errors	2	-	-	-	-
10. Help and Documentation	-	-	-	3	-

The points that were most frequently rated as problematic were design aspect number 4, Consistency and Standards, and number 8, Aesthetic and Minimalist Design, each of which received the highest severity rating of 4 from several evaluators. This indicates that the interface display may not be consistent and still feels too complex or visually inefficient. Additionally, Match Between System and the

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Real World also received relatively high scores with variations of 2, 3, and 4, indicating that the system has not fully adopted language or concepts familiar to users. Another issue found was in the Recognition Rather than Recall and Help Users Recognize, Diagnose, and Recover from Errors aspects, which indicate a lack of support when errors occur in the use of the system. Meanwhile, several points such as User Control and Freedom and Error Prevention were not heavily rated, which could mean that no significant problems were found in these aspects.

Table 4. Iteration Comparison

Comparison of Design Evaluation Results				
Usability Score on Maze				
Respondent	**Iteration 1**	**Iteration 3**	**Improvement**	**Improvement (%)**
Customer	65	85	20	30.76%
Service provider	85	93	8	9.41%
System Usability Scale				
Respondent	**Iteration 1**	**Iteration 3**	**Improvement**	**Improvement (%)**
Customer	67.5	82.8	15.3	22.66%
Service provider	78.5	80.5	2	1.57%

Table 4 above shows that in iterations 1 and 3, each respondent experienced an improvement. The design in iteration 3 is the result of design improvements from the heuristic evaluation in iteration 2. Let's look at the customer side in both evaluations. There was a significant improvement on the customer side, from a score of 65 to 85, with an increase of 20 points or 30.76%. Meanwhile, the provider saw an increase from 85 to 93, or 8 points (9.41%). This indicates that design changes have a greater impact on improving the user experience from the customer's perspective. In the System Usability Scale (SUS) test, the customer score increased from 67.5 to 82.8, with an increase of 15.3 points or 22.66%. For providers, the increase was only 2 points, from 78.5 to 80.5 (1.57%). The design iterations successfully improved system usability significantly, especially for customers. The evaluation results from the third iteration demonstrated that the application became easier, more comfortable, and more accepted by users, indicating success in enhancing interface quality to meet user needs.

4. Conclusion

Based on the results obtained at each stage, starting from interviews, analyzing user needs by creating Empathy Maps, user personas, affinity diagrams, followed by designing the system, interface design, and conducting evaluations for iterations 1, 2, and 3, leading up to the implementation of the design, the UI/UX design for the PrintOn! printing service marketplace both in the mobile app and website using the User-Centered Design (UCD) method has been successfully created with a focus on user needs. The evaluation conducted over three iterations showed improvements in design quality, with Iteration 1 and 3 undergoing usability testing using the Maze tool and SUS assessment. The usability testing score for customers increased from 65 to 85, a rise of 20 points (30.76%), while the score for providers increased from 85 to 93, a rise of 8 points (9.41%). Meanwhile, the SUS score from the customer side increased from 67.5 to 82.8, and from the provider side, it increased from 78.5 to 80.5. From the results of iteration 2 improvements by UI/UX experts and the evaluation results from iteration 3, we can see that the final design ensures the application operates according to design standards, is easy to use, and provides an optimal experience for users. From the final design, the design has been successfully implemented into the code. From the overall results described, the UI/UX design of the PrintOn! application has been successfully created and meets user needs.

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