

# PETDULI: Robust Pet-Shop Marketplace Modeling using Design Thinking Method

Ziyad Muhammad Zain Soti<sup>1</sup>, Kurniawan D. Irianto<sup>2</sup>

## Abstract

This study employs the Design Thinking methodology to construct a prototype for discovering pet shops. In this study, we gathered data through interviews to uncover key pain points; insights from these interviews informed the definition phase. During ideation, low and high-fidelity wireframes and user flows were created to guide the development of a functional prototype. This study obtained a SUS score of 81.17, indicating excellent overall satisfaction. The findings highlight that simplified product search, simplified service search, clear service categorization, and intuitive location-based search significantly enhance overall user experience. This paper concluded with actionable design guidelines for practitioners aiming to improve discoverability and usability in pet shop e-commerce platforms.

## Keywords:

Design Thinking, Marketplace, Pet Shop, SUS Testing

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## 1. Introduction

The rapid growth of the pet care industry in Indonesia has led to the increasing demand for digital platforms that can support pet shop operations. Ibrahim highlights how Instagram data can be utilized to influence consumer buying interest, particularly in Queen Petshop Jakarta. This study shows that social media engagement significantly affects customer behavior, but it does not address the need for robust application systems to manage transactions, services, and customer loyalty in a structured way [1]. Therefore, integrating marketing strategies with application design becomes a crucial step in strengthening a pet shop's competitiveness.

Several researchers have explored e-commerce-based solutions for pet shops. Rachmatullah et al. developed an e-commerce application equipped with the "Petpedia" feature, which not only facilitated product sales but also provided educational content about pets. However, the study identified challenges in user interface (UI) intuitiveness and scalability, which limited the system's ability to provide long-term robust performance [2]. This suggests that while e-commerce features are essential, design thinking approaches are required to create sustainable, user-centered applications.

Ariyanto et al. designed an Android-based pet shop marketplace system, emphasizing mobile accessibility and user convenience. Their research demonstrated that Android platforms increase customer engagement by allowing pet owners to access services directly through their smartphones. However, the lack of structured design methodologies,

**Corresponding Author:** Ziyad Muhammad Zain Soti (ziyad.soti@students.uui.ac.id)

1 Ziyad Muhammad Zain Soti, Universitas Islam Indonesia

2 Kurniawan D. Irianto, Universitas Islam Indonesia

such as design thinking, resulted in gaps in the user experience, particularly in navigation and feature integration [3]. This highlights the necessity of applying human-centered design frameworks to enhance customer satisfaction.

The role of UI/UX in application success is further emphasized in broader studies. Ainurohmah and Irianto investigated UI/UX design for smart home applications tailored for the elderly, concluding that clear navigation and simple interfaces significantly improved usability. Although not directly related to pet shops, these findings underline the importance of accessibility and ease of use in application design, which is equally relevant for pet shop customers of varying demographics [4]. Thus, ensuring intuitive UI/UX is fundamental for pet shop applications.

The design thinking method has gained prominence as a systematic approach to solving user-centric design problems. Kurnianto and Wahyuni applied this methodology in designing a database application for field workers, confirming that iterative stages such as empathy, ideation, and prototyping lead to more practical and adaptive solutions. Their findings suggest that adopting design thinking ensures applications align with user needs and behaviors, making it a suitable approach for robust pet shop application modeling [5].

Specifically, within the pet industry, several studies apply design thinking directly. Nisa et al. designed the Happypals e-commerce pet shop application using this methodology and reported improved user satisfaction and interface quality. However, their research noted limitations in system scalability and robustness, indicating that further refinements are necessary for broader adoption [14]. Similarly, Fauzi demonstrated that design thinking helps uncover customer pain points and translate them into functional features, but his study was limited to UI/UX aspects without addressing backend system resilience [15].

Further evidence comes from Muaziz and Isnaini, who implemented design thinking in creating a pet shop marketplace application. They showed that empathy and ideation stages allowed the capture of unique customer behaviors, such as booking grooming services or accessing pet care information, which traditional approaches often overlook. Garini et al. also applied the same method for a cat care service application, revealing that intuitive UI/UX design enhanced customer engagement and trust in the system [16][17]. These works confirm that design thinking enhances user satisfaction but still leave open questions about system robustness in real-world environments.

Lastly, Bautista et al. applied design thinking in developing PawsCare, a pet care application, and found that iterative prototyping and user testing reduced design flaws significantly. Their study demonstrated that design thinking contributes to higher usability scores and stronger customer adoption rates [18]. Taken together, these studies emphasize that while pet shop applications exist, many still lack robustness in handling scalability, integration, and reliability issues. Therefore, robust application modeling using design thinking becomes essential to bridge this gap and ensure both usability and technical performance in the pet shop industry.

The novelty of this study is that the paper can be a unified mobile marketplace workflow that integrates real-time stock indicators, service booking, personalized product recommendations, and secure e-wallet payments for Indonesian pet owners. The formal application of Design Thinking to a niche e-commerce domain (petshop marketplace), where its use has previously been limited. An empirical evaluation combining usability testing (SUS, N = 30) and benchmarking against *Petshop Indonesia*, providing both user-centered insights and comparative evidence.

## 2. Related Works

A study focused on leveraging Instagram data to increase consumer buying interest at Queen Petshop Jakarta. The research showed that social media presence significantly contributes to consumer engagement, but it remained limited to marketing strategies rather than addressing operational or technical challenges. A gap emerges because robust application modeling, which integrates marketing insights with system functionality, was not considered in the framework [1]. This indicates that future solutions must combine digital marketing with application robustness to ensure sustainability.

Rachmatullah et al. developed an e-commerce pet shop application with the addition of "Petpedia," an educational feature that introduces pet-related knowledge. While the application enhanced user engagement by providing learning content alongside commerce, the study pointed out weaknesses in scalability and long-term system stability. This reveals that the absence of a structured design framework, such as design thinking, can limit application adaptability and overall robustness [2]. Thus, further development requires integrating user-centric methodologies with technical modeling.

Ariyanto et al. advanced this area by creating an Android-based pet shop marketplace system, making services more accessible through mobile platforms. Their work demonstrated increased user participation through mobility but struggled with UI/UX coherence and system integration issues. The lack of a systematic design methodology constrained the usability and robustness of the system. These findings highlight that adopting design thinking can provide structured user feedback loops, improving both application usability and resilience [3].

Beyond the pet shop context, UI/UX-focused studies provide insights into the importance of user experience. Ainurohmah and Irianto designed a smart home control system for elderly users, showing that simple navigation and clear visual elements improved usability. Although unrelated to pet shops, this research emphasizes the critical role of inclusive design principles. Pet shop applications must also address diverse customer segments, ensuring interfaces are accessible to users with varying levels of digital literacy [4]. This demonstrates the universal value of applying design thinking for improved user experience.

Kurnianto and Wahyuni applied the design thinking method in developing a database application for social enterprises. Their study found that iterative prototyping and empathy stages ensured the system addressed real user needs effectively. However, the study focused more on data management than commercial transactions or service features. Nevertheless, their findings validate design thinking as a structured methodology for aligning system development with user needs, reinforcing its relevance to pet shop application modeling [5].

Studies directly applying design thinking to pet-related applications provide stronger evidence. Nisa et al. designed the Happypals pet shop e-commerce application using design thinking and reported high levels of user satisfaction and interface clarity. However, their study did not fully address robustness aspects such as handling high transaction volumes or ensuring reliable system performance. Fauzi's study on pet shop UI/UX design confirmed that design thinking improves feature relevance but primarily focused on front-end design rather than back-end resilience [14][15]. Together, these works illustrate partial advancements but leave gaps in system robustness.

Muaziz and Isnaini created a pet shop marketplace application with design thinking, showing how empathy stages captured unique customer needs, like booking grooming services. Garini et al. developed a cat care application using the same method, which improved user trust and usability. These findings highlight the adaptability of design thinking across various pet service domains. However, both studies lacked emphasis on robustness in scaling operations or integrating multiple features seamlessly, which are essential for long-term reliability [16][17].

Bautista et al. presented PawsCare, a pet care application designed with design thinking, emphasizing iterative prototyping and user validation. Their results demonstrated reduced design flaws and higher usability scores compared to traditional design methods. However, the study was narrowly focused on user experience, without exploring system performance under stress conditions or integration with broader pet shop operations. This gap reinforces the need for robust pet shop application modeling that not only prioritizes usability but also ensures stability, scalability, and performance reliability [18].

A mobile marketplace called PawsCare was developed as a dog-focused app embedding health-education modules at every Design Thinking stage. The findings indicated that integrating user research and educational content effectively supports dog-owner needs [18]. Yet, PawsCare lacked real-time stock indicators and multi-service bookings. Petduli addresses these gaps by uniting product purchases, service reservations, educational content, and care-history logs in one cohesive, transaction-ready application.

### 3. Proposed Method

This research is conducted through a series of stages that aim to achieve the main objective of integrating the Design Thinking methodology that has been proven effective in solving user problems. The research process is divided into five stages, namely Empathize, Define, Ideate, Prototype, and Test. It is a concise mathematical formulation for the Robust Pet Shop Application Modeling using Design Thinking:

Core Objective Function:

$$J(\theta) = \alpha U(P(\theta)) + \beta R(P(\theta)) - \gamma \hat{C}(P(\theta)) \quad (1)$$

Components

- Usability Index

$$U(P) = \sum_{j=1}^J w_j^u \hat{u}_j(P) \quad (2)$$

- Robustness Index

$$R(P) = \sum_{k=1}^K w_k^r \hat{r}_k(P) \quad (3)$$

The objective function  $J(\theta)$  represents the overall performance score of the Pet Shop application design, where  $\theta$  is the set of design parameters derived from the Design Thinking method (e.g., UI layout, feature set, navigation structure). The function balances three main aspects: usability, robustness, and cost/complexity. The coefficients  $\alpha$ ,  $\beta$ , and  $\gamma$  are weighting factors that prioritize each component according to project goals. The usability index  $U(P)$  is calculated as a weighted sum of normalized usability metrics  $\hat{u}_j(P)$ , such as task completion time, error rate, and user satisfaction, with weights  $w_j^u$  reflecting their importance. Similarly, the robustness index  $R(P)$  evaluates the application's resilience and adaptability, including error tolerance, cross-device compatibility, and scalability. It is also represented as a weighted sum of normalized robustness metrics  $\hat{r}_k(P)$  with weights  $w_k^r$ .

Finally, the cost/complexity term  $\hat{C}(P(\theta))$  models the trade-off of implementation effort, development resources, and system overhead. By subtracting this value, the model

ensures that high performance is achieved without excessive resource consumption. Overall, this mathematical formulation formalizes the Design Thinking outcome into an optimization model, where the best application design maximizes usability and robustness while minimizing cost and complexity.

## 4. Experimental Setup

In this study, we conduct several steps, including:

1) Empathize

Empathize is the first stage carried out in the design thinking method, which involves conducting observations and interviews to collect in-depth information with the aim of finding problems to be solved. Observations and interviews were conducted with pet owners who had bought pet products online. At this stage, the needs that exist in the Pet shop application created are obtained, such as the desired features. The following is the interview questionnaire.

**Table 1.** Interview Questionnaire

No	Question
1	Have you ever bought pet supplies online?
2	Do you prefer to shop for pet food ingredients in a physical store or online? Why?
3	What are your reasons for using marketplace apps to buy animal supplies?
4	Which type of pet food products do you buy most often over the internet?
5	What is the feature you want most from a pet shop marketplace app?
6	Do you want your pet marketplace app to have a more efficient search system?
7	What are the common problems you encounter in your online pet shopping experience?
8	Would you expect to see user reviews or testimonials for animal needs in a marketplace app?

After conducting observations and interviews, the results were obtained in the form of data from various sources, then collected and mapped, which is called an empathy map. Mapping is done with the aim of finding the best of the best solutions. Fig.1 depicts the data obtained includes user needs, preferences, actions, and feelings.



Fig. 1. Five stages of design thinking

2) Define

After empathizing, we collected and processed all interview data to synthesize clear problem statements and user requirements. This information was summarized into user personas, distinct profiles representing key audience segments to clarify users' needs, motivations, and expectations. From these personas, we identified core problems and formulated "How Might We" questions, transforming user pain points into opportunities for solution ideation

Table 2. Interview Questionnaire

How Might We	Solution
Make users have an easy and comfortable experience in online shopping for their pet needs?	The application will be designed with an intuitive UI followed by clear navigation, where all information will be neatly organized in 1 view.
Helping users to find what they are looking for effectively and efficiently?	Help users find what they are looking for effectively and efficiently?
Increase user trust in Petshops in the app?	Features customer reviews of the store, the products sold, and the services provided.
Ensure that the stock of a product in the application is always updated in real time?	The application will be integrated with the storage system in the official store or petshop, so that the stock that appears on the application page will continue to be updated in real-time. In addition, the application will present a reminder feature if the product is restocked.
Ensure the user receives the purchased product safely without any damage to the product?	By default, packaging will conform to the packaging standards of the petshop partner and delivery will conform to the delivery standards of the delivery service partner. However, users can use additional

	protection options for extra protection of the product. When the product reaches the user, the user can rate the quality of the packaging and courier for the partner's evaluation.
Make an app that sells complete products and services?	The app provides product purchases and service bookings subject to the availability of authorized stores or pet shops, so it will be an all-in-one app where users can purchase products and services such as grooming and more.

### 3) Ideation

The Ideate phase aims to explore creative solutions to the problems identified during Define. We began by generating diverse ideas, concepts, and options through brainstorming sessions. After collecting problem statements, the team created a sitemap to map the application's structural overview and feature organization. After creating a user flow, the next step is to create a wireframe, which is a two-dimensional visual representation.

### 4) Prototype

In the Prototype phase, concept ideas and two-dimensional wireframes are transformed into a high-functioning interactive model to realistically simulate the user experience and assess the effectiveness of interface elements such as buttons, forms, page structure, and navigation. This phase also encompasses visual design considerations-color selection, typography, and illustrations-while scenarios are recorded and compiled to capture user feedback for subsequent iterations.

### 5) Testing

This stage is the last in design thinking. At this stage, the results of the final design of the application that has passed some feedback at the prototype stage will be tested on selected participants to assess how useful the Petduli application is. The research subjects consisted of 30 respondents. Respondents were recruited through convenience sampling, obtained via personal contact, with inclusion criteria: having purchased animal needs online and being willing to fill out the System Usability Scale (SUS) questionnaire. The materials and platforms used included an interactive prototype developed in Figma and a visual sitemap in Canva, as well as data collection instruments in the form of a structured interview questionnaire and SUS questionnaire (10 statements, Likert scale 1-5).

**Table 3.** SUS Statement

No	Statements
1	I think I will use this app again
2	I find this app too complicated for me to use
3	I find this app easy to use
4	I need help from others to use this app
5	I feel that the features in this application work well
6	I feel like there are a lot of inconsistencies in this app
7	I feel others will quickly understand how to use this app
8	I find this app confusing
9	I feel no obstacles in using this application
10	I need to learn many things before using this app

This study involved a structured usability evaluation using an online setup. The participants consisted of 30 individuals recruited through purposive sampling based on flexible inclusion criteria. Participants qualified if they fulfilled at least one of the following: owning a pet, having experience shopping online (regardless of product type), or having previously purchased pet-related products online. No restriction was applied regarding the timeframe of these activities.

## 5. Results and Analysis

The usability testing of the developed prototype was conducted using the System Usability Scale (SUS) questionnaire, which was completed by 30 participants. This evaluation provides a quantitative assessment of the prototype’s usability and interface quality, reflecting user perceptions through standardized measurement. The SUS instrument consists of ten statements, each rated on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). This structured approach ensures consistency in evaluating usability while capturing the subjective experiences of participants objectively.

The calculation of the SUS score follows three standardized rules to derive reliable results. For items with odd numbers, the participant’s score is reduced by one, while for even-numbered items, the score is calculated by subtracting the participant’s rating from five. Subsequently, the scores for all items are summed and multiplied by a constant factor of 2.5 to normalize the values to a scale ranging from 0 to 100.

Table 4. Result of the calculation

Respondent	Calculation Scores										Score (Total)	Final Score (Total x 2,5)
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10		
R1	5	1	5	1	5	1	5	1	5	1	40	100
R2	4	1	5	1	5	1	4	2	4	1	36	90
R3	5	2	5	2	4	2	4	2	4	2	32	80
R4	5	2	5	2	5	2	4	2	4	2	33	82,5
R5	4	3	4	1	5	2	3	2	4	3	29	72,5
R6	5	2	5	1	5	2	4	2	4	2	34	85
R7	4	1	5	2	5	1	5	1	5	4	35	87,5
R8	5	2	5	2	5	2	5	2	5	2	35	87,5
R9	4	1	5	1	4	2	4	1	5	1	36	90
R10	5	2	1	2	1	1	1	1	1	2	21	52,5
R11	5	1	5	3	5	1	4	2	5	3	34	85
R12	4	3	3	2	5	2	4	2	4	3	28	70
R13	4	1	4	1	4	2	5	2	4	2	33	82,5
R14	4	2	4	2	4	2	4	2	4	3	29	72,5
R15	4	1	5	2	4	2	5	1	4	2	34	85
R16	5	2	5	2	5	1	5	1	5	2	37	92,5
R17	5	1	5	2	5	1	5	1	5	3	37	92,5
R18	5	2	5	1	5	4	5	2	5	3	33	82,5
R19	4	2	4	2	4	2	4	2	4	2	30	75
R20	5	1	5	2	5	2	5	2	5	3	35	87,5
R21	5	2	5	2	4	2	5	2	5	2	34	85
R22	5	1	5	2	5	1	5	1	5	2	38	95
R23	4	2	4	3	3	2	3	2	4	3	26	65
R24	4	1	4	3	4	2	5	2	4	4	29	72,5
R25	4	4	3	4	5	4	5	4	5	4	22	55
R26	4	3	4	2	4	3	4	3	4	4	25	62,5
R27	4	1	5	1	5	2	5	1	4	3	35	87,5
R28	4	1	4	1	4	2	5	1	5	2	35	87,5

R29	4	2	4	1	3	1	5	2	3	3	30	75
R30	5	1	5	1	5	1	5	1	5	2	39	97,5
<b>Total Score</b>												<b>81,17</b>

Based on the results of calculations using the System Usability Scale (SUS), it can be concluded that the results of the UI/UX design of the Petduli application get a final score of 81.17. The last step is to interpret the final score of sus into the sus interpretation scale as shown in Fig. 2

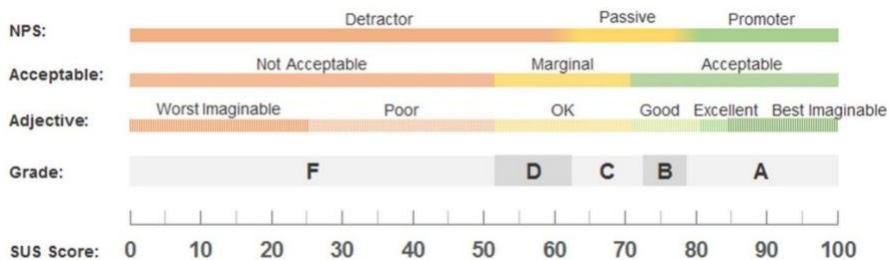


Fig. 2 SUS Score Result Interpretation Scale

The results of the ui/ux design of the Petduli application get a final score of 81.17. By interpreting the final score value into the SUS interpretation scale as in Figure 10, it can be said that the Petduli application is categorized as good through the nature approach, getting an A rating through the rating approach, classified as "Acceptable" through the acceptance level approach, and entering the "Promoter" group through the NPS approach. This result indicates that the Petduli application has succeeded in making respondents feel comfortable when using it.

## 6. Conclusion

This study applies the Design Thinking approach to the development of a Petshop Marketplace prototype that integrates product purchases with service bookings. The prototype is designed to meet the specific needs of pet owners by consolidating pet-related transactions into a single platform. Usability testing, conducted using the System Usability Scale (SUS), yields an average score of 81.17, which falls into the "Good" category. This result demonstrates that the system provides a user-friendly interface that allows participants to complete tasks efficiently with minimal friction, confirming the effectiveness of the applied design framework in producing accessible and functional digital solutions.

The findings highlight that the proposed method successfully aligns user-centered needs with technical functionality, supporting the creation of a robust and practical digital tool for pet care services. By integrating purchasing and booking features, the prototype addresses current fragmentation in digital pet services while offering a streamlined user experience. The research outcomes validate the study objectives and illustrate the potential of the prototype to evolve into a comprehensive platform that enhances convenience, reliability, and efficiency in pet-related transactions.

Future work should focus on expanding the platform's scope to accommodate a wider range of pet types and needs, including functionalities such as stray animal adoption, veterinary consultation integration, and community discussion forums. Further usability testing with larger and more diverse participant groups will strengthen design validation and ensure inclusivity across varied user demographics. In addition, iterative refinements informed by emerging technology trends, such as artificial intelligence and mobile-first enhancements, are recommended to maintain the system's usability and ensure its long-term relevance in the rapidly evolving digital ecosystem.

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