



# Designing an AI-Based Application Prototype for Finding Items Location in Supermarket Using Design Thinking Method and Human-Centered Design Approach

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**Abstract.** his research aims to design a prototype application for enhancing shopping experience at supermarket using the integration of Design Thinking method, Human Centered Design approach and AI features. Through customer observations, primary difficulties were identified, such as the challenge of memorizing the location of items, difficulty in knowing the stock and available items, promotional products, direction to desired products. Design Thinking method has holistic approach that consists of 5 steps: empathize, define, ideate, prototype and testing, while Human-Centered Design places users as the primary focus. The presence of artificial intelligence (AI) technology is expected to provide additional convenience, including personalized item searches, notifications of special offers, and recommendations based on shopping experience. After prototyping, testing step was conducted using usability testing, the application has already fulfilled the customer needs, with high score of usability score in learnability, efficiency, memorability, accuracy and satisfaction. The digital application is expected to fulfil customer needs, provide a better shopping experience, and overcome obstacles in finding items at supermarket.

**Keywords:** Design thinking, Human Centered Design, Supermarket, Artificial Intelligence.

## 1 INTRODUCTION

Supermarket has wide range of products, from fresh items such as fruits and vegetables, to various household necessities like snacks, raw meat, staple foods, and beverages. The large variety of goods and categories requires different placements in specific locations. This often becomes an obstacle for customers who struggle to find the desired products due to the wide selection and the lack of clear signage. Based on direct observations and interviews with customers, it was found that the existing signs, such as category boards, are too small in each aisle and do not provide clear and specific directions for finding items. This often results in customer dissatisfaction and potential losses for the supermarket.

Some supermarkets face a major issue related to the ineffectiveness of item location signage, which leads to customer dissatisfaction while shopping at the supermarket. To

address this problem, a smart application is proposed, leveraging AI capabilities to determine item locations and provide efficient navigation. Artificial Intelligence (AI) is used to imitate the intelligence possessed by living creatures and inanimate objects to carry out commands. AI is a framework or system in an application designed to provide convenience and help solve problems[17].

The design of the application's user interface and user experience (UI/UX) is crucial in enhancing its appeal and usability. This application is expected to think intelligently, offering optimal routes based on user behavior, whether the customer wishes to make quick purchases or enjoy exploring additional products. This study will use the design thinking method, involving customer interviews to gather structured and targeted data. Design thinking (DT) is a human-centered approach to creating innovation that integrates technology, human needs, and business requirements[7]. The UI/UX design, considering a Human-Centered Design (HCD) approach, is essential to ensure user satisfaction and application usability.

The main goal of this research is to design an AI based prototype application aimed at assisting customers in finding items in supermarket. Additionally, this study aims to evaluate the results of the AI-based prototype application in locating items in the supermarket. This evaluation is intended to ensure the effectiveness and quality of the user experience while using the application. Furthermore, this research will design the user interface and user experience of the application with various features tailored to the needs of supermarket customers. Thus, the results of this research are expected to contribute positively to improving the ease of finding items, customer satisfaction, and the effectiveness of using AI-based applications in supermarket's environment.

Considering that this application may not be commonly used by all demographics, an emphasis on user-friendly design is crucial to enhance its accessibility. The primary benefit of this design lies not only in its ease of use but also in the level of customer satisfaction during the shopping process at supermarket. With increased customer satisfaction, it is hoped to contribute positively to the quality of service provided by the supermarket. In addition to practical benefits for customers and the supermarket, this research also brings positive impacts to the academic community. The findings of this research can serve as a foundation for further development, including the creation of more advanced application systems. Moreover, this research can serve as a valuable reference for future studies focusing on application design development. This research has a holistic impact, covering aspects of practicality, customer satisfaction, and contributions to the development of knowledge in the field of application design.

## 2 METHODOLOGY

This research was conducted through in-depth observation of real conditions in the field, by directly interacting through In-Depth Interviews to apply the empathize process within the design thinking framework. This observation provides a solid foundation for understanding the challenges and needs faced by customers. After the observation, the next step is to define the problem based on the findings, identifying the actual issues faced by customers and exploring their desires for products or services. This process serves as a strong basis for the next step, which is ideation. During the ideate phase, persona analysis and in-depth interview results serve as creative guides

for designing innovative solutions. After obtaining potential ideas, the next step is to create a prototype, a visual representation of the answers to the identified problems. This process allows for testing and validating the solution concept before full implementation. The final stage is testing and validation, involving active customer participation to try out and provide feedback on the proposed solution, ensuring the solution truly meets customer needs and expectations. Thus, this research combines field observation methods, design thinking, and active customer participation to produce solutions that are relevant and oriented toward user needs.

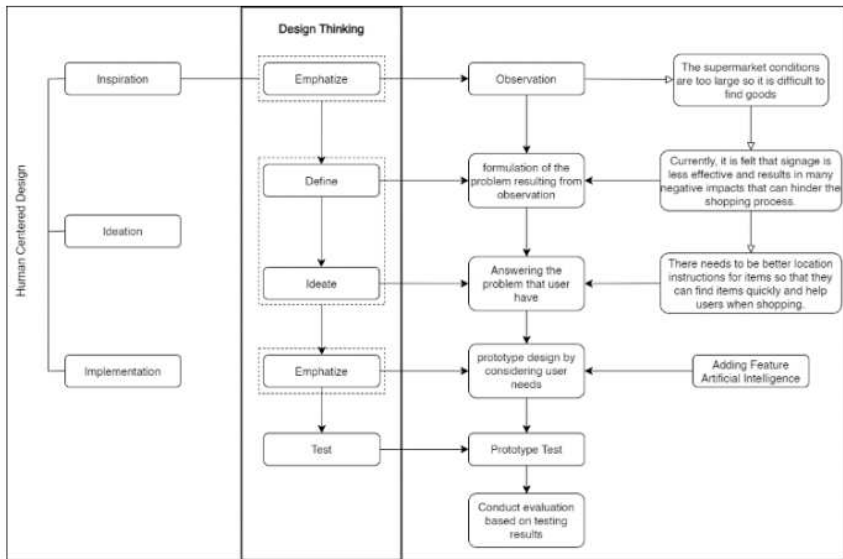
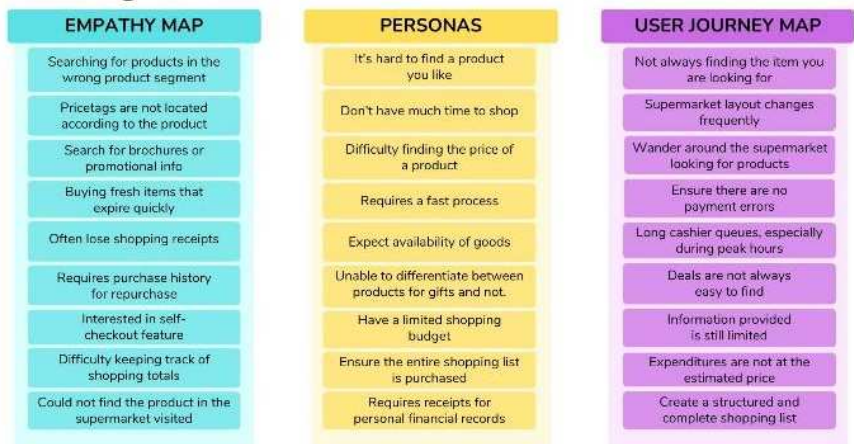


Fig. 1. Research Framework

### 3 RESULT

#### 3.1 Empathize and Define Step

The figure 2 illustrates the recapitulation of the result from empathy map, persona and user journey from **step Empathize** as the first step of Design Thinking method.



**Fig. 2.** Result from Empathize Step

The results from the **empathy map, persona, and user journey maps** have helped in identifying major user needs:

- Knowing the stock and available items for purchase.
- Ease in searching for and finding desired items.
- Complete information about promotional items, recommended products, and new items.
- Clear directions to the desired item's location.
- Ease in quickly seeking assistance.
- An effective and efficient payment system.

Based on these identified user needs, the development of an application that can provide features to meet all user needs can be implemented. Several factors influencing their choice of shopping destination include quality, availability, comfort, and proximity to home. Their shopping purpose also mainly revolves around fulfilling daily needs and as an alternative form of entertainment. The frequency of their visits to the supermarket varies, with some regular customers shopping every week, while others shop at least once a month. The following is a summary of the problem experienced by customers regarding the digital application as **Define Step**.

**Table 1.** Customers' Problem

Customer needs	Freq	%	%
Ease in searching for and finding desired items	12	44,44	100
Clear directions to the desired item's location	4	14,81	33,33
Ease in quickly seeking assistance	2	7,41	16,67
Complete information about promotional items, recommended products, and new items	4	14,81	33,33
Knowing the stock and available items for purchase	3	11,11	25,0
An effective and efficient payment system	2	7,41	16,67

### 3.2 Design Process (Ideate Step)

In Ideate step, a House of Quality was developed to determine the solution of the customer problem or need (Fig. 3). In response to the user needs, a prototype application will be created that caters to those needs. The use of this application requires a user flow to establish and visualize the flow users will follow when using the app. A user flow diagram will be used to represent the user's journey while using the application. Generally, the user's flow starts with opening the application on their device and registering if they don't already have an account. The flow of using the application can be shown in figure 4-6.

Row No	Main Problem to solve	Relative weight						
			Location feature	Stock feature	Help feature	Review feature	Check price feature	Fast payment feature
1	0.444	Ease in searching for and finding desired	3	3	3	0	0	0
2	0.148	Clear directions to the desired item's location	3	3	3	0	0	0
3	0.074	Ease in quickly seeking assistance	3	0	3	0	3	0
4	0.148	Complete information about promotional items, recommended products, new items	0	0	0	3	0	1
5	0.111	Knowing the stock and available items for purchase	0	3	1	0	0	0
6	0.074	An effective and efficient payment system	0	0	0	0	5	3
1,000		Max. value in column	3	3	3	3	5	3
14,519		Sum product	5,556	2,778	3,444	1,333	0,593	0,815
1,000		Relative weight	0.383	0.191	0.237	0.092	0.041	0.056
		Rank	1	3	2	4	5	6

Fig. 3. House of Quality (Need-Metric)

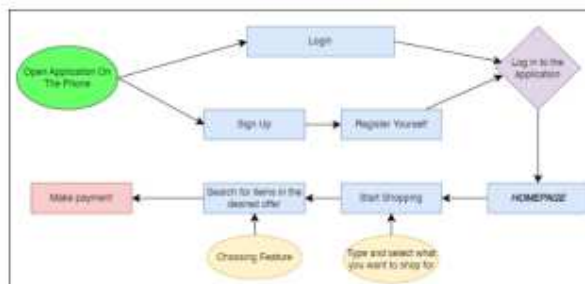
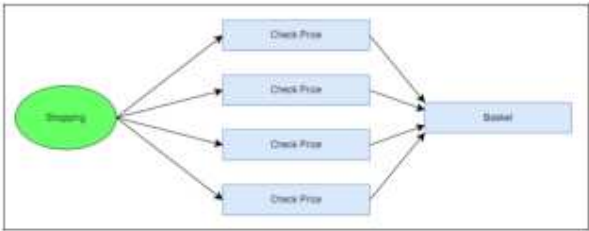


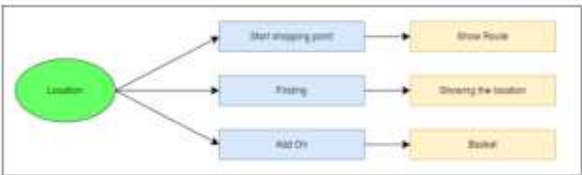
Fig. 4. User Flow of the Application

For the user flow of shopping will direct the user to do the shopping process with various choices and features where all of these things will lead and affect the basket owned by the user. The user flow image is as follows.



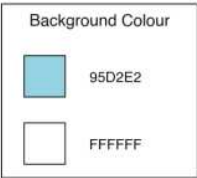
**Fig. 5.** User Flow of Shopping Feature

User flow for location: the flow of using this app feature is to guide the user to find the desired item's location and proceed to purchase it.



**Fig. 6.** Caption of the Figure 1. Below the figure.

In addition to determining the user flow, color selection is also chosen to address the user's comfort needs while using the application. This color selection can influence the user's emotions during their interaction with the app. There are three color groups used in the Happy Shop app, which are background colors, primary colors, and secondary colors. The following are the background colors used.

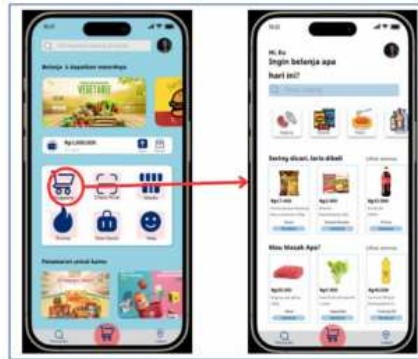


**Fig. 7.** Background colors

Light blue and white were chosen as the background colors to make the app's appearance more attractive compared to using just white alone. Next, primary colors are used, which will appear frequently and be visible; hence, choosing too many colors could make the interface look cluttered and unorganized. Lastly, secondary colors are those that rarely appear in the app's interface but still play an important role. To enhance the user experience in using this application, the placement of buttons and each section within the app must prioritize the comfort of the users by considering Human Centered Design.

### 3.3 Prototype

The application is named "Happy Shop," with the aim and purpose of assisting the shopping process and making the shopping experience more enjoyable. Below is the result of the Happy Shop app prototype, which can be viewed through the following link: <https://tinyurl.com/PrototypeHappyShop>. The prototype was created using the Figma application. This prototype is expected to provide a clear representation and help determine whether the app is truly ready and able to meet users' needs. Below is an overview of the app's prototype.



**Fig. 8.** Overview of Application Prototype

In addition, there is a location feature, which provides the best route for users based on their current location. This recommended route is assisted by a machine learning process, allowing the application to learn users' habits and recommend the best route for them.



**Fig. 9.** Feature Location with AI-Based

To support the operation of the Happy Shop application, improvements and additional facilities and supporting system installations are needed within the app. The improvements that supermarket needs to implement include enhancing signage, price tags, layout, trolleys, and the installation of RFID systems as well as other supporting systems for the application's functionality.

3.4 Validation & Testing

After the prototype was created, validation and usability testing were conducted with a total of five respondents. This validation test was carried out to determine whether users' needs were met through the provided features. Below is a summary of the task validation results, where users were able to perform the given tasks.

Table 2. Task Validation Result

Number	Test Case	R1	R2	R3	R4	R5	Score
1.	View Category List	✓	✓	✓	✓	✓	100%
2.	Search for items to buy	✓	✓	✓	✓	✓	100%
3.	View available promotions	✓	✓	✓	✓	✓	100%
4.	Scan price	✓	-	✓	✓	✓	80%
5.	Search for items	✓	✓	✓	✓	✓	100%
6.	View items in the cart	✓	✓	✓	✓	✓	100%
7.	Seek staff assistance	✓	-	✓	✓	✓	80%
8.	Find shopping route	✓	✓	✓	✓	-	80%
Total Result							92.5%

In addition to testing the respondents' ability to use the available features, an assessment of the effectiveness of this application was also conducted to determine whether it meets users' needs. The results are as follows.

Table 3. Effectiveness of the Application in Meeting Needs

Number	Need	Validity Status				
		R1	R2	R3	R4	R5
1.	Provide promotional information	✓	✓	✓	✓	✓
2.	Provide information on new items	✓	✓	✓	✓	✓
3.	Call for assistance	✓	✓	✓	✓	✓
4.	Search for item locations	✓	✓	✓	✓	✓
5.	Provide items recommendations	✓	✓	✓	✓	✓
6.	Make self payments	✓	✓	X	✓	✓

Based on the validation results of the available features, it can be seen that almost all features are valid and meet user needs. However, there is one aspect that is not valid, which is the self-payment feature, as reported by respondent 3, who felt that the self-payment feature was not sufficiently implemented, leading to their perception of it as invalid. The testing was conducted using five aspects of usability testing: learnability, efficiency, satisfaction, errors, and memorability. The results of the testing based on these five aspects are summarized in the following tables.



**Table 4.** Usability Testing Result

Indicator	Question	Answer (%)					Score
		R1	R2	R3	R4	R5	
Learn ability	The Happy Shop application can be learned easily	100	80	100	100	90	
	Easily able to understand and comprehend the flow of the application	100	90	90	100	90	
	It is easy to know and remember the features of Happy Shop	100	100	90	100	100	
Memorability	Easy to remember how to use the Happy Shop application	90	90	Valid	100	100	
Efficiency	Able to quickly find the information being searched for	100	80	90	100	100	
	The provided features are effective and easy to use	100	100	100	100	100	
	Can find the desired features and menus	100	80	100	90	90	
Errors	No errors occurred in the existing features	100	100	100	80	100	
	Successfully completed all given tasks	100	80	100	100	90	
	The titles and features are aligned with their intended purposes	100	100	100	100	100	97%

User satisfaction levels are also an important aspect of this testing process. The results of user satisfaction levels are as follows.

Table 5. User Satisfaction Levels

Number	Criteria	Point					Result
		R1	R2	R3	R4	R5	
1.	Satisfied with the application's appearance	5	5	5	5	5	5
2.	The application is easy to use	5	5	4	5	5	4.8
3.	Comfortable using this application	4	5	4	5	5	4.6
4.	Satisfied with the features of this application	5	5	5	5	5	5
5.	This application is informative	4	5	5	4	4	4.4
6.	Whenever I make a mistake or press the wrong button, I can quickly return	4	5	5	4	5	4.4
7.	Easy to find the information I need	4	5	4	5	5	4.6
8.	The grouping of features into categories is clear	5	5	5	5	5	5
9.	Completed tasks and scenarios in this application	5	4	5	5	5	4.8
10.	Overall satisfied with the application	5	5	5	4	5	4.8
.		4.5	4.9	4.7	4.7	4.9	4.74

In addition, qualitative usability testing has also been conducted and figure 10 reveals the result.

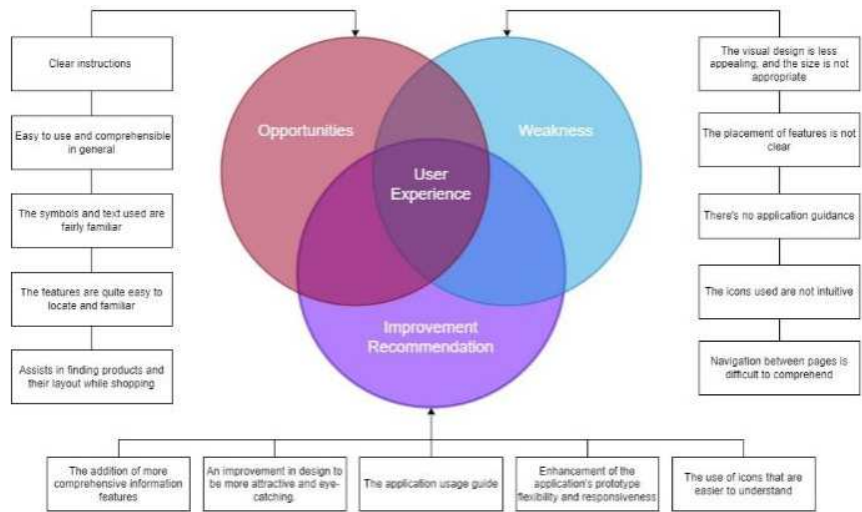


Fig. 10. Result of Qualitative Usability Testing

The score of Happy Shop was also compared to that of competitor applications, with Happy Shop achieving a score of 68.5% and competitors scoring 50%. Overall, it is evident that Happy Shop outperforms its competitors significantly. Happy Shop has a much higher rating, particularly for its homepage and user interface features. However, there is still room for improvement in many features, which can be learned from competitor applications. It's important to note that Happy Shop focuses on offline shopping features, while competitors primarily offer online shopping. Additionally, validation of the Happy Shop application was conducted in other supermarkets through interviews with the owners, resulting in feedback that this application is indeed needed and can be implemented in other supermarkets.

## 4 DISCUSSION

This research aims to design a prototype of the Happy Shop application with a focus on user interface (UI) and user experience (UX), using the Design Thinking method and a Human-Centered Design approach. This application is expected to facilitate supermarket customers in locating items and enhancing their shopping experience. Through observations of customers, key difficulties were identified, such as the challenges of memorizing item locations and shortcomings in facilities or service quality. Design Thinking and Human-Centered Design were employed to deeply understand customer needs, with customer observation serving as the primary foundation for the design process. By integrating design methods and AI technology, it is hoped that Happy Shop will become an optimal solution for improving the shopping experience. The prototype application underwent feature validity testing and usability testing, yielding positive results, including high scores in learnability (94%), memorability (95%), efficiency (97%), errors (94%), and accuracy (97%). With high scores in usability testing, customer satisfaction, and feature validation, it is anticipated that this application will meet customer needs, provide a better shopping experience, and address obstacles at supermarket. Furthermore, the feature validation test on the Happy Shop application resulted in a score of 92.5%, with average user satisfaction above 4.5. In comparison with competitor applications, Happy Shop achieved a score of 68.5%, indicating superior performance. Validation tests with other supermarket owners also supported the application's potential for implementation. This research demonstrates that Happy Shop can meet user needs and enhance the shopping experience, successfully achieving high customer satisfaction through the implementation of Design Thinking and Human-Centered Design methods.

## 5 CONCLUSION

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