User Experience of the "EcoHarvest" Organic Waste Management Application Based on Gamification Using the Design Thinking Method

Karunia Suci Lestari[*1], Yusuf Nur Putra Pranata [2], Rangga Darmawan [3], Suhendi [4]
[1,2,3] Information Technology Study Program, [4] Information System Study Program
Faculty of Science and Technology, Universitas Raharja, Indonesia
E-mail: [*1] **suci@raharja.info**, [2] yusuf.nur@raharja.info,
[3] rangga.darmawan@raharja.info, [4] suhendi.hendi@raharja.info

Abstract

Household organic waste management remains a major challenge in urban areas due to the lack of integrated collection services and low public motivation. This study aims to design the user interface of the "EcoHarvest" application, which serves as an organic waste drop-off platform connecting users with waste management partners. Employing the Design Thinking methodology, the study translates user requirements into a functional interface featuring waste-weight tracking, drop-off location mapping, and a reward-based points system integrated with UTAUT and gamification principles. Usability testing conducted using the System Usability Scale (SUS) with 50 respondents yielded an average score of 69.2 (Grade B). This result indicates an acceptable level of usability for the application prototype. These findings represent a preliminary evaluation of a UI/UX prototype, highlighting its potential to streamline household waste management prior to full system implementation.

Keywords — *UI/UX Design, Organic Waste, Design Thinking, Gamification, Eco-friendly App*

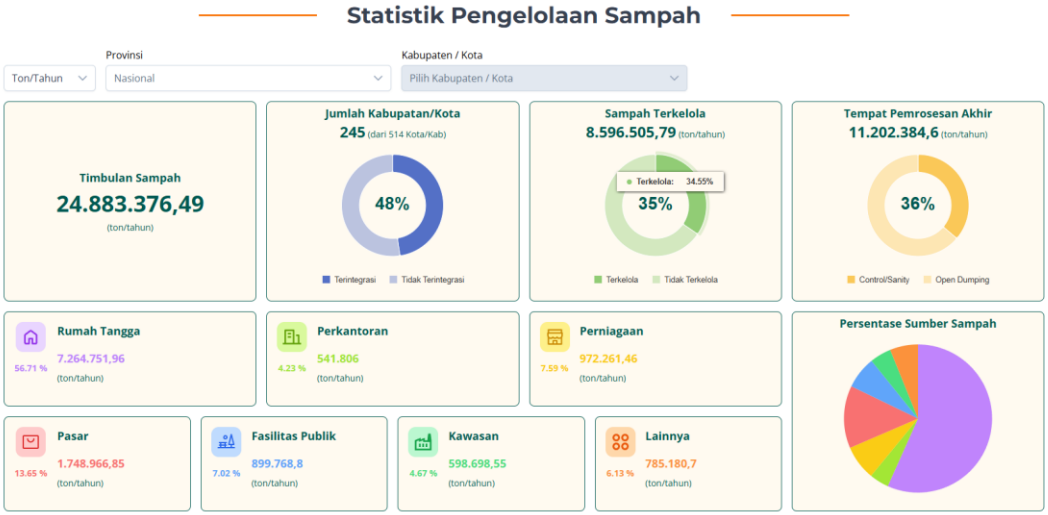
1. INTRODUCTION

Household organic waste management remains a major problem in urban areas because it contributes significantly to the total volume of waste generated. Referring to the National Waste Management Information System (SIPSN) of the Ministry of Environment, 2024 data (based on input from 348 regencies/cities) shows that total waste generation reaches approximately 39 million tons per year. In terms of waste type, food waste is the largest component, accounting for around 39% in 2024 [1]. Within this total, food waste composition remains the dominant category with percentages ranging from 39% to 41% during 2022–2024 [2]. These high figures indicate that organic waste is a crucial issue that requires immediate handling at the source level.

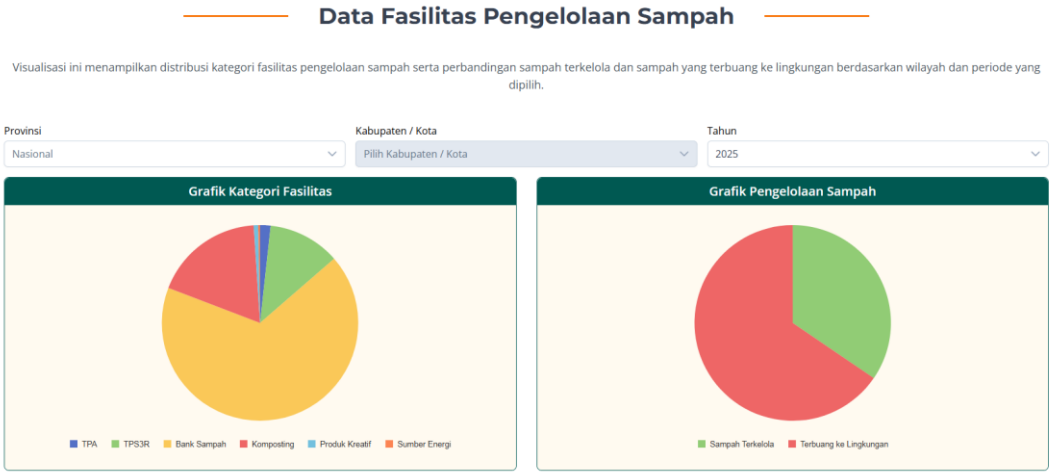


Source: https://dataindonesia.id/ (Accessed February 24, 2026)
Figure 1. Static Data on the Composition of Waste Generation in Indonesia in 2022

As illustrated in Figure 1, food waste occupies the highest proportion at 41.69%, far exceeding other waste types such as plastic (18.22%) and wood/branches (13.37%). The high amount of organic waste creates serious environmental impacts. The decomposition of unmanaged organic waste produces leachate that contaminates groundwater, causes unpleasant odors, and releases methane gas (CH4) which accelerates global warming [3].



Source : https://portal-sipsn.kemenlh.go.id/ (Accessed February 24, 2026)
Figure 2. Waste Management Statistical Data



Source : https://portal-sipsn.kemenlh.go.id/ (Accessed February 24, 2026)
Figure 3. Waste Management Facility Data

Based on Figures 2 and 3 obtained from the National Waste Management System (SPSN) managed by the Ministry of Environment, the latest data as of April 2025 shows increasingly concerning conditions. Out of 33.621 million tons of annual waste, approximately 39.91% or 13.417 million tons remain unmanaged. This large amount indicates systemic obstacles where providing physical solutions alone is insufficient without behavioral changes from the community.

However, deficiencies in service infrastructure have resulted in organic waste separation not being implemented effectively. Many households are willing to sort their waste, but they are often uncertain about where to dispose of organic waste, facilities are not always located nearby, and collection or drop-off schedules are unclear and not coordinated within a single service system. This situation complicates the drop-off process and reduces the sustainability of source-level waste management.This condition shows that providing physical solutions alone, such as waste bins or collection infrastructure, is not sufficient without changes in community behavior. This is where digital

technology and motivational elements (gamification) become crucial in bridging this gap. Persuasive technology is a type of interactive digital tool meant to change how people think or act.It is part of the study of Human-Computer Interaction (HCI). This kind of technology can subtly influence users, often without them realizing it. It has the potential to make a big difference in how digital work environments are designed [5]. Research by Venturi et al. [6] states that the integration of gamification in digital platforms is effective in encouraging informed recycling behavior through positive reinforcement and social influence mechanisms. Another study by Yulianti et al. [7] through the "Rubbish Go" platform demonstrated that integrating community-based reporting features and digital incentive systems can strengthen public participation in the waste management ecosystem in Indonesia. Therefore, EcoHarvest adopts a similar approach [6] to ensure sustainable user participation. However, most existing solutions still have gaps in integrating service location transparency with sustainable motivationally systems. In addition to service access issues , another important challenge is user motivation. Sorting and disposing of organic waste is often perceived as an additional burden because it adds extra steps to daily routines without providing immediate, tangible benefits. Therefore, a gamification approach using a points-and-rewards system can be applied to increase user engagement and encourage consistent behavior in developing more environmentally friendly habits. According to UTAUT, how people act is directly based on their intention to act. This intention is influenced by how well they expect to perform a task. The expectation of good performance, in turn, is shaped by how easy the task is, the influence of others, and the support available [8].

To address these limitations, EcoHarvest introduces a novel approach by uniquely coupling localized drop-off facility mapping with a dual-incentive structure specifically tailored for domestic organic food waste. Unlike general waste-reporting platforms such as 'Rubbish Go' [7], EcoHarvest directly embeds the Unified Theory of Acceptance and Use of Technology (UTAUT) and Gamification Framework into its core architecture. Specifically, Performance Expectancy is addressed through a streamlined waste-logging stepper that minimizes effort, while Hedonic Motivation and Effort Expectancy are fostered through interactive points dashboards and real-time location tracking. This theoretical synthesis ensures that visual interactions directly mitigate user friction at the household level.

Considering these challenges, a digital solution in the form of an application is required to connect households with organic waste processors (such as composting services or maggot-based processing providers) in a transparent and user-friendly manner. The EcoHarvest application was developed to offer a simple drop-off process with minimal friction, clear service information such as a drop-off location map, and an incentive-based points system to encourage user participation.

Unlike conventional waste management systems, EcoHarvest integrates digital location transparency with a reward-based incentive system to overcome user motivation barriers. User interfaces are complex systems involving visual design, interaction mechanisms, information architecture, and user context that must work harmoniously [9]. To ensure that the application design aligns with user needs, this research applies the Design Thinking method in the UX design process and evaluates the design outcomes through usability testing.

Design thinking is a cognitive and iterative process that involves understanding users, identifying problems, and generating innovative solutions [10]. UI/UX design plays a crucial role in the success of an application because it affects user comfort and ease of interaction [6]. As technology evolves and new interaction paradigms emerge, User Interface (UI) and User Experience (UX) become increasingly important in shaping user expectations and needs [11].

Through the Design Thinking approach, this research aims to design a digital solution that is not only technically functional but also capable of addressing users' psychological barriers through an intuitive interface and a sustainable incentive system.

2. RESEARCH METHODS

This study uses the Design Thinking method as an approach for designing the User Experience (UX) of the EcoHarvest organic waste management application. This method was chosen because it focuses on users (user-centered design) and is capable of producing relevant solutions through systematic stages. The Empathize stage was conducted through observation of household waste management habits and interviews to identify challenges in waste sorting. The Define stage aimed to

formulate the main problems, such as unpleasant odors caused by storing waste for too long and user confusion regarding how to process or dispose of organic waste. In the Ideate stage, solutions were developed in the form of scheduled waste collection features and a waste-to-points conversion system as a gamification-based incentive.

The Prototype stage was carried out by designing a high-fidelity prototype using Figma to illustrate the application workflow. Figma is a cloud-based vector design platform that supports high-fidelity prototyping and real-time collaboration features [12].

The Test stage was conducted through usability testing using the System Usability Scale (SUS) to measure usability, efficiency, and user satisfaction

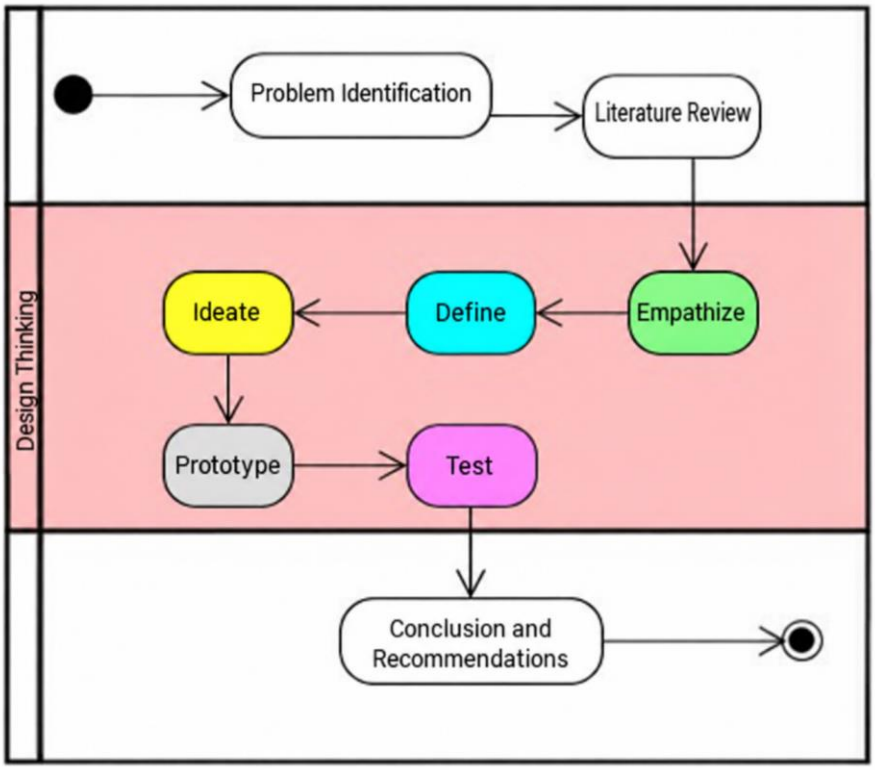


Figure 4. Design Thingking Method

2.1. Research Stages

After gaining deeper insights through literature studies, the research proceeded to the Design Thinking implementation stage. This method facilitates problem-solving related to users, design, and problem formulation, ultimately producing innovative solutions and ideas. The Design Thinking process consists of five stages; Empathize, Define, Ideate, Prototype, and Test.

2.1.1. Empathize

The Empathize phase aimed to understand users' habits, needs, and challenges regarding the management of household organic waste. A total of 50 participants residing in Tangerang were selected using a convenience sampling method. The participants came from diverse backgrounds, offering varied perspectives on daily waste management. Recruitment was conducted by directly distributing an online Google Form questionnaire to contacts and local community channels via private messaging.

The questionnaire gathered data regarding waste disposal habits, baseline knowledge of organic waste, and operational obstacles encountered during waste sorting. Upon collecting all 50 responses, a thematic analysis was performed to identify and categorize recurring user complaints. The analysis revealed three primary user challenges: (1) organic waste rapidly produces unpleasant odors if stored for extended periods, (2) users face time constraints in managing waste routines, and (3) users lack awareness regarding nearby organic waste drop-off locations.

2.1.2 Define

Based on the findings from the Empathize stage, a problem statement was formulated. The main problem identified was the lack of a system that allows people to dispose of organic waste easily and with minimal effort. The main user pain points include; Difficulty finding organic waste drop-off locations, Waste disposal processes perceived as complicated, Lack of direct incentives that encourage waste sorting behavior.

2.1.3. Ideate

In the Ideate stage, solution ideas were developed based on the previously defined problems. The proposed solution is the EcoHarvest application, featuring organic waste drop-off services and a gamification system with points and rewards to increase user engagement.

2.1.4. Prototype

The Prototype stage was conducted by designing a high-fidelity prototype using Figma software. This prototype represents the user interface and interaction flow of the EcoHarvest application. The prototype includes, Dashboard page, Waste submission feature, Location map feature, Points and reward display

2.1.5. Test

The testing phase evaluated the application's ease of use and user satisfaction regarding the developed prototype using the System Usability Scale (SUS) method.

An online questionnaire consisting of 12 questions was distributed. The first two questions aimed to gather general feedback on the UI/UX design flow and the application's educational value; these were excluded from the official usability scoring. The remaining ten items comprised the standardized SUS questionnaire, formatted with alternating positive (odd-numbered) and negative (even-numbered) statements rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

Only the ten standard SUS questions were included in the SUS calculation; the initial two questions were excluded from the final score computation, as their purpose was solely to gather additional user feedback.

The individual SUS scores were computed using standard calculation procedures:

1. For odd-numbered statements (positive statements), the score contribution was determined by subtracting 1 from the respondent's raw answer value (Score - 1).
2. For even-numbered statements (negative statements), the score contribution was determined by subtracting the respondent's raw answer value from 5 (5 - Score).
3. The converted score contributions for the ten statements (each ranging from 0 to 4) were summed for each respondent.
4. The sum was then multiplied by 2.5 to derive the individual SUS score (ranging from 0 to 100).
5. Finally, the mean score across all 50 respondents was calculated to determine the prototype's overall usability score.

Table 1. Standardized SUS Questionnaire Items

No.	Question
S1	I think that I would like to use the EcoHarvest application frequently (for routine waste drop-offs).
S2	I found the application to be unnecessarily complex, whereas the waste deposit process should be simple.
S3	I thought the application was easy to use, even for non-tech-savvy users.
S4	I think that I would need technical support from another person to understand how to deposit waste or redeem points.
S5	I found the various functions in this application (Map, Deposit, Points) were well integrated.
S6	I thought there was too much inconsistency (confusing elements) in this application.

S7	I would imagine that most people would learn to use this application very quickly.
S8	I found the application very cumbersome/confusing to use (too many steps).
S9	I felt very confident using the application (sure that my waste logging data was correctly recorded).
S10	I needed to learn a lot of things before I could get going with this application.

Note: The questionnaire was administered in Bahasa Indonesia to fit local respondent demographics and translated here for reporting purposes.

3. RESULTS AND DISCUSSION

3.1. User Persona Discussion

In designing the User Experience (UX) for the EcoHarvest app, a user persona approach was used to represent the main characteristics of the target users. The user persona used is Ibu Sari, a 35-year-old homemaker who cares about keeping the environment clean but has limited time for daily activities.

Ibu Sari is a user who needs a simple, easy-to-understand solution for managing organic waste that doesn't require many steps. By using this user persona, the interface design process is focused on making it easier for users to manage waste in a sustainable way with minimal effort.

3.2. Discussion of User Interface and User Experience Design

Design Decisions Based on User Issues To transform the outcomes of the Design Thinking process into a usable solution, the EcoHarvest app design addresses the key issues identified during the Empathize and Define stages. The design decisions made are as follows:

1. Issue: Users do not know the location of the nearest organic waste collection point.

Design Decision: We created a Map feature to help users locate the nearest waste bank or organic waste collection point. This feature also displays the estimated distance to each location, making it easier for users to decide where to drop off their waste.

2. Issue: Users have limited time and perceive the waste disposal process as overly complicated.

Design Decision: We developed a Waste Submission feature with a simple, streamlined process. For the waste weight input, we implemented a stepper (plus/minus buttons) so users can easily specify the amount of waste without manual typing. This allows the waste submission process to be completed more quickly.

3. Issue: Users need motivation or rewards to encourage them to sort organic waste regularly.

Design Decision: We incorporated a points and gamification system displayed on the Dashboard. Users earn points each time they successfully submit waste. These points can be redeemed for various rewards, such as mobile phone credit, plants, and compost. This system serves as a reward mechanism to encourage users to sort and submit organic waste more consistently.

3.2.1 Color and Layout Analysis

The EcoHarvest app interface uses green and white as its primary colors to evoke sustainability and maintain visual clarity. Green represents growth and nature, while white is used to create a clean look and make the interface easier to read.

A card-based layout is used for the educational and informational menus to simplify the user's browsing experience without feeling overwhelmed. Card-based layouts organize educational menus to reduce cognitive load. This use of color and layout can be seen in the app interface, this visual hierarchy corresponds directly to Figure 5.

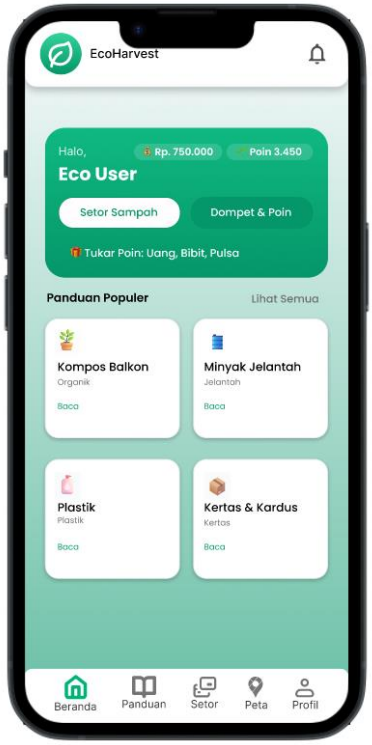


Figure 5. EcoHarvest Application Interface Display

3.2.2 Waste Submission Feature

The main feature of the EcoHarvest app is the waste collection feature. This feature has an easy-to-follow and uncomplicated process, starting with selecting the type of waste to be disposed of, entering the weight of the waste, selecting a collection schedule, and finally, confirming the collection.

This process prioritizes efficiency and minimizes effort, allowing users to complete the waste deposit process quickly and without confusion. To address the user pain point regarding complicated processes, the submission workflow prioritizes efficiency through a step-by-step selection of waste type, weight, schedule, and confirmation. The interface design for this workflow is illustrated in Figure 6.

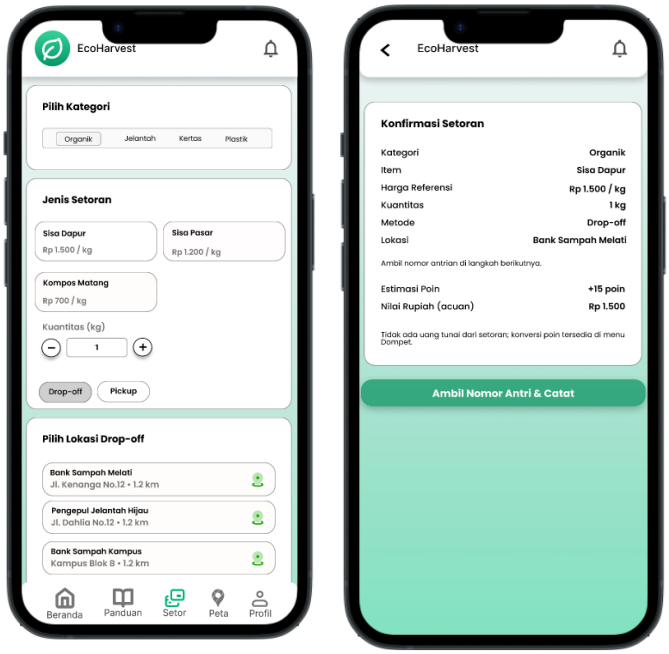


Figure 6. Flow of the Waste Deposit Feature in the EcoHarvest Application

3.2.3 Data Visualization on the Dashboard

The EcoHarvest app has a Dashboard page that serves as the primary information display for users. This page displays information on the total organic waste processed (in kg) to provide positive behavioral reinforcement and the number of points the user has accumulated.

The data visualization on the dashboard provides positive feedback, thus increasing user engagement in organic waste management. This feature operationalizes Hedonic Motivation from the UTAUT framework by rewarding consistent participation. The dashboard display is presented in Figure 7.

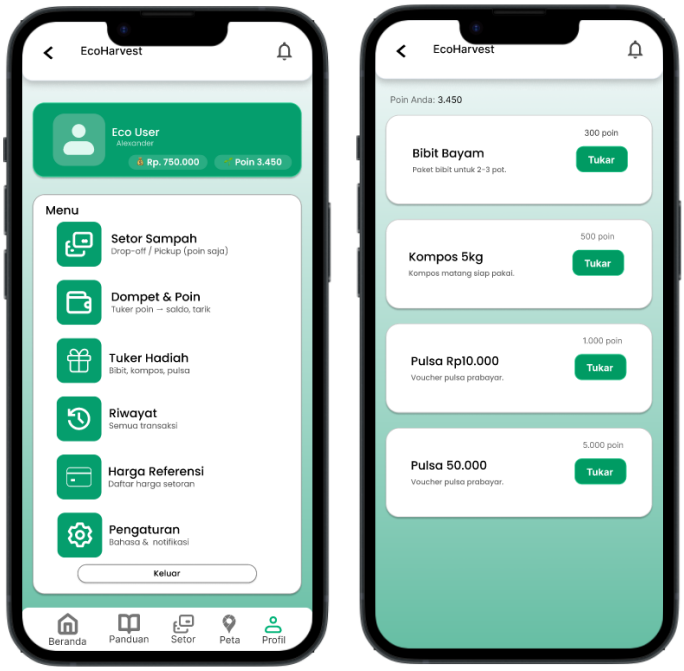


Figure 7. EcoHarvest Application Dashboard Display

3.2.4 Interaction Design and Error Prevention

Modern mobile applications frequently optimize screen real estate by pairing explicit visual components, such as buttons and menus, with implicit interaction mechanisms to streamline user workflows [13]. In EcoHarvest, to prevent manual typing errors and reduce input friction, incremental stepper controls (+ / -) were implemented for entering waste weight.

This interaction design approach ensures accurate data entry while maintaining a clean visual hierarchy, helping users—particularly those less familiar with manual numeric inputs—feel more confident during the submission process. The implementation of the stepper element is depicted in Figure 8.

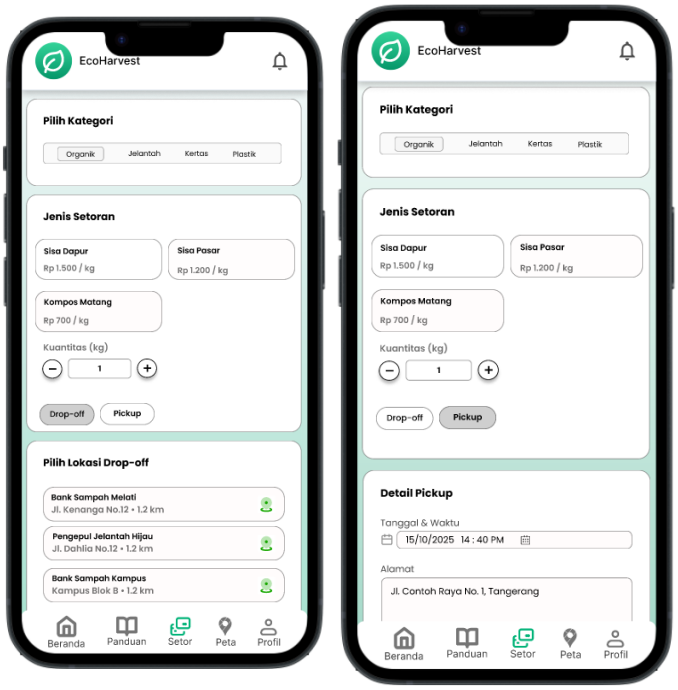


Figure 8. Interaction Design for Garbage Weight Input Using Stepper

3.3. Usability Testing Analysis Using SUS

Before analyzing the SUS scores, it is important to outline the profiles of the respondents who participated in the testing. A total of 50 participants were selected for this trial using a convenience sampling method. The respondents were residents of Tangerang who handle household waste in their daily lives and possess basic knowledge of using mobile applications.

The respondents came from diverse backgrounds, including students, working professionals, and homemakers. This diversity was leveraged to gather feedback from users with varying activities and habits. Through this approach, the testing could provide insights into the ease of use of the EcoHarvest application across different types of users.

The detailed distribution of individual SUS scores from the 50 respondents is presented in the table below:

Table 2. SUS Respondens

Resp	Q1	Q2	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
R1	Agree	Agree	4	4	4	5	5	5	5	5	5	5
R2	Strongly Agree	Strongly Agree	4	5	5	4	5	3	4	3	4	3
R3	Agree	Agree	5	5	5	4	5	5	4	4	4	4
R4	Agree	Agree	4	3	3	4	3	3	4	3	4	4
R5	Agree	Agree	3	1	5	5	4	2	5	1	4	1
R6	Strongly Agree	Strongly Agree	5	4	4	4	4	4	4	4	4	4
R7	Agree	Agree	4	4	4	4	4	4	4	4	4	4
R8	Agree	Agree	4	2	4	4	4	2	4	3	4	4
R9	Agree	Strongly Agree	4	2	5	3	5	2	5	1	5	5
R10	Netral	Agree	4	2	4	2	4	2	5	1	5	1
R11	Strongly Agree	Strongly Agree	4	2	4	2	4	2	3	2	4	3
R12	Agree	Agree	3	2	4	3	3	2	4	1	4	3
R13	Agree	Agree	3	3	4	3	4	3	3	3	3	3

R14	Agree	Agree	3	4	4	4	5	1	4	2	4	4
R15	Agree	Agree	4	2	4	3	4	2	4	2	4	4
R16	Strongly Agree	Agree	4	3	4	4	5	5	4	4	4	4
R17	Strongly Agree	Strongly Agree	5	1	5	1	5	1	5	1	5	2
R18	Strongly Agree	Strongly Agree	4	2	5	3	4	2	5	2	4	4
R19	Agree	Agree	4	1	4	2	5	2	4	2	4	5
R20	Strongly Agree	Strongly Agree	4	2	5	3	4	2	5	2	4	5
R21	Agree	Agree	5	4	4	5	4	5	5	5	4	4
R22	Agree	Netral	3	3	3	3	3	3	3	3	3	3
R23	Strongly Agree	Agree	4	3	5	4	5	3	4	2	4	4
R24	Agree	Agree	4	1	4	1	4	1	4	1	4	2
R25	Agree	Agree	4	3	4	4	4	4	4	3	4	3
R26	Agree	Netral	4	3	3	4	4	3	4	3	4	4
R27	Strongly Agree	Strongly Agree	4	4	4	5	5	2	3	2	2	4
R28	Strongly Agree	Agree	4	1	5	2	4	1	5	2	5	1
R29	Strongly Agree	Strongly Agree	5	2	5	3	5	2	5	5	5	3
R30	Agree	Agree	3	2	4	4	3	4	3	3	3	3
R31	Agree	Agree	4	4	4	4	4	4	4	4	4	4
R32	Strongly Agree	Strongly Agree	5	5	5	5	5	5	5	5	5	5
R33	Agree	Agree	4	1	4	1	4	1	5	1	5	2
R34	Strongly Agree	Strongly Agree	3	1	5	1	5	1	4	1	5	1
R35	Strongly Agree	Strongly Agree	4	1	4	1	5	1	4	1	5	1
R36	Strongly Agree	Strongly Agree	5	1	5	2	4	1	4	1	5	1
R37	Netral	Agree	4	4	4	3	5	4	5	4	4	5
R38	Strongly Agree	Strongly Agree	4	2	4	3	5	2	5	3	5	2
R39	Strongly Agree	Strongly Agree	5	5	5	5	5	5	5	5	5	5
R40	Agree	Agree	4	2	3	4	4	3	3	2	3	5
R41	Agree	Agree	3	3	3	3	3	3	3	3	3	3
R42	Agree	Strongly Agree	5	2	5	1	4	1	5	1	5	1
R43	Netral	Netral	3	3	3	3	3	3	3	3	3	3
R44	Strongly Agree	Strongly Agree	4	1	5	1	4	2	4	1	4	1
R45	Strongly Agree	Agree	5	1	4	1	4	1	4	1	5	1
R46	Strongly Agree	Strongly Agree	4	1	4	1	5	1	5	1	4	1
R47	Strongly Agree	Strongly Agree	5	1	4	1	4	1	4	1	4	2
R48	Strongly Agree	Strongly Agree	4	1	4	1	4	1	4	1	4	2
R49	Strongly Agree	Strongly Agree	5	1	4	1	5	1	4	1	4	1
R50	Strongly Agree	Strongly Agree	5	1	4	1	5	1	4	1	4	1

Table 3. Average SUS Score

Resp	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	SUS
R1	4	4	4	5	5	5	5	5	5	5	**47.5**
R2	4	5	5	4	5	3	4	3	4	3	**60**
R3	5	5	5	4	5	5	4	4	4	4	**52.5**
R4	4	3	3	4	3	3	4	3	4	4	**52.5**
R5	3	1	5	5	4	2	5	1	4	1	**77.5**
R6	5	4	4	4	4	4	4	4	4	4	**52.5**
R7	4	4	4	4	4	4	4	4	4	4	**50**
R8	4	2	4	4	4	2	4	3	4	4	**62.5**
R9	4	2	5	3	5	2	5	1	5	5	**77.5**
R10	4	2	4	2	4	2	5	1	5	1	**85**
R11	4	2	4	2	4	2	3	2	4	3	**70**
R12	3	2	4	3	3	2	4	1	4	3	**67.5**
R13	3	3	4	3	4	3	3	3	3	3	**55**
R14	3	4	4	4	5	1	4	2	4	4	**62.5**
R15	4	2	4	3	4	2	4	2	4	4	**67.5**
R16	4	3	4	4	5	5	4	4	4	4	**52.5**
R17	5	1	5	1	5	1	5	1	5	2	**97.5**
R18	4	2	5	3	4	2	5	2	4	4	**72.5**
R19	4	1	4	2	5	2	4	2	4	5	**72.5**
R20	4	2	5	3	4	2	5	2	4	5	**70**
R21	5	4	4	5	4	5	5	5	4	4	**47.5**
R22	3	3	3	3	3	3	3	3	3	3	**50**
R23	4	3	5	4	5	3	4	2	4	4	**65**
R24	4	1	4	1	4	1	4	1	4	2	**85**
R25	4	3	4	4	4	4	4	3	4	3	**57.5**
R26	4	3	3	4	4	3	4	3	4	4	**55**
R27	4	4	4	5	5	2	3	2	2	4	**52.5**
R28	4	1	5	2	4	1	5	2	5	1	**90**
R29	5	2	5	3	5	2	5	5	5	3	**75**
R30	3	2	4	4	3	4	3	3	3	3	**50**
R31	4	4	4	4	4	4	4	4	4	4	**50**
R32	5	5	5	5	5	5	5	5	5	5	**50**
R33	4	1	4	1	4	1	5	1	5	2	**90**
R34	3	1	5	1	5	1	4	1	5	1	**92.5**
R35	4	1	4	1	5	1	4	1	5	1	**92.5**
R36	5	1	5	2	4	1	4	1	5	1	**92.5**
R37	4	4	4	3	5	4	5	4	4	5	**55**
R38	4	2	4	3	5	2	5	3	5	2	**77.5**

R39	5	5	5	5	5	5	5	5	5	5	**50**
R40	4	2	3	4	4	3	3	2	3	5	**52.5**
R41	3	3	3	3	3	3	3	3	3	3	**50**
R42	5	2	5	1	4	1	5	1	5	1	**95**
R43	3	3	3	3	3	3	3	3	3	3	**50**
R44	4	1	5	1	4	2	4	1	4	1	**87.5**
R45	5	1	4	1	4	1	4	1	5	1	**92.5**
R46	4	1	4	1	5	1	5	1	4	1	**92.5**
R47	5	1	4	1	4	1	4	1	4	2	**87.5**
R48	4	1	4	1	4	1	4	1	4	2	**85**
R49	5	1	4	1	5	1	4	1	4	1	**92.5**
R50	5	1	4	1	5	1	4	1	4	1	**92.5**
									Mean		**69.2**
									Deviasi/ SD		**17.09397793**
									Min		**47.5**
									Max		**97.5**

3.3.1. Average SUS Score and Interpretation

Based on the evaluation of 50 respondents, the EcoHarvest prototype achieved a mean SUS score of **69.2** (SD = 17.09, Min =47.5, Max = 97.5). With a mean score exceeding the standard benchmark threshold of 68, the prototype falls within the 'Acceptable' range with a 'Grade B' rating.

Table 4. SUS Score Interpretation

Score Range	Grade	Category
> 80	A	Excellent
68–80	B	Good
67	C	OK
51–66	D	Poor
< 51	E	Awful

3.3.2. Discussion of Test Results

The statistical results confirm that the prototype satisfies basic usability requirements for household organic waste logging. However, the score distribution (SD = 17.09) reveals notable variability among user groups. While tech-savvy respondents rated the app favorably (Max = 97.5), lower individual scores (Min = 47.5) highlight usability barriers in navigation clarity and task steps. Because a score of 69.2 represents borderline acceptable usability, these findings reflect an initial prototype evaluation rather than a fully deployed operational application.

4. CONCLUSION

This research designed and evaluated a high-fidelity prototype of the EcoHarvest application as a digital solution to support community-based organic waste management using the Design Thinking framework integrated with UTAUT and gamification concepts. Through the Empathize, Define, Ideate, Prototype, and Test stages, a comprehensive understanding of core user challenges was established: a lack of motivation to sort waste, limited information on collection locations, and the absence of a tangible incentive structure. Based on these insights, key features were developed, including a drop-off location map, a point-based reward system, and a streamlined user dashboard.

The usability evaluation yielded a mean System Usability Scale (SUS) score of 69.2 (Grade B, Acceptable) among 50 respondents. This result demonstrates that the prototype provides a promising and acceptable foundation for digital waste management interfaces. However, given that 69.2 represents a preliminary evaluation score, the findings validate prototype usability rather than definitive behavioral change or full operational effectiveness. Future work should focus on iterative UI refinements to lessen navigation friction, expanded field testing, and integrating real-time logistics services before full implementation.

5. REFERENCES

[1] Waringin Margi Yusmaman, Herri Widiyanto, Siti Nur Rohmah, and Muhammad Ali Akbarsyah, "Bahaya Lingkungan Pada Open Dumping Sampah Organik Perkotaan," Jurnal Bengawan Solo Pusat Kajian Penelitian dan Pengembangan Daerah Kota Surakarta, vol. 2, no. 2, pp. 85–101, Dec. 2023, doi: https://doi.org/10.58684/jbs.v2i2.83.

[2] Kemenko PMK, "7,2 Juta Ton Sampah di Indonesia Belum Terkelola Dengan Baik," Kementerian Koordinator Bidang Pembangunan Manusia dan Kebudayaan, 2023.

[3] Pemerintah Kota Cirebon, "Bahaya dan Manfaat Sampah Organik - Dinas Lingkungan Hidup," Cirebonkota.go.id, 2025. https://dlh.cirebonkota.go.id/artikel/bahaya-dan-manfaat-sampah-organik (accessed Feb. 19, 2026).

[4] Ni Nengah Widiani, Syahrullah Syahrullah, Rahma Laila, Chairunnisa Ar Lamasitudju, and Dwi Shinta Angreni, "UI/UX Design of Jepun Bali Store Product Ordering Application Using Design Thinking Method," CCIT (Creative Communication and Innovative Technology) Journal, vol. 19, no. 1, pp. 1–17, 2026, doi: https://doi.org/10.33050/ccit.v19i1.3965.

[5] K. Wenker, "A systematic literature review on persuasive technology at the workplace," Patterns, vol. 3, no. 8, p. 100545, Aug. 2022, doi: https://doi.org/10.1016/j.patter.2022.100545.

[6] S. Venturi, K. Zulauf, R. Cuel, and R. Wagner, "Trash to treasure: Gamification and informed recycling behavior," *Resources, Conservation and Recycling*, vol. 215, p. 108108, Feb. 2025, doi: 10.1016/j.resconrec.2024.108108.

[7] D. Yulianti, K. C. Febriantika, Z. D. Priamita, and P. K. F. Ananto, "Rubbish Go: An Innovative Community-Based Platform for Digital Waste Management in Indonesia," *Journal of Artificial Intelligence and Engineering Applications (JAIEA)*, vol. 5, no. 1, pp. 12-18, Oct. 2025.

[8] Ömer Faruk Ursavaş, "Unified Theory of Acceptance and Use of Technology Model (UTAUT)," pp. 111–133, Jan. 2022, doi: https://doi.org/10.1007/978-3-031-10846-4_6.

[9] S. Park et al., "Bridging Gulfs in UI Generation through Semantic Guidance," arXiv.org, 2026, doi: https://doi.org/10.1145/3772318.3791966.

[10] Satu Grönman, E. Lindfors, and Marja-Leena Rönkkö, "Design thinking in early childhood education and care. A literature review and consideration from the perspective of young learners' craft, design, and technology education," International Journal of Technology and Design Education, Oct. 2024, doi: https://doi.org/10.1007/s10798-024-09944-z.

[11] V. Arifin, V. Handayani, L. K. Wardhani, H. B. Suseno, and S. U. Masruroh, "User Interface and Exprience Gamification-Based E-Learning with Design Science Research Methodology", MATRIK, vol. 22, no. 1, pp. 165–176, Nov. 2022, doi: 10.30812/matrik.v22i1.2427.

[12] K. S. Lestari and H. Henderi, "Model Dashboard Information System untuk Peningkatan Kualitas Pengelolaan Jurnal Ilmiah," Jurnal Ilmiah Matrik, vol. 23, no. 2, pp. 142–149, Aug. 2021, doi: https://doi.org/10.33557/jurnalmatrik.v23i2.1405.

[13] M. Kweon, S. Park, S. Lee, Y. B. Lee, J. Rhee, and J. Seo, "GhostUI: Unveiling Hidden Interactions in Mobile UI," Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems, pp. 1–22, Apr. 2026, doi: 10.1145/3772318.3790283.