Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 269 (2025) 749–761

Procedia Computer Science

www.elsevier.com/locate/procedia

The 10th International Conference on Computer Science and Computational Intelligence 2025

From Waste to Worth: Enhancing Access to Edible Surplus Food Using a Mobile App for Better Distribution

Yudhistya Ayu Kusumawati[a]*, Vicky Aurellia[b], Lasmy[c], Kukuh Lukiyanto[d], Mariah Binti Awang[e], Chua Soo Han[f]

[a-b]*Visual Communication Design Department, School of Design, Bina Nusantara University, Jakarta, Indonesia 11480*
[c]*Management, BINUS Business School Undergraduate Program, Bina Nusantara University, Jakarta, Indonesia 11480*
[d]*Entrepreneurhip, BINUS Business School Undergraduate Program, , Bina Nusantara University, Jakarta, Indonesia 11480* [e]*Civil Engineering Technology, Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia 86400*
[f]*School of Media Art and Design, Asia Pasific University of Technology and Innovation, Kuala Lumpur, Malaysia 57000*

Abstract

Food waste remains a pressing global issue, with tons of edible food discarded daily while many communities continue to struggle with food insecurity. This research explores an innovative solution to bridge that gap by developing a mobile application designed to facilitate the redistribution of surplus yet still-consumable food. The app connects food donors such as restaurants, supermarkets, and households. Through user-friendly features like real-time food listings, pickup scheduling, and geo-location services, the app aims to simplify and streamline the donation process. The research combines design thinking methods, community engagement, and technology integration to create an accessible and sustainable food-sharing platform. Early user testing and feedback indicate increased efficiency in food redistribution and a positive social impact within participating communities. Beyond addressing food waste, the project promotes a culture of sharing, environmental consciousness, and social responsibility. This approach not only reduces the environmental burden of food waste but also fosters collaboration among stakeholders. By turning potential waste into a valuable resource, this study demonstrates how digital innovation can be a powerful tool in promoting food equity and sustainability.

Keywords: Design thinking; Food security; Food waste; Mobile apps

* Corresponding author. Tel.: +6282-33470-7133; fax: +0-000-000-0000 .
E-mail address: ykusumawati@binus.edu

10.1016/j.procs.2025.09.018

1. Introduction

Food shortage crises are a pressing global social problem in most parts of the world, where people are unable to access nutritious and healthy food [1]. Every year, a large amount of food is wasted or spoiled before it reaches consumers, especially in developing countries. Food loss generally occurs at the production, storage and transportation stages, while food waste occurs at the consumer level, when food that is fit for consumption is discarded [2]. This problem not only affects food availability but also threatens global food security as food that is still suitable for consumption is wasted and not utilized properly. This phenomenon exacerbates inequality in food distribution, so that certain regions experience food surpluses, while other regions experience scarcity [3].

Food loss is often caused by inadequate agricultural infrastructure, inappropriate storage equipment, and constraints in the processing of agricultural products [4]. For example, fruits and vegetables often deteriorate before reaching the market due to lack of cold storage facilities and poor transportation. Inefficient distribution challenges also make matters worse. Poor road infrastructure, especially in remote areas, makes access to markets difficult. Many regions that are rich in agricultural resources are unable to evenly distribute food to areas in need. Inefficient distribution also adds to logistics costs, resulting in higher food prices in the market, which in turn affects the purchasing power of low-income people [5]. On the other hand, agriculture as the most important sector in food supply also faces its own challenges in reducing food loss [6]. Malang Regency is one of the regions in Indonesia that is rich in agricultural potential, but some areas in it still face the problem of food shortages. This issue is frequently caused by a variety of circumstances, including unfair food distribution, natural calamities, and inadequate farming systems. Because there is frequently lacking infrastructure and transportation, access to food supplies can be challenging in rural or remote areas. Furthermore, unpredictable weather patterns and climate change have an impact on agricultural output, which in turn affects local people access to food.

Technology-based application solutions might be a very useful tool in solving this problem. Creating an application that functions as an integrated platform for food delivery is one strategy [7]. By establishing direct connections between farmers, distributors, and consumers, this application can reduce food waste during the distribution process. With the aid of precise information, farmers may use this method to sell their agricultural goods directly to customers or local marketplaces. The system can also be equipped with a tracking feature that monitors the condition and quality of food during the distribution process, so as to prevent product damage due to improper handling.

This research introduces a mobile-based solution that acts as a real-time bridge between food donors and recipients, streamlining the redistribution of surplus edible food. Unlike traditional food aid systems, the proposed app leverages geolocation, real-time inventory updates, and community-driven interaction to optimize food sharing logistics. Its user-centered design empowers individuals, small businesses, and local communities to contribute actively in minimizing food waste while supporting vulnerable populations. The innovation lies in its hybrid model that integrates technology, sustainability, and social equity, offering a scalable, adaptable, and inclusive approach to tackling food waste transforming what was once discarded into a valuable resource. This research aims to identify more effective and efficient solutions in distributing food worthy of consumption to areas in Malang District that are food insecure, both mildly food insecure and moderately food insecure. Thus, the results of this research can reduce inequality in food access between urban and rural areas. It is hoped that the results of this research will provide policy recommendations that support equitable food distribution, improve local food security, and contribute to the welfare of people in remote areas.

2. Literature Review

In most regions of the world, people lack access to wholesome food, making hunger crises a serious societal issue. Much food is wasted or spoils before it is consumed each year, particularly in developing nations. Food loss often happened during manufacturing, storage, and transportation, whereas food waste happens at the consumer level when edible food is thrown away of [8]. Since there is an inefficient use and wastage of edible food, this problem not only affects food supply but also affects global food security. Food distribution inequality becomes worse by this impact, which causes insufficient in some areas and surpluses in others [9].

The design thinking approach and UI/UX elements are innovative methods that are highly relevant in creating digital solutions to address food loss challenges [10]. Design thinking focuses on user needs at every stage of solution development, from empathy to testing [11]. In the context of food distribution in Malang, this approach can help design an application that is intuitive and suits the needs of end users, such as traders, consumers and social institutions. Therefore, the user interface/user experience (UI/UX) takes responsibility for ensuring that the application design is user-friendly, intuitive, and capable of delivering an exceptional user experience [12]. Studies indicate that apps developed through design thinking and enhanced by excellent UI/UX can improve food distribution efficiency while minimizing food waste, so guaranteeing that edible food is delivered to people in need promptly.

Table 1. Previous Research

Title of Journal	Design Android-Based Mobile Food Vendor Location Search Application
Journal Authors	Nadia Bintang, Sumpena, Wawan Setiawan, Agung Raharja
Problem of Journal	Lack of an effective platform to connect consumers with mobile food merchants, resulting in difficulties in locating them in real-time.
Method Research	Create an application prototype with a design thinking approach
Conclusion	The developed application successfully implements GPS technology and Google Maps API, allowing users to find the location of food vendors easily and testing showed a high level of user acceptance, with the application stated to fulfil functional needs and provide a positive user experience [13].
Differences with other research	The application only allows consumers to find merchants but not the other way around.

Title of Journal	Distribution of Food Aid to Residents of Bunar Village, Sukatani Village, Cisoka District, Tangerang
Journal Authors	Anni Rohimah, Maya Lestari, Jaka Supriyatna, Abdul Azis Setiawan, Dadang, dan Ryan Ardiansyah
Problem of Journal	The problem of poverty and food shortages in the Tangerang Regency area, especially in Kecamatan Cisoka.
Method Research	Doing community service directly to the location
Conclusion	Food aid distribution activities can reduce the burden on the community in fulfilling their basic needs, and also show that the community still needs education about hygiene and health [14].
Differences with other research	Distribute by coming directly to areas with food shortages in the Tangerang district.

Title of Journal	UI/UX Design Design for Foodstuff E-Commerce Application at Pasar Wage Purwokerto
Journal Authors	Agung Prasetiyo, Elianna Gerda Pertiwi, Bachrul Restu Bagja
Problem of Journal	Pasar Wage Purwokerto has experienced a decrease in the income of food traders due to the Covid-19 pandemic, and lack of information about food prices and availability of goods.
Method Research	Distributing questionnaires to Purwokerto and surrounding communities who are familiar with technology.
Conclusion	The food e-commerce application in Purwokerto Wage Market designed has met the functional requirements and is well received by the citizens of Purwokerto [15].
Differences with other research	The application created is used for Purwokerto residents to see food prices.

The establishment of an Android app to find food vendors demonstrates how technology might improve communication between informal sector buyers and suppliers [13] [14] [15]. The position-Based Service (LBS) approach uses the Global Positioning System (GPS) and Google Maps API to provide real-time merchant position data. This application's UI/UX implementation is based on the prototype method, which enables iterative development based on user feedback and takes into account user requirements. The results indicate that this application effectively integrates Google Maps API and GPS technology to simplify the process of locating food purveyors through the user interface. The application was developed using a design thinking approach, which emphasizes the importance of user-centered solutions that take into account the requirements of consumers and merchants.

3. Research Methods

Design thinking is a human-centered approach to problem-solving that starts with empathy, deeply understanding the real needs, challenges, and behaviors of the people we're trying to help [16]. When it comes to the issue of food waste and hunger, design thinking offers a powerful framework to bridge the gap between surplus and need. In this case, we're focusing on the edible surplus food that often goes to waste from restaurants, grocery stores, or households and how it could be redirected to people who need it most. The idea is simple, but the solution must be thoughtful, inclusive, and efficient.

Through the design thinking process, we begin by empathizing with key stakeholders: food donors, distribution volunteers, and recipients facing food insecurity. By listening to their stories and observing their experiences, we uncover not just logistical barriers but also emotional and social dynamics, like stigma or lack of information. The data collections through questionnaires and interviews to analyze the distribution of food worthy of consumption in remote areas in Malang Regency. Furthermore, questionnaires were distributed to communities in the target areas to collect data on challenges in food access and interest in application-based solutions. In-depth interviews were then conducted to obtain qualitative data from the affected local residents in order to gain a more thorough understanding of the constraints of food distribution in remote areas. Through a combination of these methods, the research aims to produce a relevant, efficient and customized app solution to improve food access in remote areas of Malang.

Next, we define the core problem: How might we create an accessible, trustworthy, and efficient way to connect surplus food sources with those in need without making anyone feel like they're receiving leftovers? We move to the ideation stage, where creative brainstorming leads to potential solutions like a mobile app that lets businesses quickly post available surplus food, while alerting nearby recipients and volunteers for real-time pickup and delivery. With the concept in mind, we prototype a lightweight version of the app. It might include features like a map of available food, push notifications, safety guidelines, and a simple matching system. Then, we test it with real users, gathering feedback and refining it iteratively to ensure it meets real-world needs—functionally and emotionally. This iterative, user-focused process helps ensure that the final app is not just a piece of technology, but a meaningful tool that supports community resilience, reduces food waste, and promotes equity in food access.

3.1. Interview

This research methodology uses qualitative and quantitative approaches through in-depth interviews and questionnaire surveys. Interviews were conducted directly with Mr. Arifin, an expert in food distribution, to gather in-depth information regarding challenges, strategies and best practices in food distribution in remote areas. The interview aimed to understand in detail a practitioner's view of the main constraints, needs and opportunities in the process of distributing food fit for consumption, as well as gaining insights into how application-based solutions can be implemented in the field.

In interviews conducted through discussions on WhatsApp, there were several main points related to the challenges of food distribution in remote areas of Malang. The main challenge is inadequate infrastructure, especially poor road conditions and extreme weather that hampers transportation. In addition, the lack of adequate storage facilities is another significant obstacle. The current distribution system still has many shortcomings, although some technology-based initiatives have been used for mapping hard-to-reach areas.

To maintain food quality, good packaging methods and cold chain systems are implemented, especially for perishable products. The efficacy of inventory management and transportation monitoring is substantially improved by technology. Through direct purchasing and education, local producers are able to reduce their dependence on external food sources and ensure a consistent food supply by collaborating to improve the quality of their crops. The health and education of children are negatively impacted by insufficient food, which leads to destitution and a scarcity of food.

3.2. Questionnaires

The quantitative data itself was collected through questionnaires filled out by 106 respondents who were residents in Malang city and Malang district. The results from the questionnaires will be used to complement and strengthen the findings from the interviews and provide a broader view of the needs of potential users in the application of food distribution technology.

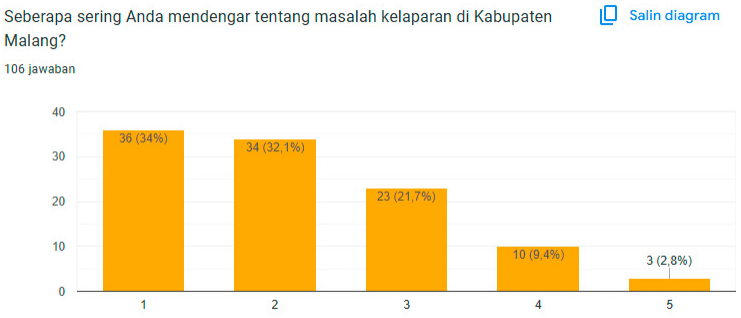

Fig. 1. Questionnaire about how often the respondents hear about the problem of hunger.

According to these amounts, about one-third of the respondents are ignorant of local hunger and food security problems. This signifies an urgent need for educational and social campaigns about the significance of food security and the ramifications of hunger, to raise awareness about issues impacting health, education, and social welfare within communities.

Fig. 2. Questionnaire about how often mobile apps are used by respondents.

The questionnaire results indicated that 43% of respondents were interested in using a food distribution application that was specifically designed for remote locations of Malang Regency. This number indicates the genuine necessity for digital solutions that might enhance food accessibility, particularly in remote regions.

4. Result and Discussions

The FreshBind app is a modern mobile application that boosts merchant economies with a modern and helpful design while providing food to areas facing food insecurity. FreshBind predicts supply needs in real time utilizing information technology to ensure efficient distribution. The user-friendly interface design ensures universal accessibility, increases involvement in the digital ecosystem, and promotes the economic growth of Indonesian communities and food-insecure villages.

4.1. Visual Concept

The FreshBind app has a tone and manner; informative, eco-conscious, and modern. FreshBind provides a variety of informative content that is accurate and relevant to people's lives such as news features about food commodities and healthy food recipes that can be accessed through the community page. As an application that focuses on eradicating food insecurity, FreshBind is presented with content that focuses on Sustainable Development Goals two, which is Zero Hunger so that in the use of the FreshBind application, users can access information related to hunger and can foster environmental awareness and empathy through the contents in the application. In addition, FreshBind has a modern UX design with the use of a fresh color palette, clean appearance, and minimalist design so that it suits users who match the target audience targeted by researchers.

Color choosing influences user perception and comfort [17]. FreshBind's design incorporates orange, green, and beige, which boosts its visual appeal while harmonizing psychological values with color. Orange can give a positive impression and is an ideal color to attract the attention of users, besides that orange is also suitable as an accent color for an application. Green gives a calming effect and is relevant to food products. Finally, beige is suitable for giving a modern impression and is suitable for being a neutral color in an application [18].

The font selection uses a modern and minimalist Sans Serif model to make the application look professional and give a clean look [19]. In the process of developing FreshBind application, the Poppins font was chosen for all typography uses because it fits the impression that wants to be displayed in the FreshBind application, which is Modern and Informative. In addition, the Poppins font also has a modern and fresh look so that it further supports the design appearance of the FreshBind application.

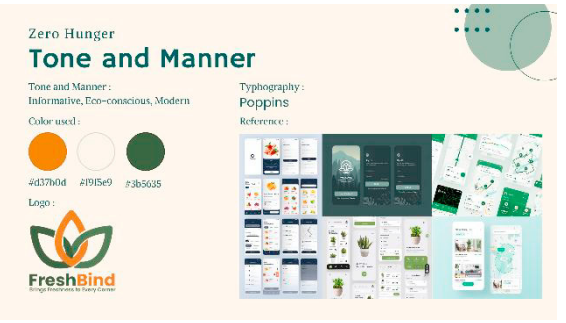

Fig. 3. Visual concept FreshBind application.

4.2. User Flow

User Flow is one of the most essential parts in making an application. User Flow describes the possible steps that users take when using digital products, one of which is an application [20]. By designing user flow, user navigation will become more structured, improve user experience, and minimize obstacles when users use the application.

The FreshBind app's user experience begins with a splash screen that shows the app's name and logo. The sign-in screen is then displayed to users, where they can either choose to create a new account or log in using their email address and password. If users choose to create an account, they will be directed to the account creation screen, where they must fill in information such as email, username, password, and password confirmation before pressing the “Create a new account” button. After successfully logging in or creating an account, users will be directed to the

homepage, which displays features such as search fields, product categories, exciting promotions, and product recommendations, providing an easy and enjoyable shopping experience.

The #BerbagiPangan feature allows users to donate either money or food. There are 3 donation options: food donation, money donation, and current donation. Users can choose to donate directly to a specific village or choose the program they want to support. After selecting a donation, users will be directed to the donation form and will receive a thank you message. In addition, users can also choose the volunteer feature which will be directed to the volunteer registration form. After submitting the form, users will receive an announcement about the continuation of volunteer registration.

Belanja allows users to find and order food items in the marketplace. Users can select the items they wish to purchase from the various food stores available in the app. After selecting the products, users will be directed to the order confirmation page and make payment. Users can then track their order on the order tracking page.

The Delivery section of the application provides food delivery services either delivery between users or delivery of orders from the marketplace to users. Users can track their orders via Check Order and track their orders in real time.

Communities allow users to connect with other users who are interested in food. Users can read news, view recipes, or join forums. Users can also select recipes they want to make and share them with other users.

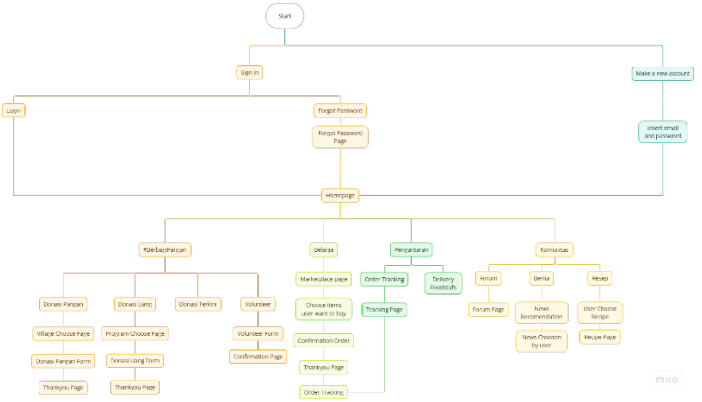

Fig. 4. User flow 1.

4.3. Final Design

The Final Design of the FreshBind app features a user-friendly design and has a modern look. FreshBind has a clean and modern aesthetic, using a green and orange color palette for a fresh and positive impression. Users have two options which are sign in or make a new account for new users. There are several sign in options that users can choose from, namely email, google, apple, and facebook. If a user who has an account forgets their password, the user will be directed to the forgot password page and can reset their password again. If the user is a new user, the user will be directed to create an account with an email and password. After having an account, users can quickly access the main features such as Food Sharing, Shopping, Delivery, and Community.

The Final Design of the FreshBind app features a user-friendly design and has a modern look as mention in figure 5. FreshBind has a clean and modern aesthetic, using a green and orange color palette for a fresh and positive impression. Users have two options which are sign in or make a new account for new users. There are several sign in options that users can choose from, namely email, google, apple, and facebook. If a user who has an account forgets their password, the user will be directed to the forgot password page and can reset their password again. If the user is a new user, the user will be directed to create an account with an email and password. After having an account, users can quickly access the main features such as Food Sharing, Shopping, Delivery, and Community.

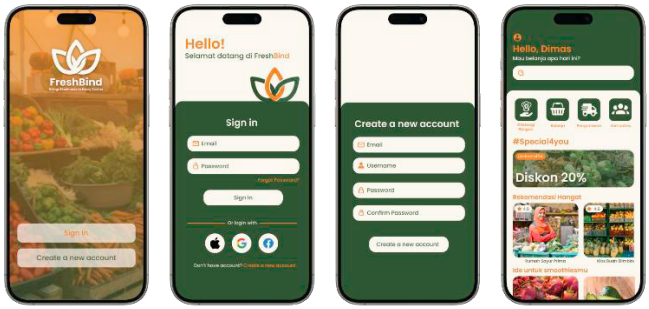

Fig. 5. Splash screen, login option, and homepage display.

In the #BerbagiPangan screen, there are several features that can be accessed such as Donasi Pangan, Donasi Uang, Donasi Terkini, and Volunteer. The #BerbagiPangan feature facilitates donations and allows users to choose different ways to contribute, including donating food, money, or volunteering as mention in figure 6. The Food Donation screen allows users to select a specific village to help by displaying a list of villages with images. After selecting the village to help, users will be redirected to a donation form page where they can submit their details and specify the type of food they wish to donate. The food items donated must be non-perishable food items such as oil, instant noodles, or rice. After submitting the form, users will be presented with a “Thank You” screen thanking them for their contribution.

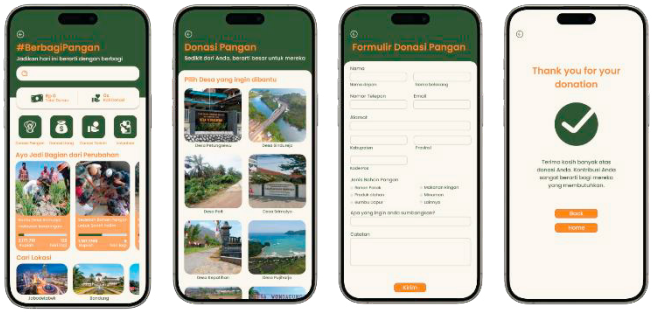

Fig. 6. #BerbagiPangan page and Donasi Pangan feature.

On the Donasi Uang screen, there are several program options that display various donation programs with photo and descriptions, including the target amount, progress bar, and remaining contribution time, thus encouraging users to choose a program that suits their interests as mention in figure 7. After selecting the desired program, the user fills out a form containing personal information and then specifies the donation amount and desired payment method. After submitting the form, users will be presented with a “Thank You” screen thanking them for their contribution.

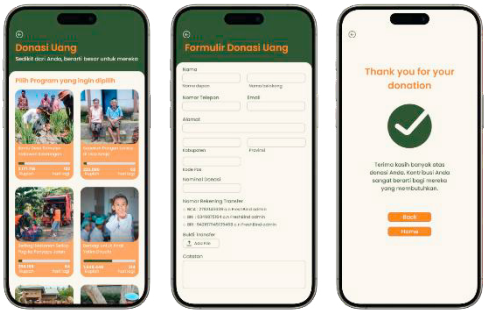

Fig. 7. Donasi Uang Feature.

The Recent Donations feature allows users to check the number of donations that the user has made. if the user has never donated, the food donation and money donation options will appear to invite the user to donate as mention in figure 8. In addition, there is also a volunteer feature that allows users to register as volunteers. After clicking the volunteer feature, the user will be given a special form to volunteer which contains personal information and terms and conditions for volunteering. If the user has submitted the form, the user will get a thank you page and information containing the continuation of the user's volunteer registration.

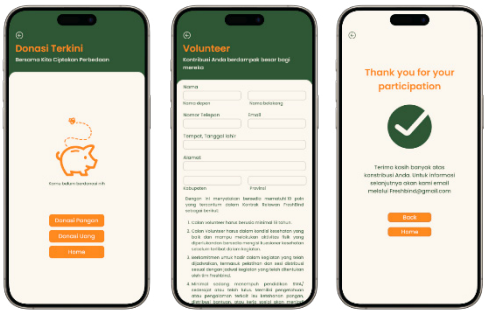

Fig. 8. Donasi Terkini and Volunteer features.

Belanja Page offers category navigation, recommendations to enhance the buying experience, and a search function that makes it easier for customers to search for specific products as mention in figure 9. On the Shop Page, customers can view the names and locations of the stores and search for specific products. Users can choose the groceries they want with a selection of fresh products from the store with clear pictures, names, and prices. Users can decide on shipping and payment choices on the checkout page, which also shows the products in their cart along with their number and total cost. The user receives a thank-you page after payment and informed that their product will be shipped in a moment, and has the option to check their order using the "Check Order" feature.

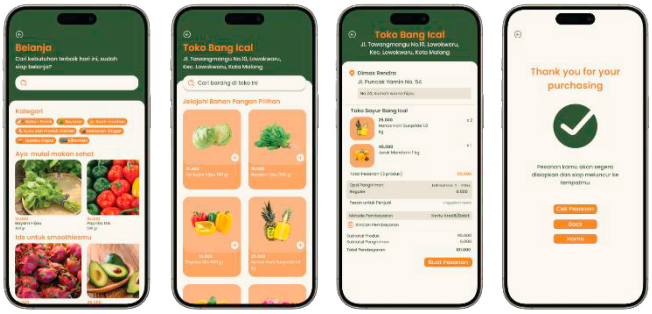

Fig. 9. Belanja feature.

On the Delivery page, users can add the location they want as their favourite location for food distribution as mention in figure 10. In addition, in this feature, users can check their orders in real-time and will be notified if the order is being delivered by the courier or the order has arrived. In the Order Tracking Page, users can find out the courier's profile and can interact via chat or phone.

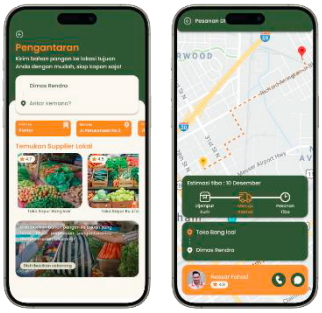

Fig. 10. Pengantaran feature.

The Community features intend to create interaction between users by enabling them to post and browse through recipes and part take in conversations as mention in figure 11. These functionalities include a forum which serves a purpose of facilitating communication and a recipe and news posting area. The Berita features is dedicated to providing all necessary information and up to date news. Articles are recommended where editors' selection of them is provided, so that users have enjoyable and informative materials all the time.

Fig. 11. Komunitas dan Berita features.

In the Forum feature, users can see various posts related to food topics as mention in figure 12. In addition, users can also join the desired community and write the desired post either to share information or to ask various questions about food topics. Meanwhile, the Resep feature provides a platform for users to find and share recipes.

After the user clicks on a recipe, more specific information will be displayed such as preparation time, portions, calories, difficulty level, ingredients needed, and cooking steps. Finally, the Profile feature allows users to see their personal information, including location and profile photo, as well as the number of places saved, donations made, and transactions completed. On the profile page, users can also make settings regarding their account.

Fig. 12. Forum, Resep features, and Profile user.sss

4.4. Testing

When developing a mobile app to help reduce food waste and improve food access, it's not enough to ask users whether they "like" or "dislike" it. We need to understand *how* they feel about the app in a more nuanced way what emotional and cognitive responses it triggers, and how those responses might affect their willingness to use it. This is where the semantic differential method comes in. It's a simple yet powerful tool that helps researchers capture the attitudes and perceptions of users toward a product in this case, a mobile app designed to connect surplus food sources with people who need it [21]. Semantic tables are crucial in application testing as they aid in understanding the meaning within graphical user interface elements. Researchers can evaluate the symbols, icons, and text in an application to create identity and structure in the application text, which is easier for users to comprehend. Semantic tables / help identify where the mistakes can occur / if we cannot know / different people interpret it differently / giving us a better usage and more likely to meet user expectation. Therefore, utilizing semiotic tables in application testing does not just improve usability, but it also increases the likelihood of meeting user expectations.

Table 2. Semantic Differential Table

No.	Adjective 1	1	2	3	4	5	6	7	Adjective 2
1.	Boring						v		Interesting
2.	Traditional							v	Modern
3.	Incomplete features							v	Complete features
4.	Not innovative							v	Innovative
5	Messy						v		Organized
6.	Confusing Navigation							v	Clear navigation
7.	Ambiguous Information							v	Clear Information
8.	Nout User-Friendly							v	User-Friendly
9.	Irrelevant						v		Relevant
10.	Not Helpful								Helpful

Through the semiotic table of the FreshBind application trial results, it can be seen that the FreshBind application received a fairly positive response from a total of 61 respondents. The FreshBind application is considered to have a fairly attractive and organized appearance, a modern-looking application design, complete and innovative features, clear navigation, informative content, useful for the community and quite relevant to the problem of Sustainable Development Goals number 2, and user-friendly. Based on the analysis of the semiotic table, the FreshBind application has met the requirements to be an effective application, with clear, informative, and easy-

to-understand interface elements, so that it is able to provide an optimal user experience and meet user needs and expectations. To help enhance the welfare of society and bridge the gap in food access, FreshBind has become an efficient and applicable tool. This application has come a long way and strives to improve the distribution of food all the while making sure that the issues pertaining to food security in specific regions are dealt with. FreshBind can be of great help to engage the users of the application by assisting members of the society to take charge in efforts geared towards donating fresh foods or tracking the needed goods. The design of the application is intuitive which, alongside a well-presented semiotic table analysis, helps to explain why FreshBind is the current and relevant food delivery application.

Data Availability Statement

The data supporting the findings of this study, "From Waste to Worth: Enhancing Access to Edible Surplus Food Using a Mobile App for Better Distribution," are available upon reasonable request from the corresponding author. Due to the inclusion of personal information gathered from participants during the user research and design testing phases, such as interviews and usability testing recordings, some data are not publicly available in order to protect participant privacy and comply with ethical research standards. However, anonymized datasets relevant to interface evaluations, design iterations, and survey results have been deposited in an open-access repository and can be accessed via the following URL: https://tinyurl.com/3e2c6cv09. Researchers interested in further collaboration or access to raw qualitative data may contact the corresponding author, subject to approval by the ethics review board and participant consent agreements.

Authorship Statement

This manuscript represents a collaborative effort among multiple contributors. To ensure transparency and proper attribution of each participant's role, we provide the following details on contributions: *Y. A. Kusumawati* developed the initial research ideas and theoretical framework, designed the research methods and procedures, including the data collection process, reviewed and revised the manuscript critically for important intellectual content and improved clarity. *V. Aurellia* wrote the first draft of the manuscript, incorporating the research findings and theoretical implications. *Lasmy* performed the data analysis and interpretation, ensuring accuracy and validity, supervised the project and provided overall guidance and mentorship throughout the research process. *K. Lukiyanto* contribute in generating data-driven insights and strategic frameworks that inform decision-making, and drive innovation. *C. S. Han c*ontribute significantly to shaping innovative, human-centered solutions that address complex societal, cultural, and technological challenges.

Each contributor has been acknowledged according to their involvement in the study, and their respective contributions have been documented to uphold the principles of open and transparent scholarship. We affirm that there are no conflicts of interest and that all contributors have agreed to the final version of the manuscript. This statement clearly outlines the specific roles and contributions of each individual involved in the research, ensuring that credit is accurately attributed and maintaining transparency in the research process.

Acknowledgement

This work is supported by Bina Nusantara University as part of Bina Nusantara University's BINUS International Research – Applied Entitled "Sustainable Development Strategies for Eco-Tourism Conservation In Edelweiss Wonokitri Tourism Village, Bromo Tengger Semeru National Park" with contract number 069C/VRRTT/III/2024 and contract date: March 18, 2024.

References

[1] Muna, Abida. (2024). The Global Food Crisis: How Geopolitical Conflicts and Climate Change are Disrupting Food Security. 10.13140/RG.2.2.33878.66889.

[2] Nicastro, Rosalinda & Carillo, Petronia. (2021). Food Loss and Waste Prevention Strategies from Farm to Fork. Sustainability. 13. 23. 10.3390/su13105443.
[3] Gustavsson, J. & Cederberg, Christel & Sonesson, Ulf & Otterdijk, R. & Meybeck, Alexandre. (2011). Global Food Losses and Food Waste- Extent, Causes and Prevention.
[4] Boiteau, Jocelyn & Pingali, Prabhu. (2023). Can we agree on a food loss and waste definition? An assessment of definitional elements for a globally applicable framework. Global Food Security. 37. 100677. 10.1016/j.gfs.2023.100677.
[5] Reuveni, Saada. (2025). The Role of Food Prices and Market Access in Contributing to Hunger in Low-Income Populations. Eximia. 14. 69-96. 10.47577/eximia.v14i1.531.
[6] Boni, Annalisa & Ottomano Palmisano, Giovanni & De Angelis, Maria & Minervini, Fabio. (2022). Challenges for a Sustainable Food Supply Chain: A Review on Food Losses and Waste. Sustainability. 14. 16764. 10.3390/su142416764.
[7] Ritha, Madhu & Nedumaran, G. (2025). Online Food Delivery Apps in the Modern Era: A Contemporary Perspective. ComFin Research. 13. 1-12. 10.34293/commerce.v13i1.8357.
[8] Ishangulyyev, Rovshen & Kim, Sanghyo & Lee, Sang. (2019). Understanding Food Loss and Waste—Why Are We Losing and Wasting Food?. Foods. 8. 297. 10.3390/foods8080297.
[9] Putra, Andi & Tong, Guangji. (2020). Food Security Challenges in Rapidly Urbanizing Developing Countries: Insight from Indonesia. Sustainability. 12. 10.3390/su12229550.
[10] Tarmidzi, A. F., Dewi, A. F., Suhartono, B. H., Mufida, N. F., & Rahma, Osyida A. (2023). Seminar Nasional Teknologi Dan Sistem Informasi (SITASI). Inovasi Zero Food Waste Melalui Aplikasi Donasi, 6–7.M.
[11] Juniantari, Made & Ulfa, Saida & Praherdhiono, Henry. (2023). Design Thinking Approach in The Development of Cirgeo's World Media. Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI). 12. 42-55. 10.23887/janapati.v12i1.55203.
[12] Roth, Robert. (2017). User Interface and User Experience (UI/UX) Design. Geographic Information Science & Technology Body of Knowledge. 2017. 10.22224/gistbok/2017.2.5.
[13] Bintang, N., Sumpena, Setiawan, W., & Raharja, A. (2024). Journal of Computer Science Advancements. Design Android-Based Mobile Food Vendor Location Search Application, 2(1), 48-51
[14] Rohimah, A., Lestari, M., Supriyatna, J., Setiawan, A. A., Dandang, & Ardiansyah, R. (2023). Jurnal Soma. Distribusi Bantuan Bahan Pangan kepada Warga Kampung Bunar, Desa Sukatani, Kec. Cisoka, Tangerang, 12(3), https://doi.org/10.22236/solma.v12i3.12754
[15] Prasetiyo, A., Pertiwi, E.G., Bagja, B.R. (2023). Askara. Perancangan Desain UI/UX Aplikasi E-Commerce Bahan Pangan di Pasar Wage Purwokerto, 2(1), 42-47.
[16] Foster, Mary. (2019). Design Thinking: A Creative Approach to Problem Solving. Management Teaching Review. 6. 237929811987146. 10.1177/2379298119871468.
[17] Rathee, Rupa & Rajain, Pallavi. (2019). Role Colour Plays in Influencing Consumer Behaviour. International Research Journal of Business Studies. 12. 209-222. 10.21632/irjbs.12.3.209-222.
[18] Apriyansyah, Bahalwan & Malak, Naufal & Bhawika, Gita & Agustin, Harisatul & Himma, Ika. (2024). The Effect of Orange Color Usage on the Brand Element of the Attributes of Shopee Food Driver Partners Towards Brand Personality. Procedia Computer Science. 234. 909-919. 10.1016/j.procs.2024.03.079.
[19] Gumber, Sugandha. (2023). MINIMALISM IN DESIGN: A TREND OF SIMPLICITY IN COMPLEXITY. ShodhKosh: Journal of Visual and Performing Arts. 4. 10.29121/shodhkosh.v4.i2.2023.539.
[20] Sudirjo, Frans & Dewa, Dominica & Kesuma, Lucky & Suryaningsih, Lilik & Utami, Eva. (2024). Application of The User Centered Design Method To Evaluate The Relationship Between User Experience, User Interface and Customer Satisfaction on Banking Mobile Application. Jurnal Informasi dan Teknologi. 7-13. 10.60083/jidt.v6i1.465.
[21] Hsu, Shang & Chuang, Ming & Chang, Chien. (2000). A Semantic Differential Study of Designers' and Users' Product Form Perception. International Journal of Industrial Ergonomics. 25. 375-391. 10.1016/S0169-8141(99)00026-8.