Upcycling Mobile App as a Way to Raise Awareness About Sustainable Living and Decrease Fashion Waste

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Abstract. Upcycling aims to reduce clothing waste by turning clothing waste into functional products with higher value. This research aims to design the user interface for the Upcycle app as an app where users from the Upcycle community, upcycle activists, and clothing waste owners can meet, collaborate, and participate in the production of recycled products. Creating intuitive navigation with clear and intuitive menus, categories, and sections may help to educate people about the environmental impact of clothing waste and develop their upcycling skills to encourage their engagement in sustainable practices. And it also aims to increase awareness of recycling activities and sustainable lifestyles and reduce fashion waste and the negative stigma of recycled products in society.

1 Introduction

The fashion industry is one of the most polluting industries in the world. One of these funders is Indonesia, which is included in the top 10 largest textile-producing countries in the world [1]. Due to the long chain of the production process, which goes from the beginning of the industrial production process to the hands of the consumers of the product, the impact of production waste in the fashion industry varies from water pollution to the use of dyes, gas emissions, and soil contamination through synthetic microfibers in fabric processing [2]. According to [3], 64% of the 32 billion pieces of clothing produced each year end up in landfills, and 95% of this clothing is still suitable for reuse or recycling. In recent decades, clothing production has increased by 8-11%, but only 12% is recycled. The growth in clothing production was supported by demand trends and an increase in the number of clothing purchases by consumers. This phenomenon is known as fast fashion, where rapid trend changes and high levels of consumption cause the production of the fashion industry to grow rapidly, using various available resources [4]. One of the negative impacts of fast fashion is the consumption or behaviour of people when dressing. Consumers have many options for disposing of unused clothing, such as donating, selling, or burning it [5].

Various steps have been taken in the industry to reduce clothing waste and environmental footprint by using alternative materials or recycling used clothing into raw materials for new clothing. For consumers, the alternative is to reduce unnecessary clothing purchases and reuse existing clothing through recycling. Upcycle is an effort to reduce clothing waste by turning unused clothing into other functional products. Recycling is a way to reduce clothing waste that we and the general public as clothing consumers can do, however, in terms of recycling, there are still some hurdles in Indonesia. Public awareness of fashion waste disposal in Indonesia is still very low, including recycled products which continue to carry a negative stigma. The community still has an unfavourable attitude towards recycled products because the raw materials are used materials. They believe that recycled products are not properly sanitized. Also, most people are unaware of the harmful effects of this fashion waste. Adding to the problem of the negative stigma attached to recycled products, most Indonesians are unaware of recycling options for their clothing waste because fashion waste suppliers and facilities are still unregulated and hard to reach. Usually, people donate their clothes or throw them away because they don't know where to send their old clothes. For donations, this option can also lead to problems such as the accumulation of clothing that is not used by the donors and even the accumulation of clothing that eventually ends up in the landfill.

According to information from the Ministry of Environment and Forestry cited from [1], Indonesia produces 2.3 million tons of clothing waste. However, only 0.3 million tons are recycled or reused, and the rest is landfilled or incinerated (88%). 2 million tons of used clothing are consumer clothing that is no longer worn. At that time, independent fashion companies that made recycled products sprang up in Indonesia. They receive materials from community donations or production waste, but due to limited tools and facilities to sort the clothes before shipping, the donations they receive are sometimes
not according to the needs, so the processing process takes more time, and it can become a fashion waste if not used. Product sales are also hampered by a lack of awareness of recycled products and a poor image. Therefore, alternative enforcement solutions allow people to direct their unused clothing through recycling activities or send their clothing to upcycle activists, indirectly increasing public awareness of recycling activities and helping reduce stigma. Negative associated with recycled products. The solution comes in the form of an app design because you can adjust the recycling process that is still done traditionally with technology and design that makes it easy for users to complete the process and is available to the public anytime, anywhere.

2 Literature Review

2.1 Definition of Sustainability

Quoted by [6], Sustainability or sustainable life according to the Oxford dictionary as: "capable of maintaining itself at a certain level, or "preserving the ecological balance by avoiding the depletion of natural resources". The simplest definition of life sustainable is that the level of natural resources and their consumption should be adequate Sustainability is about durable, non-destructive, and environmentally friendly products. In sustainable living, the concept of 3Rs is: reuse, reduce and recycle is considered one of the most popular solutions. In fact, when 4R was developed where the addition of elements was "repurchase" or repurchase. The 4R concept emphasizes the importance of reusing products made from recycled or recycled materials [6]. Based on the above theory, the sustainable living approach applied in this design introduces the concept of 4R buyback in the form of an upcycle.

2.2 About Upcycle

According to [6], the term "upcycling" was first coined by Reiner Pilz from Pilz GmbH in 1994 and describes the concept of adding value to old or used products. Recycling for the development of sustainable, affordable, innovative and creative products. For example, downcycling, the opposite of upcycling, produces rags from used T-shirts, while upcycling turns these T-shirts into new products, such as unique rugs and blankets [6]. According to [7], the upcycle process is divided into 3 stages, namely collection, classification and processing. The collection is the process of collecting products discarded by consumers. The grading process works to check and grade products based on their quality and type. Sorting clothes is a subjective process and requires a lot of standardization. Everything is done in two stages, namely:

1. In the first stage, residues and goods that are still good are distinguished.

2. In the second stage, the clothing products that can still be worn can be classified according to type and style.

Sorting is done manually in most cases [7]. The final stage is a process that includes various activities such as cleaning, repairing, and redesigning old products to restore functionality and increase utility. As for the design to be made, the designed application must support the above two recycling collection and sorting processes using technology to make your own recycled products, which is the final process for the purpose of recycling activists. The research project will be focusing on how the visual UI will imply to encourage and motivate people to reduce fashion waste and improve sustainable living.

2.3 Understanding Fast Fashion

Fast fashion is a term used to describe cheap and affordable clothing that adapts very quickly to the needs of the latest trends. Fashion is a medium of self-expression that is increasingly characterized as a commodity that has a short shelf life, impulse purchases, and high market demand [6]. The rise of the Internet combined with the spread of technology combined with digitization has led to the rapid spread of information and trends, giving consumers more choice [6]. As consumers demand more new trends and fashions in a short period of time, clothing brands are also rapidly adopting designs, with new designs hitting stores in as little as 3-5 weeks. Fast fashion makes consumers buy more and more throwaway clothes because people see clothes as short-term products [6]. According to a survey by [5], 3 out of 10 Indonesians throw away their clothes after wearing them once, and most throw away their clothes after wearing them only 7-8 times. They throw away their clothes because they are bored and do not follow the fashion. 66% of Indonesians choose to donate clothes, 12% sell used clothes online and 10% trade clothes for new things. They are no longer using. From the above data, it can be concluded that fast fashion and consumption are the main factors and problems of the large amount of clothing waste, resulting in a large amount of unused clothing waste, which is the focus of this research.

2.4 Definition of Clothing Waste

According to [1], ordinary clothing waste is divided into two categories: pre-consumer and post-consumer. In its application, the clothing waste on which the handling is focused is used clothing waste, that is, clothing waste that originates from consumers in the form of ready-to-wear clothing. These residues are usually seen in the Final Disposal Site (TPA) [6].

2.5 Upcycling benefits

Upcycle is an attempt to increase the functionality of a product to a higher level. Recycling is a way to revive existing products that may not be used and are mostly wasted [8]. Garment recycling activities can increase consumer interest in extending product life. According to [6], clothing consumers respond positively to appearance, reliability, cost, and a preference for recycled clothing. Recycled clothing can become a market to create a circular and sustainable environment. Fashion trends in the clothing industry change rapidly and certain designs
and trends become irrelevant after a certain period of time. Therefore, it is important to increase interest in recycled products. Redesigned clothing increases the reuse of goods by reducing dependence on natural resources and increasing aesthetic value [7].

3 Methodology
This study employs a qualitative technique, expert sources, and user observational analysis to improve the application’s characteristics and technology.

3.1 Qualitative Method
Qualitative data collection was carried out through interviews with fashion waste removal contractors. Pak Gema Minang, as Chief of Operations Setali Indonesia, Setali Indonesia, an organization dedicated to eliminating fashion waste by accepting used clothing donations from individuals, communities, or other organizations that are also involved in creative processing through recycling and upcycling. Starting with the collection, sorting, and processing of old clothes. The capture process uses a Google Form captured via chat, which makes the process less flexible. Clothing collected by a collection system is sent to the Setali warehouse, where the clothing is sorted by appropriate category and type and processed by upcycling, recycling or repair. This sorting process is very time-consuming because you receive a lot of clothes in a short time. Currently, the fashion waste problem is still considered an underestimated problem by the community at large due to the lack of awareness of the importance of this fashion waste problem. However, some people find the design uncomfortable and there are hygiene issues such as getting dirty even after washing and cleaning.

Then interview recycling activists and people who recycle. Fashion designer Najua Yanti, a member of the Indonesian Chamber of Fashion. She practices the principles of sustainability, one of which is upcycling, in running the business and producing her products. Validation data was gathered from this interview regarding the concept of upcycling, a method of turning unused or discarded materials into new forms and adding new value. The processes associated with recycling activities are the collection, sorting, design, and production of recycled clothing. The collection and classification of garments is the longest process since it takes between 1 and 6 months. Najua often uses leftover materials to make upcycled products, depending on the collection and designs she creates. Materials that are not available are purchased or searched for on a website called Auction.com, a website created by designers for charity through clothing distribution, last stock available, or for resale. Najua added that although public awareness of recycling activities is still low, the enthusiasm of the community is applied in everyday life, and high-quality recycling products have their own uniqueness.

Interviews with technical sources were conducted Mr. John Keating, the Academy's design mentor, who studies application development, design, and coding based on Apple technologies from a business perspective, to learn about technical resources. John emphasizes that most design decisions are based on user input or the desired feel of the app. B. Artwork style and colour options. He can define the font size and grid layout compared to the existing layout system. According to Mr. John, contrast is very important for user accessibility, as it makes it easier for them to navigate the app and interact with elements.

3.2 Observational Analysis
Observation analysis in this application is a collection and classification process. Both processes are time-consuming and complex enough for technology to support. Part of the functionality of the Fine Waster app is the ability to share project ideas. This feature simplifies the sorting process by providing information to other users about the clothing they need and the status so they can customize it. Collection process, this feature facilitates the collection process. Providing a unique address and shipping method between the thrift store and the project owner ensures that the collection process is efficient and secure. This feature allows users to view the progress and achievements of their projects to see the progress of the projects they have contributed to, so that they can participate in the implementation of the project and ensure that the clothes they have contributed are used and recycled correctly and have a higher value. This feature also allows project creators (recyclers) to share their work with multiple people. This feature can be very helpful in reducing the bad stigma of upcycling and increasing the opportunities for upcyclers or project creators to sell their products on the market.

4 Result & Discussion

4.1 Application Concept
The application developed is called Finewaste. It comes from the English words 'fine' which means 'good or good' and 'waste' which means 'garbage' or 'garbage'. Finewaste reflects the activities carried out in this application. That is, to make something good out of garbage and waste. In this context, it is clothing waste. Finewaste is an app that helps recyclers create awareness of sustainable living and the environment by incorporating the recycling process into the app. Recyclers and clothing waste owners who share materials, contribute, collaborate, and promote can make the recycling process easier, and efficient. The main characteristic of Finewaste is the fusion of used clothing with the aim of creating recycled products. Based on the research data obtained,

Finewaste is an application with the following values:
- Creativity because the application supports recycling activities. This is a creative activity in the eyes of society.
- Collaboration and contributions between project owners and clothing vendors create a tight-knit community.
- Continuity. Finewaste's mission is to support sustainable living by reducing clothing waste.
The functionalities implemented in the interface design integrate the initial collection and sorting process until it is designed in the hands of upcycle activists. As can be seen in the research carried out, the collection and classification process are two very complex and slow processes that can be assisted with the help of technology. Features of the finewaste app include:

1. Share recycling project ideas. This feature allows users to upload the project they are currently working on and the requirements needed to create the project. This feature simplifies the sorting process by giving other users information about what clothes they want, what condition they want it in, and allowing them to customize it.

2. Collaborate on project ideas related to the characteristics of the previous points. This feature allows users to customize the clothes they have with the needs of the users who have the project. As a result, used products and clothing once entrusted to project owners will not be thrown away.

3. Pickup Process – This feature can simplify the pickup process by providing a clear address and shipping method between the two parties, the thrift store and the project owner. Make sure your debt collection process runs efficiently, securely, and reliably.

4. View the progress and achievements of the project. This feature allows users to see the progress of projects they have contributed to, so they can participate in project creation and know what they are wearing.

Your donation will be put to good use and will result in higher-value recycled products. This feature also allows project authors (recyclers) to share their work with multiple people. This feature reduces the negative image of upcycling and increases the opportunities for upcyclers and project developers to sell their products on the market. Finewaste uses digital media as its main platform in the form of apps.

According to [9], here are some reasons to use the app over other digital media that can be applied to Finewaste.

- By leveraging the capabilities of existing phones, multimedia application implementations offer flexibility in terms of using the capabilities available through the phone itself, such as the use of the camera and GPS that Finewaste needs for project collaboration.

- Notifications are included, which allows the user to know quickly and in real time when the user is participating in a project or following a delivery in progress through the application.

- Layout and navigation flexibility that provides convenience and reduces user time by using the tab bar for more efficient navigation or with gestures like swapping, tapping. This is more difficult to achieve with other digital media, for example, websites that must be accessed from a home page and rely on browser capabilities such as the back button, and the refresh function.

4.2 Communication Strategy

Finewaste is an app where users, both clothing waste owners and upcycle activists, can exchange materials to encourage the production of upcycle products. Therefore, the communication target of this app is clothing waste owners and recycling activists.

4.3 User Experience Design

This user experience design approach supports the author in obtaining research data and building an application that is suitable for the intended user.

![User Persona Target 1](source: Devina Ranlyca)

This persona was also created for the application's current prototype, as shown in the Figure 1. This enables the author to map out the behavior patterns, pain points, goals, and wants of the target users. Figure 1 shows women between the ages of 18 and 25 who are often into fast fashion.

![Application Information Architecture](source: Devina Ranlyca)

Figure 2 illustrates the application information architecture includes the content and capabilities found in the application pages so that you can easily find the necessary navigation from one page to another when developing user flows. Once the information architecture is created, the following are the user flows that are carried out:
Figure 3 illustrates the user flow is based on scenarios (use cases) that users encounter when using the application.

Figure 4 shows the wireframe was digitally fine-tuned using Figma software, and the screen from the lo-fi prototype became the basis for the hi-fi prototype. The visual identity used in this phase consists of layout design and the use of typography before becoming a high-fidelity prototype with additional colors and illustrations.

5 Visual Design

5.1 Design Development

The created logo has a correctly readable logogram and logo elements, which means it matches the theme of the app. The logogram seems to be in the shape of the letter F which stands for Finewaste, because the upcycle app and the different colors of the logo represent a well-known clothing recycling technique, namely Patchwork. This is in line with the Finewaste app which aims to recycle, that is, turning unused clothing into new, more valuable products.

Figure 5 shows the Finewaste logo complete with a logogram representing the famous upcycling technique, Patchwork.

Figure 6 shows the detailed structure of the Finewaste logogram with a comparison of the scale (above) and the appearance of the icon to be used in the Finewaste application (below).

The illustration style used follows defined keywords, visual focus, tone, and manner, i.e. joy, connection and creativity, using dynamic elements outlined with a predefined color palette. The graphic elements used follow the Finewaste theme, using recycled clothing and tools to make recycled clothing to highlight one of the goals of the show, namely reducing clothing waste.
Figure 7 shows the style of illustration according to the keywords and graphic elements using pieces of clothing and tools to make upcycle clothing.

![Figure 7 Illustration](source: Devina Ranlyca)

Figure 8 shows the illustration used for the onboarding and icon button for the Finewaste app.

The icon style used in the application is an outline style, in accordance with the illustration style compatible with the choice of communication destination preferences. Icons in an outline style filled with palette colours are used on the main page as category illustrations to make it easier for users to navigate the application.

![Figure 8 Illustration](source: Devina Ranlyca)

Figure 9 shows the category icons in an illustrated style according to the preferences of the communication target.

![Figure 9 Icon Category](source: Devina Ranlyca)

5.2 Design Development

Based on the shapes and drawings provided, the final application view or Hi-Fi prototype is applied to the finished Lo-Fi design. At this stage, the appearance of the application has reached the prototype stage, where the created UI design can be clicked or used to remember future operations of the application. Below is an overview of the finished app, including all the app's features.

![Figure 10 The entire application view](source: Devina Ranlyca)

Figure 10 shows the complete Finewaste application prototype created with Figma software and its details and interactive flow.

![Figure 11 Finewaste application view](source: Devina Ranlyca)

Figure 11 shows a final Hi-Fi prototype whose interface will be the same as the application later on.

6 Visual Design

The visual communication design of the upcycle app UI design called Finewaste aims to provide convenience and efficiency in the implementation of upcycle communication objects, reduce the stigma towards upcycle products, and most importantly, Of course, raise awareness about sustainable living and acting early on, which helps reduce clothing waste or fashion waste. To achieve this goal, a playful twist has been given to the design that creates a positive impression and stimulates the user's creativity in using the app. This applies to the elements that make up the appearance of the application, such as the use of bright and fresh colors, minimalist icons, legible fonts, and dynamic flat vector images in a sketch style, screens, and images to use. The results of the application visualization are then tested in the usability testing stage for potential users to validate concepts and solutions related to the problems created. Based on the
results of the usability test, the concepts and functions of the application are easy to understand, and positive feedback on the images made is appreciated. In the future, this app will potentially allow users to create and join collaborative upcycling projects so they can even work remotely with the same initiative to engage in sustainable living. Moreover, this app perhaps will also contribute to a high impact in research on the significant environmental and waste impact of the fashion industry.

Acknowledgment

The independent research paper has been accomplished as required as faculty member in Bina Nusantara University.

References