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A Smartphone Application Facilitating Sustainable Fashion

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Abstract

This paper aims to present a novel approach to promoting sustainable fashion in India through the development of a smartphone application. The fashion industry has come under intense scrutiny due to its significant environmental and social repercussions, thereby making sustainability a critical concern both on a global scale and in India. According to the United Nations Environment Programme, the fashion industry is a major contributor to carbon emissions, accounting for 8-10% of total carbon emissions. This alarming statistic highlights the fashion industry's substantial environmental footprint, surpassing the combined carbon emissions from two major global sectors: international flights and maritime shipping. The primary objective of this study is to bridge the gap between sustainable fashion and the Indian public by leveraging the ubiquitous presence of smartphones. This study employs qualitative and quantitative research methods comprising surveys, contextual interviews, and market analysis. The survey received 262 responses, serving as a vital instrument for gauging the level of awareness concerning sustainable fashion. The survey and the contextual interviews highlighted opportunities to address existing barriers and foster greater adoption of eco-friendly fashion practices and products. The variation in awareness levels for sustainable fashion among respondents from different age groups highlighted the need for a solution. Hence, the proposed app aims to educate and engage consumers in sustainable fashion practices while providing easy access. By combining education, accessibility and engagement, the application offers a unique platform to sustainably spark the public's interest and encourages them to make more eco-conscious choices. In the future, the app can incorporate augmented reality (AR) technology for virtual clothing try-ons and supply chain exploration, elevating the user experience. This immersive approach to sustainable fashion engagement could revolutionise how consumers interact with and make informed choices about eco-conscious clothing, further promoting sustainability in the fashion industry.

Keywords: Sustainable fashion; Smartphone application; Awareness; Environmental impact; Eco-conscious

1. Introduction

The fashion industry wasn't always as destructive as it is now. Buying new clothes used to be an occasional experience that happened a few times a year in response to changing seasons or outgrowing our existing wardrobes. However, 30 years ago, there was a shift. Prices dropped, fashion cycles quickened, and shopping became a weekly pastime for many people. The advent of fast fashion brought about a radical shift in consumer behaviour [1]. Fast fashion is characterised as affordable, stylish apparel that quickly and furiously transforms concepts from the catwalk or celebrity culture into finished items to satisfy customer demand. The goal is to get the newest fashions available as soon as possible so that consumers may buy them while they're still quite trendy and then, regrettably, throw them away after a few wears. It reinforces the notion that repeatedly dressing in the same clothes is a fashion faux pas and that one must wear the newest styles as they emerge to be current. It plays a significant role in the destructive system of overconsumption and production that has made fashion one of the leading pollutants in the world [1]. Amid the myriad concerns associated with the rapid fashion

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industry's explosive growth, the significant environmental repercussions stand out as a major worry. To produce garments, the fast fashion sector outsources its manufacturing operations to countries with low labour costs, thereby circumventing the stringent minimum wage regulations enforced by numerous developed nations. The consequences of fast fashion are not without their costs. Consequently, it becomes our responsibility as consumers to seek out alternative approaches for addressing the often-overlooked environmental consequences of this form of consumerism. Our society's consumption levels have seen a substantial increase in recent decades. While this surge may offer economic advantages, it has led to a higher number of items being disposed of in landfills. This is primarily due to the limited durability of lower-quality garments, which often wear out after just a few washes, prompting the need for frequent replacements [2]. Sustainability encompasses the principle of meeting the present generation's needs without jeopardising the requirements of future generations, all the while maintaining a harmonious equilibrium between economic advancement, environmental stewardship, and social welfare. Within the realm of environmental sustainability, the emphasis is placed on preserving biodiversity without sacrificing economic and societal development. The core tenets of environmental sustainability include protecting water resources, energy conservation, waste reduction, adopting recyclable packaging, minimising or eradicating plastic usage, promoting sustainable transportation methods, reusing paper materials, and safeguarding the diverse ecosystems of plant and animal life [3]. The planet faces challenges like soil degradation, deforestation, and greenhouse gas emissions. The fashion industry contributes 5% to 10% of global greenhouse gas emissions, but the issue goes beyond the environment. Unethical labour practices, low wages, and harmful chemicals in clothing are part of the problem. Ethical manufacturing lies at the core of the sustainable fashion movement, guaranteeing fair treatment for workers and environmental preservation through strategies like minimising water consumption. This aligns closely with following global guidelines that establish safety, quality, and environmental consciousness standards in production processes [4]. Considering the current gap between sustainable fashion awareness and consumer behaviour, how can sustainable fashion practices be advanced in India? Fashion brands face challenges in addressing consumer sentiment and demand, with many consumers unaware of the adverse environmental effects of fast fashion and the advantages of sustainable clothing. India's burgeoning fashion industry, buoyed by a growing middle class and robust manufacturing sector, is poised to make significant contributions to the global fashion market, with the Indian apparel market forecasted to reach $59 billion by 2022. However, a considerable segment of India's population, particularly the Gen Z demographic, has been raised in a culture where fast fashion prevails, potentially hindering their appreciation for sustainable fashion [4]. One obstacle hindering the adoption of sustainable fashion among Indian youth is the perception that it is more costly than fast fashion. Moreover, they encounter difficulties in identifying and procuring eco-friendly clothing. Additionally, a lack of education and awareness regarding the environmental and societal impacts of fast fashion may impede Indian youth from recognising the benefits of sustainable fashion and viewing it as a viable alternative [5].

1.1. Objectives of the research

This paper presents an innovative approach to promoting sustainable fashion in India through a smartphone application. Utilising a blend of qualitative and quantitative research methods, including market analysis, contextual interviews, literature study, and surveys, the study aims to enhance awareness of sustainable fashion practices. With 262 survey responses, the research gauges the Indian population's awareness of sustainable fashion, supplemented by field research and interviews at shopping malls to uncover user preferences and attitudes. Age-related disparities in awareness levels are identified, emphasising the need for a targeted approach. The proposed smartphone application aims to educate and engage consumers in sustainable fashion practices, prioritising accessibility. The paper includes discussions on implementation, limitations, and future scope, organised into relevant sections reviewing works, introducing methodology, discussing results, and concluding with a summary of findings.

2. Related Works

2.1. Literature Study

Sustainable fashion is gaining popularity globally, with consumers becoming more conscious of their purchasing decisions' environmental and social impact. The sustainable fashion industry is currently worth over $6.5 billion and is expected to grow to $10.1 billion by 2025, with an estimated CAGR of 8.7% since 2015 [8,9,10]. In India, 89% of Indians surveyed claimed to buy sustainable and eco-friendly fashion, making Indian survey participants the most eco-conscious dressers of all surveyed countries [11]. The sustainable fashion market in India is expected to grow at a CAGR of 10.6% during 2021-2026. The report also suggests that the market’s growth will be driven by increased consumer awareness, government initiatives, and the availability of sustainable materials. The Indian sustainable fashion market is estimated to reach $9 billion by 2025 [12,13]. Attitudes, societal norms, environmental awareness, and care for the environment greatly impact purchasing intention. The perceptions of consumers regarding their activity do not always accurately predict their actual purchasing behaviour; nonetheless, the purchase of eco-friendly clothes was greatly impacted by societal norms and environmental understanding [14]. However, with all this being said, it has been demonstrated that customers are often sceptical about embracing sustainable consumer behaviour changes. This phenomenon is typical of industries that interchange items quickly and sell sustainable products. Although some apparel and fashion firms are attempting to alter their operations and incorporate sustainable practices, genuine market change is impossible without customers. Customers' growing worry over fashion businesses' unethical practices has been demonstrated; however, this concern is not always evident in their actions [15]. According to certain studies on consumer behaviour, a person's overall concern for social and environmental well-

being, their opinion of sustainable fashion, and their prior engagement in ethical consumer behaviour all influence how they feel about sustainability when purchasing apparel [16].

2.2. Background and prior art

While there are brands and smartphone applications that are catering to the need for sustainable fashion and promoting it, they are still falling short on a few parameters. Brands like Poshmark avail reselling of clothes to promote the concept of "thrifting" or "pre-loved clothing". Poshmark is an online marketplace that enables vendors to post their products and consumers to purchase them. When the perfect buyer comes along, they can buy the item or make an offer; the seller gives images, details, and a price. Poshmark sends the seller a mailing label after the item sells, which they print, attach to the package, and mail to the USPS [16,18]. There are also brands in the market solely focused on selling sustainable clothes made from either recycled or eco-friendly materials. No Nasties is one of the biggest brands in India focused on ensuring high labour, safety, and well-being standards for workers. No Nasties uses 100% organic cotton in the production of their apparel, promoting sustainable and eco-friendly practices [18]. The clothing and apparel are still expensive and not easily catered to the regular audience. The primary gap lies in the absence of a platform that offers both enduring fashionable clothing and a resale feature for unwanted items. This dual functionality promotes sustainability and encourages thrifting. Thrifting refers to the act of shopping at thrift stores, consignment shops, or online platforms to purchase secondhand or used clothing, accessories, and other items [19].

2.3. Research Gap

A critical gap in current research is the absence of a unified platform that effectively combines sustainable, enduring fashion with a resale feature for unwanted items. This dual functionality is crucial for fostering sustainability in the fashion industry and promoting thrifting. The lack of exploration in current research regarding platforms merging these elements poses a significant gap, demanding attention, and investigation. Addressing this gap would contribute valuable insights to sustainable fashion, providing practical solutions for environmentally conscious consumers seeking economically viable alternatives in their clothing choices.

3. Methodology

The Double Diamond design process is a widely used methodology for identifying problems and developing solutions. The process is divided into four phases: Discover, Define, Develop, and Deliver (Figure 1). The Double Diamond model represents a process of exploring an issue more widely or deeply (divergent thinking) and then taking focused action (convergent thinking) [20, 21]. In the study approach that is being used, the first stage entails a concerted attempt to fully comprehend the problem that is being faced, emphasising engaging directly with those directly impacted by the difficulties rather than making assumptions.

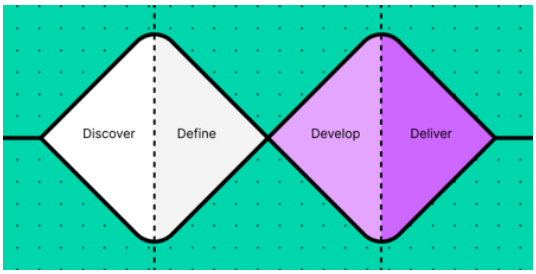

Fig. 1. Double Diamond Process

Spending a lot of time in the community and having meaningful interactions are part of this discovery period. After that, the description of the study issue is significantly altered by the insights gained from the discovery phase, which provides a new viewpoint and a more sophisticated comprehension. Then, in the development phase, a wide range of solutions are put forth to deal with the problem, which is now well-defined. This stage promotes creative solutions to the research challenge by embracing a co-design approach involving a variety of stakeholders and taking inspiration from outside sources. The delivery phase, the last stage, entails testing various solutions on a modest scale in real-world scenarios. Solutions that show promise are improved for further development in this iterative process, while those that prove useless are discarded. This deliberate process guarantees a flexible and adaptable approach, increasing the likelihood of producing significant and long-lasting results [21,22].

4. Results

4.1. Define phase.

In the define phase, an elaborative survey was conducted with users. A total of 262 responses were received from the study. The following data was gathered.

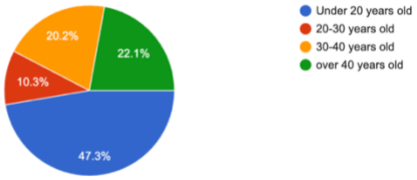

Fig. 2. Age groups in the survey

The primary users were aged between 15 to 35 and predominantly women, expressed diverse clothing preferences in a survey covering various age groups, gender identities, and employment statuses. The majority focus on purchasing tops (84.4%) and bottoms (56.1%), emphasising the importance of comfort (83.6%), quality (79.8%), and price range (74.4%). Insights revealed that only 27.9% actively follow fashion trends, guiding decisions on design emphasis. Spending habits indicated that 68.7% of users typically spend between Rs. 1,000-5,000, and a significant portion (86%) still prefer purchasing clothes from physical stores, with nearly half using their clothes for 1-3 years. 89% of respondents are concerned about the fashion industry's social, environmental, and ethical

impacts. However, nearly 70% of the target users have never purchased environmentally friendly or sustainable items, citing reasons such as higher costs, limited options, and concerns about fashion and quality. While 54% are open to buying second-hand clothing, 46% face hurdles due to hygiene and quality concerns. Approximately 60% of users would choose sustainable clothing, even at a higher cost, if style, comfort, and quality are equal. Furthermore, 50% are willing to pay up to 5% more for sustainability, with varying levels of willingness among the rest. Following the completion of the research phase, we initiated the affinity mapping process (Figure 3) to sift through the gathered information systematically. This method facilitated the synthesis and organisation of findings by identifying patterns and themes. Through this approach, we methodically documented user requirements and pain points. Ultimately, this enabled a more effective understanding of the problems faced by the users. The analysis that was derived was collated into user personas to understand the mental model of the end-user (Figure 4).

Fig 3. Affinity mapping

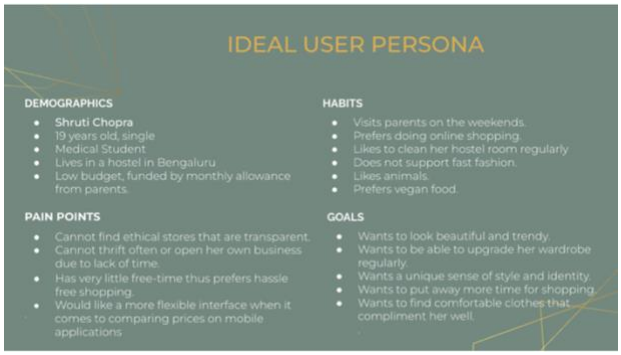

Fig 4. Ideal user persona

4.2. Solution Neutral Problem statement

With the research that was conducted, the following problem statement was derived. (SNPS)
The goal is to address the need for increased availability, accessibility, and a superior user experience in the market for a sustainable fashion brand.

4.3. Develop phase.

The process of task clarification was adopted. Task clarification is prioritising important requirements and possible constraints to propose solutions. Table 1 displays the requirements generated from the study's define and discover phase. The requirements were generated using different ideation methods such as brain dumping, mind mapping, sketch storming. Brain dumping involves adding ideas related to the SNPS. Mind mapping involves elaborating on each idea to create a network of ideas.

Table 1. Requirements

Serial Number	Requirements
1	The sustainable fashion app should/must feature a robust price comparison functionality that allows users to easily compare prices across various sustainable clothing items.
2	The app should/must include a user-friendly "sharing with friends" feature that allows users to effortlessly share their favorite products, recommendations, or other content within the app with their friends or contacts.
3	The system must/should include a robust "Buyer Count" feature that accurately tracks and displays the total number of buyers for each product or service. This feature must/should provide real-time updates, ensuring that users have access to current information on the popularity and demand for specific items.
4	The system must/should incorporate an efficient "Price Tracker" feature that enables users to monitor and track the pricing fluctuations of selected products over time.
5	The platform must/should provide comprehensive "Product Information" for each listed item, including details such as materials, manufacturing processes, and sustainability certifications.
6	The user interface must/should prioritize "Easy Navigation," ensuring an intuitive and seamless browsing experience.
7	The system must/should offer functionality for "Saving Filters and Sort Options for Future" use.
8	The platform must/should integrate a "Virtual Try and Buy" feature that allows users to virtually visualize how selected clothing items will look on them.
9	The system must/should support the "Creating Outfits and Saving Them" feature, allowing users to mix and match different products to form outfits.
10	The system must have a simple interface for easy navigation.

Using the requirements, a priority matrix was formulated to assess each criterion in relation to others. This evaluation aimed to determine the relative importance of product features from the user's perspective. The priority list of features was converted into cards to conduct card sorting (Figure 5). Card sorting is a research method used to group, label, and describe information more effectively based on feedback from customers or users. It is a technique that helps design or evaluate a site's information architecture [22]. Based on user card sorting, an information architecture was developed for the application (Figure 6). Information architecture is a discipline that deals with the organisation of information and the presentation of content, aiming to make information easy to find and understandable for users [23].

Priority	A	B	C	D	E	F	G	H	I	J	Total	Decimal	Place
A	-	7	5	4	8	10	6	9	8	7	64	0.64	8th
B	7	-	6	8	4	5	8	9	6	5	58	0.58	10th
C	10	9	-	6	8	7	8	8	10	9	75	0.75	3rd
D	10	10	9	-	9	9	10	9	8	7	81	0.81	2nd
E	6	7	8	9	-	7	8	6	7	9	67	0.67	6th
F	9	8	7	6	5	-	5	6	7	7	60	0.60	9th
G	9	9	8	6	7	7	-	5	6	8	65	0.65	7th
H	8	8	10	9	7	7	7	-	8	9	73	0.73	5th
I	9	7	8	8	9	9	10	8	-	6	74	0.74	4th
J	10	10	8	10	9	9	10	8	9	-	83	0.83	1st

Fig. 5. Priority matrix for features

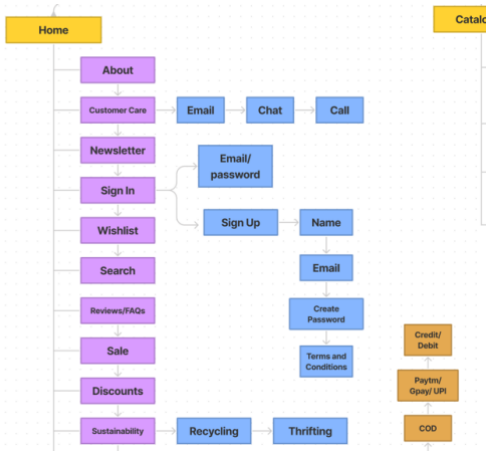

Fig. 6. Information Architecture for the application

After establishing the framework and flow of the application, preliminary pencil wireframes were created to comprehend the screen layout and the positioning of elements.

A design system was created to display the final elements, such as the colour palette, font, and icons, as well as any repeating elements that would be present throughout the application (Figure 7).

Fig. 7. Design system.

4.4. Mockup/Prototype

A prototype for the application, Heather, was developed, offering a user-friendly platform for selling sustainable clothing crafted from top-quality materials. The application ensured transparency in product information, including allergen details, and introduced a price tracker and comparison feature. A key focus was on recycling and thrifting, enabling users to contribute worn-out or damaged clothes for recycling. The thrifting section empowered users to resell items at their chosen price points. Additionally, an in-app sharing feature was incorporated, fostering a sense of community among users (Figure 8).

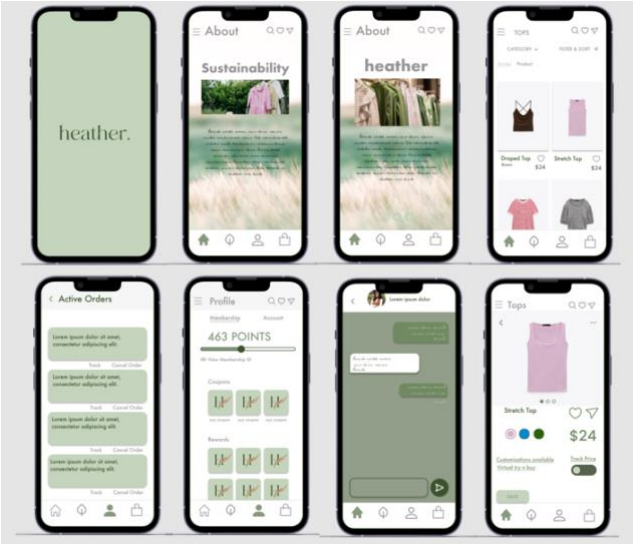

Fig. 8. Prototype

4.5. Stakeholder Validation

Additional validation and feedback were sought from apparel designers, aiming to gain insights into the application's target market and potential users, as well as the concept of thrifting. The designers expressed positive feedback regarding the application's concept, particularly highlighting its potential resonance with millennials and Gen-Z demographics. They recommended integrating a feature that suggests complementary products to enhance the appeal and fashionability of sustainable clothing, thereby further motivating adoption.

5. Discussions

Creating the Heather application prototype is a significant achievement, establishing a user-friendly platform for sustainable clothing transactions. The application's commitment to transparency, exemplified by detailed product information, allergen disclosures, and innovative features like the price tracker and comparison tool, reflects a dedication to user empowerment and informed decision-making. The strategic emphasis on recycling and thrifting within the application aligns seamlessly with sustainable fashion goals. By allowing users to contribute worn-out or damaged clothes for recycling and facilitating the resale of items at user-determined price points, Heather promotes environmental responsibility and empowers users in their consumption choices. The incorporation of an in-app sharing feature is recognised for fostering a sense of community among users, emphasising the collaborative and communal aspects of

sustainable fashion practices. This social dimension adds depth to the user experience, potentially enhancing user engagement.

6. Conclusion

The Double Diamond process facilitated a comprehensive and cohesive study segmentation, ensuring a user-centric approach to address Sustainable Fashion Practices' (SNPS) challenges. In the Discover stage, the literature study delved into fast fashion's impacts, sustainability's importance, and consumer perceptions. Primary research, encompassing interviews and a survey (262 responses), provided insights into user purchasing habits and constraints on sustainable choices. The Define phase generated requirements, employing methodologies like brain dumping, mind mapping, and affinity mapping. This approach guided the creation of a smartphone application, effectively mitigating the identified SNPS. The scope of the study should introduce usability testing as the next phase in the application's development. Usability testing will serve as a critical evaluation tool, providing insights into the application's user experience, identifying potential challenges, and informing iterative improvements. This approach aligns with the user-centred design philosophy, ensuring that the Heather application not only meets but exceeds user expectations, further solidifying its role in advancing sustainable fashion practices.

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