DROBE

FANTASTIC 4
Devela, Leon Marco
Evangelista, John Mikael
Paulos, Rae
Sevilla, Tristan Jay

EXECUTIVE SUMMARY

The fashion industry, particularly fast fashion, is a major contributor to environmental degradation, producing over 92 million tonnes of waste annually and accounting for 10% of global carbon emissions. In the Philippines, consumerism and social media exacerbate excessive clothing consumption, leading to significant textile waste. The DROBE app tackles this issue by promoting sustainable fashion through AI-driven wardrobe management and outfit recommendations, aiming to reduce reliance on fast fashion despite its affordability and trendiness.

DROBE's SMART objectives include reaching 50,000 active users, ensuring 70% of new users upload 80% of their wardrobe, facilitating 10,000 clothing trades, boosting engagement by 40% via gamified challenges, and offering sustainable styling suggestions within six months. Built using an Agile methodology, the app leverages user-generated data and fashion databases to optimize wardrobe use and support circular fashion. Challenges such as brand integration, AI personalization, scalability, and feature prioritization are addressed with standardized formats, machine learning, cloud solutions, and iterative development. Success is determined through user engagement, AI accuracy, marketplace activity, app performance, and sustainability metrics like CO_2 reduction. Aligned with SDG 12, DROBE encourages responsible consumption, aiming to mitigate fast fashion's environmental impact by maximizing existing wardrobes and fostering sustainable practices.

KEYWORDS

fast fashion, sustainable fashion, circular fashion, AI-driven wardrobe management, consumer behavior, environmental impact, SDG 12, agile development, user engagement, fashion industry

BACKGROUND

The fashion industry is one of the largest contributors to environmental degradation, with fast fashion leading to excessive waste, high carbon emissions, and unethical labor practices. With over 92 million tonnes of waste produced by the industry annually and an estimate of it rising to 134 million tonnes by the year 2030, this steady incline poses a severe environmental threat (Matthews, 2024). Moreover, the industry alone accounts for over 10% of all global carbon emissions, further exacerbating the effects of climate change and the space it takes up in dedicated landfills (Maiti, 2025). This rapid turnover of clothing trends, driven by consumerism and the affordability of low quality, mass-produced garments, fuels the problem of overproduction and waste.

In the Philippines, the fast fashion industry has rapidly expanded, driven by the rise of large retail clothing brands (Bigtas, 2019). Due to social media and a consumerist mindset of the Filipino people, coupled with the influence of celebrity endorsers and influencers alike has created a culture of constant wardrobe makeovers, leading to excessive consumption and the disposal of clothing apparels at an alarming rate.

THE PROBLEM

Fast fashion promotes an excessive amount of garments consumed or bought, most of which are only used a handful of times. This cycle of consumption and not fully utilizing garments results in the increase of material waste that greatly damages the environment because of the land it takes for the waste produced pre and post production of clothing apparels.

LITERATURE

Over the past few decades, clothing production and consumption have surged due to rapid population growth, rising global incomes, and higher standards of living (Shirvanimoghaddam et al., 2020). With that said, rather than prioritizing sustainability, the industry focuses on rapid trend cycles, resulting in excessive consumption in order to maximize profit (Kozlowski et al., 2018).

The fashion industry is ranked amongst the highest polluting industries in the world (Grazzini et al., 2021). The environmental impact of the waste produced annually goes beyond landfills, water pollution, carbon emission, and also resource depletion.

Although the industry has taken various measures to reduce its environmental impact, the rapid rate of consumption continues to outpace these sustainability efforts, making it difficult to achieve meaningful and lasting progress in environmental conservation (Fletcher, 2016).

Consumer behaviour significantly influences the sustainability of the fashion industry. The affordability and accessibility of fast fashion encourage excessive purchasing and short garment lifespans, contributing to high levels of textile waste (Niinimäki et al., 2020).

It is important to note that even though the consumers at the grassroot level are the ones actively purchasing clothing, there should be a responsibility shouldered by the governing bodies, industry regulators, and policy makers (Niinimäki et al., 2020). Without combined proactive (prevent and reduce) and reactive (reuse, recycle, and dispose) efforts by both parties, the cycle of overproduction will persist. However, consumers play a crucial role in

driving the shift towards sustainability. When consumers prioritize sustainable fashion, second-hand clothing, slow fashion brands, and locally made garments, it sends a strong signal to the industry that sustainability is a growing concern and not an afterthought.

To mitigate the environmental impact of fast fashion, the adoption of Circular Fashion and other alternative business models or services that include the resale of pre-loved clothing, rentals, and upcycling initiatives, presents a viable alternative to the traditional business model of mass producing clothing apparels (Medkova & Fifield, 2016).

Globally, there is an average of 25% of garments collected intended for reuse or recycling (Ellen MacArthur Foundation, 2017). However there are large regional differences such as countries like the USA and China, one of the largest consumers of fast fashion, only contributes 10% to 15% and some countries in Asia and Africa have no collection or recycling efforts designed specifically for clothing. Moreover, developed nations mainly just export old clothes to poorer parts of the globe. Although it may seem like a valiant effort, most clothes usually end up in landfills (Kozlowski et al., 2018).

OBJECTIVES

The following are the SMART objectives of the DROBE app, designed to promote responsible consumption and production under SDG 12 by maximizing the use of existing wardrobe and supporting sustainable fashion practices.

Grow to 50,000 active users within one year, encouraging them to rely on what they already own instead of buying new clothes.

Have 70% of new users upload at least 80% of their wardrobe within the first three months, promoting responsible use of existing garments.

Enable 10,000 clothing trades and form partnerships with 15 sustainable fashion brands in the first year to support circular fashion.

Increase daily active engagement by 40% in nine months by introducing gamified styling challenges that inspire creative outfit reuse and reduce unnecessary consumption.

Introduce a sustainable styling recommendation feature within six months that suggests at least five creative outfit combinations per user each week based on their wardrobe, helping users maximize their existing wardrobe and reduce unnecessary purchase.

SCOPE & LIMITATIONS

The project will explore the development of DROBE, a digital wardrobe app designed to provide AI-driven outfit suggestion and wardrobe management features. The project will focus on building key functionalities, such as personalized recommendations.

The project will emphasize the technical development of DROBE's core features, ensuring the app is user-friendly, scalable, and efficient in processing wardrobe data. Through AI-driven recommendations, DROBE will assist users in optimizing their wardrobe usage by categorizing items, suggesting outfits, and integrating personalization based on style preferences.

Moreover, this project will align with the United Nations Sustainable Developments Goals (SDGs), particularly SDG 12: Responsible Consumption and Production. By implementing AI-driven wardrobe and fashion suggestions, the app will contribute to technological innovations that minimize the

environmental impact of fast fashion and support sustainable wardrobe habits.

One of the limitations of this project is the reliance on user-provided data. The effectiveness of DROBE's AI system depends on the accuracy and completeness of the wardrobe information inputted by users. Inconsistent or incomplete data may impact the quality of personalized outfit recommendations and wardrobe insights. Additionally, privacy and data security pose significant challenges, as users may be hesitant to upload personal wardrobe details. Ensuring compliance with privacy regulations and implementing strong security measures will be crucial in maintaining user trust.

Another limitation of the study is the challenge of addressing geographical and cultural diversity in fashion. Clothing preferences vary across regions, and sustainability practices differ among users. Designing a platform that accommodates diverse fashion styles and consumption habits while promoting sustainable fashion requires careful consideration.

DATASETS UTILIZED

The development of DROBE relies on a combination of structured datasets to enable AI-driven wardrobe management and outfit recommendations. These datasets are essential for training machine learning models, optimizing user experience, and ensuring the app's efficiency in promoting sustainable fashion choices. The following key datasets are utilized:

1. **User-Generated Data Collection:**
Users upload images of their clothing, which are processed using computer vision models to extract attributes like color, type, and fabric. Metadata (brand, material, style preferences) is either auto-filled using AI recognition or manually entered by users.

2. **Curated Fashion & Sustainability Databases:**
Trend data is gathered from publicly available fashion sources, fashion brand collections, and historical datasets. Sustainability information is sourced from textile research, sustainability reports, and open-source fashion databases.

3. **AI-Powered Data Processing & Enhancement:**
Machine learning models analyze user preferences and interaction data to continuously refine outfit recommendations. AI compares user-uploaded wardrobe items with fashion trend data to generate personalized styling options.

4. **Sustainable Fashion Decision Support:**
The system integrates garment lifecycle data to provide insights on responsible clothing care, recycling, and swapping options. This information is used to guide users toward making sustainable wardrobe choices within the app.

METHODOLOGY

DROBE, the AI-driven wardrobe app will adopt an Agile development methodology to ensure rapid iterations, continuous user feedback, and adaptive feature enhancements. By breaking development into short sprints, the team can prioritize core functionalities such as wardrobe digitization and AI outfit recommendation, refine them based on real user interactions and feedback, and progressively expand features such as sustainability insights and a pre-owned fashion marketplace.

Tools and Technologies:
- **Development Platform:** Visual Studio Code for application development.
- **Database:** MySQL Workbench for data management.
- **Version Control:** Git with GitHub repositories for collaborative code management.
- **Project Management & Collaboration:** Google Docs for documentation and Zoom and Microsoft Teams for task tracking and communication.
- **Testing & Quality Assurance:** A select group of beta testers will gain early access to DROBE's latest features, providing valuable feedback to resolve bugs and enhance performance before the public launch.
- **Design & User Experience:** Figma for Interactive UI/UX prototyping and user flow mapping.

By adopting an Agile Development Methodological approach, DROBE ensures a structured yet adaptable development process, maximizing efficiency and user engagement while supporting sustainable fashion choices.

POTENTIAL CHALLENGES

The following are the potential challenges that the DROBE app might face during the development process.

Integration with Fashion Brands and Retailers - Enabling companies to natively upload their collections requires seamless integration, standardized file formats, and clear communication channels.

AI Personalization and Recommendation Algorithm - Creating an AI that effectively mixes and matches outfits based on user wardrobes, style trends, and sustainability metrics is demanding.

Scalability and Technical Infrastructure - Building a backend that supports a growing user base, heavy media uploads, and real-time AI processing is critical.

Feature Prioritization and MVP Development - Deciding which features to include in the minimum viable product (MVP) versus later releases can be challenging.

MITIGATION STRATEGIES

The following are the mitigation strategies to reduce the possible impact of potential challenges.

1. Implement standardized formats for all potential retailers and users such as having a Universal API, file formats as JSON or XML, this to be used in creating or integrating clothing outfits.

Mitigation Plan:
- Develop and document a universal API for retailers to upload collections easily.
- Standardize file formats (JSON, or XML) for compatibility

2. We will be applying a machine learning AI model to have a user feedback loop that tunes the recommendation accuracy, based on the ratings and corrections.

Mitigation Plan:
- Use machine learning models trained on diverse datasets to improve recommendation accuracy.
- Start with rule-based suggestions before gradually refining AI using real user interactions.
- Implement a user feedback loop to fine-tune AI recommendations based on ratings and corrections.

3. At DROBE, we'll ensure a solidified backend code infrastructure to support a growing user base, manage media-heavy uploads, and handle real-time AI processing. Our approach will focus on cloud-based solutions and optimized processing to maintain performance and reliability.

Mitigation Plan:
- Optimize AI workload by leveraging batch processing for non-critical tasks and edge computing for real-time recommendations.
- Updating our app to utilize cloud storage solutions (e.g., AWS S3, Firebase Storage) to handle media uploads efficiently.

4. Deciding which features to include in the Minimum Viable Product (MVP) versus later releases is crucial for balancing development effort and user value. At DROBE, we'll focus on delivering a core wardrobe management system first, followed by AI-powered suggestions and social engagement features.

Mitigation Plan:
- Conduct user surveys and competitor analysis to prioritize high-impact features.
- Use an Agile development approach with iterative updates based on user feedback and performance metrics.
- Maintain a feature roadmap to align development with evolving user needs and business goals.

SUCCESS METRICS AND KPI'S

The success of DROBE will be measured and tracked by the Key Performance Indicators (KPIs) in relation to user satisfaction, AI recommendation accuracy and effectiveness, marketplace activity, the performance of the app, and its overall sustainability impact.

Customer Success
- Daily & Monthly Active Users: Measure how frequent users engage with the app.
- User Retention Rate(%) - Tracks the number of users who continue using the app after the first few months.
- User Feedback - Measured by in-app reviews and reviews on the Playstore.

AI Accuracy Metric
- AI Outfit Recommendation Rating - Measured through user feedback on outfits suggestions.

Marketplace Activity Metric
- Total Listing & Transactions
- Number of preloved clothing items listed, sold, and traded to other users.
- Average Listing Time - Measure how long an item takes to sell or get traded,

Developer Metrics
- Crash Rate(%) - Ensures a smooth user experience by tracking performance issues.
- Bug Resolution - Time it takes to resolve issues flagged by users.

Sustainability Impact Metric
- Total Items Resold / Traded - Number of preloved items bought / traded instead of purchasing new clothing.
- Co2 & Waste Reduction - Tracks the estimated carbon footprint reduced by using the app.

By actively tracking these KPIs, DROBE can ensure that it remains user-centric and impactful in promoting sustainable fashion. Through these efforts, DROBE aims to create a lasting impact by reducing fast fashion dependency and encouraging sustainable clothing consumption.

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