

EcoWardrobe : A Clothing Library Platform

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Abstract—EcoWardrobe is a Graphical User Interface (GUI) application created with Python's Tkinter, designed to enable users to borrow and return clothing items from a digital clothing library. The library offers a wide selection of garments for both men and women, available in various sizes and price ranges. By offering an alternative to fast fashion, EcoWardrobe supports a circular economy and aims to reduce textile waste. The intuitive interface allows users to rent items, enjoy them for as long as needed, and return them. The inventory status is updated in real-time whenever an item is rented or returned. This project highlights the significance of sustainability in the fashion industry, promoting responsible consumption and the reuse of garments.

Index Terms—clothing library, fashion rental, sustainability, digital platform, circular economy

I. INTRODUCTION

The fashion industry has a profound impact on the global environment. Its rapid production and sales, fast manufacturing processes, and the creation of low-quality, short-lived products contribute to unsustainable consumption habits and significant environmental damage.

In 2015, the industry emitted 1.2 billion tons of CO₂ equivalent, surpassing the combined emissions of all international flights and maritime shipping. It uses an enormous amount of water—equivalent to 86 million Olympic-sized swimming pools annually. Furthermore, the rate of textile waste is alarming; every second, a garbage truck's worth of textiles is either dumped or incinerated. If current trends continue, the fashion industry will use up a quarter of the world's carbon budget by 2050.

The rise of fast fashion exacerbates these environmental challenges. Brands like Zara initiated this trend in the 1990s, significantly reducing production cycles. Today, Shein continues to push these boundaries, producing up to 10,000 new designs daily. This rapid turnover encourages consumers to continually purchase new, cheap items, leading to a situation where three out of every five garments end up in landfills or are burned each year.

Given its significant environmental footprint, it is crucial for the fashion industry to adopt more sustainable practices. Transitioning from a linear (take, make, dispose) model to a circular system that emphasizes efficiency, recycling, and reuse can mitigate environmental impacts. Additionally, innovative business models such as renting, leasing, refurbishing, repairing, and reselling garments can extend their lifespans and promote a more sustainable lifestyle. These strategies not only optimize resource use but also reduce overall consumption.

II. RESEARCH QUESTION AND RELEVANT LITERATURE

A. Research Question

This research project centers on the development of a digital clothing library platform, designed to promote sustainable consumption habits by enabling users to borrow and return garments through an intuitive graphical interface.

The research question explicitly addressed is: "How can a user-friendly Python-based digital platform encourage sustainable consumption habits in clothing among users?" The study specifically aims to create a platform that promotes a circular economy model, encouraging users to engage in eco-friendly practices by minimizing waste and reducing the demand for new clothing production.

B. Literature Review

- *The Environmental Price of Fast Fashion.*
Source: Niinimäki, K., Peters, G., Dahlbo, H., et al. (2020). Nature Reviews Earth and Environment.
This study highlights the severe environmental costs associated with fast fashion resulting from rapid production cycles and the creation of low-quality, inexpensive garments. The authors call for a radical transformation towards more sustainable and circular practices within the industry, emphasizing the importance of reducing production and consumption, improving garment durability, and increasing recycling and reuse efforts.
- *A New Textile's Economy : Redesigning Fashion's Future.*
Source: Ellen MacArthur Foundation (2017).
This report critically analyzes the fashion industry, highlighting a significant increase in clothing production and declining garment utilization rates since 2000. As depicted in Figure 1, clothing sales have doubled in the last fifteen years, while the number of times a garment is worn before disposal has significantly decreased. This trend emphasizes the growing waste problem associated with fast fashion and underscores the urgent need for a transformative approach. The foundation advocates for a new textile economy rooted in circular economy principles, where clothing, textiles, and fibers maintain their value during use and re-enter the economy afterward, avoiding becoming waste.
- *Exploring the Spectrum of Fashion Rental*
Source: Battle, A., Henninger, C.E. (2020). Journal of Fashion Marketing and Management.

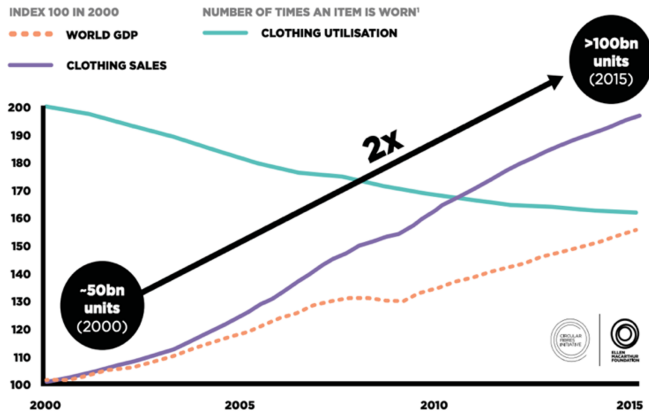


Fig. 1. Growth of clothing sales and decline in clothing utilization since 2000

This paper delves into the various business models within the fashion rental industry, highlighting its growth and potential sustainability benefits. It categorizes the different types of rental services and examines consumer motivations and barriers to adoption. The study also discusses the environmental impact of these services, suggesting that while fashion rental can offer a more sustainable alternative to traditional consumption, its success and sustainability depend significantly on consumer behavior and the efficiency of the logistics involved.

III. METHODOLOGY

A. Overview

Python serves as the primary coding language for this application, while Tkinter is utilized for constructing the Graphical User Interface (GUI). This project combines basic Python programming concepts with advanced techniques to develop a user-friendly clothing library application.

Fundamental Python constructs such as branching, loops, functions, and lists are extensively used throughout the code. Two global lists facilitate the passing of information about items between different classes, ensuring smooth communication and data sharing within the application.

A SQLite database of 500 clothing items is created to store detailed information about the clothing inventory, rentals, and returns. Items are generated with randomized attributes, including gender, size, and price. This avoids the need for hardcoding each item individually.

Object-Oriented Programming (OOP) is central to the project's structure, ensuring the code is organized and easy to maintain. Several classes are defined, each responsible for a distinct part of the application. Encapsulation groups related data and methods within these classes, making the code more cohesive and manageable. Inheritance allows classes to reuse code from parent classes, promoting consistency across the application.

The project uses Matplotlib to plot graphs and charts for visualizing statistical data. These visualizations are integrated

into the GUI, giving users insights into rental patterns and other relevant metrics.

B. Libraries

The program is structured using the following libraries :

- **Tkinter** : The primary library for creating the graphical user interface (GUI), providing tools for creating windows, dialogs, buttons, text fields, and other essential UI elements.
- **ttkbootstrap** : Enhances the appearance of Tkinter widgets with modern, bootstrap-like styling, making the GUI more visually appealing and user-friendly.
- **Pil/Pillow** : Handles and manipulates images, including loading, displaying, and processing images for items in the clothing library.
- **os** : Interacts with the operating system, particularly for handling file paths and directory operations.
- **random** : Generates random values for various purposes, such as selecting random items for the database during initialization and testing.
- **sqlite3** : Manages the SQLite database that stores information about clothing items, rentals, returns, and user data. It provides functions for executing SQL commands, accessing the database, and managing the inventory.
- **Matplotlib** : Generates graphs and charts to display statistical data related to the clothing library.

C. Complexity and Challenges

The complexity of this project lies in integrating multiple interacting components and coordinating various functionalities. The application must also efficiently handle a large amount of data, ensuring real-time updates across different classes and components.

A key challenge was ensuring seamless information transfer between different classes. For example, when an item is rented in the Rental class, it needs to be added to the Return class for the user to process its return. To address this, a global list was created to pass rented items between classes.

Another major challenge was keeping the database and the Treeview updated in real-time. After each transaction, whether a rental or a return, the clothing items in the database needed to be accurately updated. This included ensuring that the status of the items was correctly reflected in the Treeview component of the GUI, which displays the current inventory.

IV. IMPLEMENTATION

A. Program implementation

The EcoWardrobe application is stored in a GitHub repository. The repository contains the main script `Clothing_Library.py`, which is used to run the application, and an `Images` folder that holds all the images of the clothing items available for rent. The repository is well-organized and includes all the necessary files and documentation to set up and run the clothing library platform on your local machine. Ensure you update the file paths for the images in the application to match the paths on your local system.

B. Structure

The user interface has the following structure, displayed graphically in the Flowchart in Figure 2 :

- 1) Home Page : Platform's main window.
- 2) Eco-Comparator : Compares the environmental impact of renting versus buying clothing items.
- 3) Rental : Manages the process of renting items.
- 4) Return : Manages the process of returning items.
- 5) Statistics : Displays various statistics to the users about the clothing library.

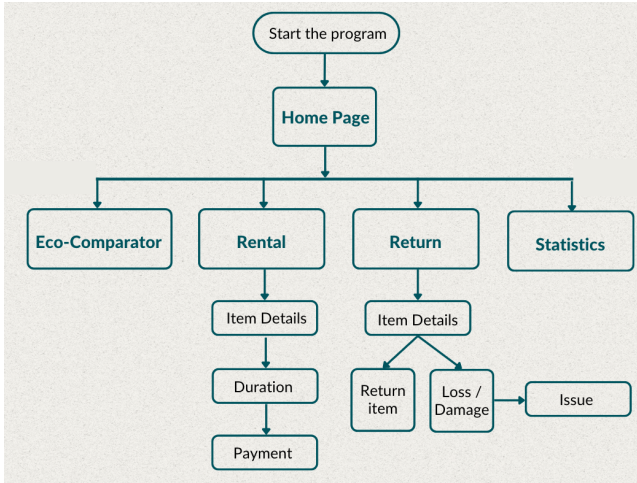


Fig. 2. Platform's Flowchart

1) Home Page : The Home Page serves as the platform's main window and acts as the central hub for navigating to other sections. In terms of coding, it is implemented using the HomePage class, which inherits from ttkboot.Window. This class initializes the main interface, sets up the window, and includes buttons and links to the other sections (Eco-Comparator, Rental, Return, and Statistics). The HomePage class also initializes hidden instances of the Return and Eco-Comparator classes to pass the global lists rented items and transaction items between classes.

2) Eco-Comparator : The Eco-Comparator provides users with insights into the environmental benefits of renting clothing instead of buying. It is implemented through the Eco-Comparator class, inheriting from tk.Toplevel. This class sets up the window, initializes the required labels, and integrates Matplotlib plots to visualize data related to CO2 savings and water usage reduction. The class interacts with the global list transaction items to track all rented clothes (including those already returned) and calculate the user's savings in terms of CO2 and water usage.

3) Rental : The Rental section handles the process of renting clothing items. It is managed by the Rental class, which also inherits from tk.Toplevel. This class allows users to view item details, then select the desired rental duration, and proceed to payment. The class interacts with the global list rented items to update the inventory and ensure the rented items are displayed in the Return class.

4) Return : The Return section manages the process of returning rented items. It is implemented using the Return class, which inherits from tk.Toplevel. This class allows users to view the details of rented items and either process their return or report any loss or damage to EcoWardrobe. When reporting loss or damage, the user must select the type of issue that occurred with the rented items. The class updates the global list rented items to remove returned items and ensures they no longer appear in the Return window. Additionally, the database is updated to reflect the return, and the item status is changed back to available in the Treeview in the Rental class.

5) Statistics : The Statistics section displays various statistics about the clothing library. It is handled by the Statistics class, which inherits from tk.Toplevel. This class generates and displays graphs and charts using Matplotlib to provide insights into item popularity, gender distribution, price sensitivity and rental status. The statistical data is updated in real-time, reflecting the latest transactions and inventory status.

V. MAINTENANCE AND UPDATE

Maintaining and updating the codebase for the EcoWardrobe project involves several key tasks to ensure the application remains functional and up-to-date. Currently, the stock of items is generated each time a user opens the application, meaning the data is not persistent and items are randomly created for each session. To implement a real and persistent inventory, it would require manually entering data for all items into the database.

Additionally, regular updates to the codebase should include enhancements to the user interface and the integration of new features. For example, incorporating a user authentication system to manage different user accounts and rental histories.

To facilitate these updates, it is crucial to maintain proper version control using tools like Git for tracking changes, collaborating with other developers, and managing code versions. Unit testing should also be implemented to ensure new changes do not introduce bugs, maintaining a reliable codebase for future development.

VI. RESULTS

The implementation of this project's script sets up the Graphical User Interface (GUI) for the clothing library platform, starting with a welcoming Home Page for users.

A. Home Page

The Home Page of the EcoWardrobe platform serves as the main entry point for users, providing a welcoming and informative interface. At the top, the EcoWardrobe logo and tagline set the tone for the platform's mission. The central area of the Home Page features a detailed welcome message that explains the purpose and benefits of using EcoWardrobe. At the bottom of the page, four interactive buttons allow users to navigate to different sections of the platform.

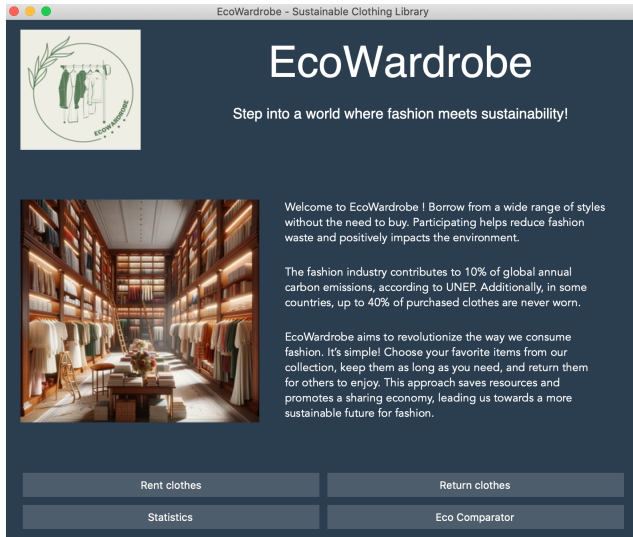


Fig. 3. Home Page

B. Rental

The Rental page allows users to rent clothing items. The first Treeview displays the stock of EcoWardrobe, where users can browse and search for items they like. By clicking on an item, the user can view its details. If the item is available, the user can proceed to rent it. A new window will pop up asking for the desired rental duration in weeks. After selecting the rental period, a summary of the order with the final price will be shown, allowing the user to proceed to payment. Finally, a message box confirms the rental. The item will then appear in the "My Rented Clothes" Treeview, and its status will be updated from available to rented in the Stock of Clothes Treeview.

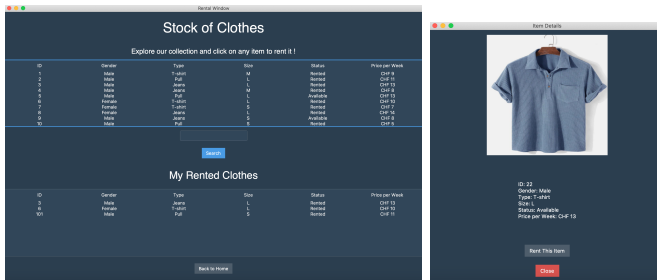


Fig. 4. Rental and item details

C. Return

The Return page allows users to return clothing items. The Treeview automatically displays the clothes rented by the user. By clicking on an item to return it, the user has two options: return the item or report a loss or damage. When an item is returned, it disappears from the "My Clothes" Treeview, and its status is updated to available in the Stock of Clothes. If the user reports a loss or damage, a new window pops up asking for the type of issue. The user selects the issue, and the item is classified as "In repair" in the Stock of Clothes.



Fig. 5. Return and report loss or damage

D. Eco-Comparator

The Eco-Comparator page provides users with insights into the environmental benefits of renting clothing instead of buying. The Treeview displays all the clothes rented by the user, including those that have been returned, to show the overall impact. The cumulative environmental benefits in terms of CO2 equivalent and water usage are computed and displayed graphically. Additionally, two alternative measures are provided to help the user understand the significance of these benefits.



Fig. 6. Eco-Comparator

E. Statistics

The Statistics section provides users with a range of insightful metrics about the clothing library. It includes key statistics that might interest users, such as the gender distribution of clothing items, the most rented items, the rental status of the stock, and the price sensitivity of each item.

VII. CONCLUSION

EcoWardrobe is a Python-based GUI application developed to promote sustainable consumption in the fashion industry. The platform allows users to borrow and return clothing, supporting a circular economy and reducing textile waste. With its intuitive interface, EcoWardrobe simplifies the process of renting and returning garments, ensures real-time inventory updates, and provides insights into the environmental benefits of these practices.



Fig. 7. Statistics

EcoWardrobe's significance lies in its potential to alleviate the environmental impact of fast fashion, characterized by rapid production cycles and considerable waste. By promoting sustainable practices, the platform helps decrease the demand for new clothing production and encourages garment reuse.

However, the project's success depends on user adoption as well as the efficiency of logistics related to garments rental and return. Currently, the inventory is not persistent, and items are randomly generated for each session. A real and persistent inventory would require manual data entry for all items. Future updates should also enhance the user interface and add features like user authentication for managing accounts and rental histories.

In conclusion, EcoWardrobe not only provides a practical solution for sustainable fashion consumption but also raises awareness about the importance of reducing waste and promoting eco-friendly practices. By encouraging users to adopt these habits, the platform contributes to a more sustainable future in the fashion industry.

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APPENDIX

In the development of this project, I have utilized Chat-GPT and Copilot for code development and writing assistance.