

Executive Summary

Mission: Promoting circular fashion by allowing users to extend the life of their clothing through reselling and swapping.

Product: An online marketplace focusing on sustainability that allows you to buy, sell, or swap pre-owned clothing.

Motivation: The environmental impacts due to clothing production:

- It takes 700 gallons to produce one cotton t-shirt and 2,000 gallons to produce one pair of jeans
- Every second, one full garbage truck of clothes is burned or dumped into landfills
- Fashion industry is the second-largest industrial polluter and is responsible for 10% of global carbon emissions

Background

Consequences of Fast Fashion: Water pollution from textile chemicals kills roughly 1.8M people per year from unsafe water. 1.712M tons of CO₂ produced from textile, contributing to climate change-linked disease, cancer and weather-related mortality [2]. 85 % of the clothing Americans consume, 3.8B pounds annually, is sent to landfills as solid waste [1].

High-Level Need: In order to reduce damage to the environment people need a convenient and trusted platform to swap, sell, and buy second-hand clothing.

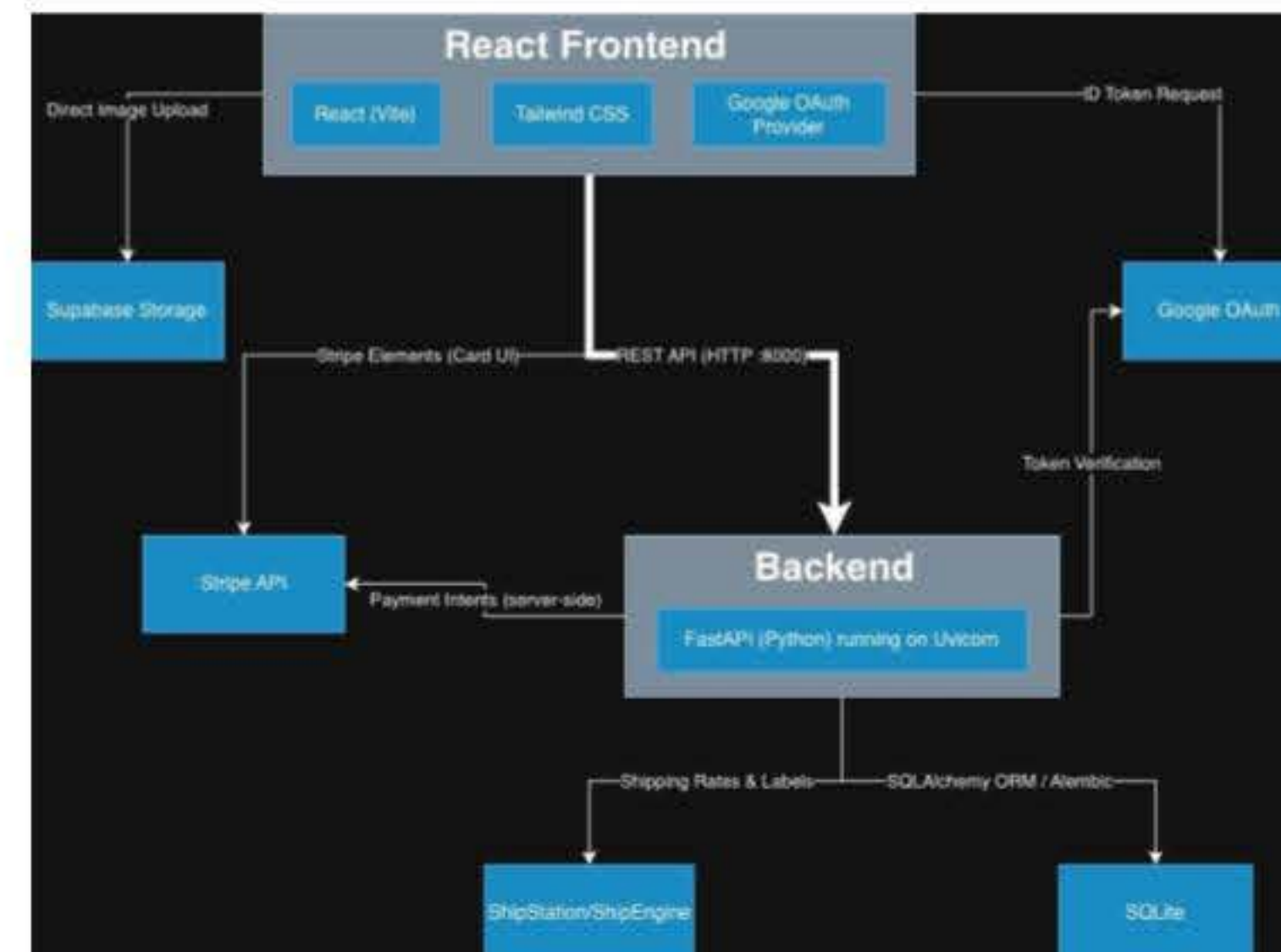
Solution - Conscious Couture: An sustainable fashion application for people to exchange second-hand clothing. Features include sustainability tracking, shows how much waste they save, ratings and reviews, a feedback system within the community, and supports direct swaps and fixed priced sales.



Figure 1. View of used clothes discarded in the Atacama desert, in Alto Hospicio, Iquique, Chile, on Sept. 26, 2021. (Photo by MARTIN BERNETTI/AFP via Getty Images)

Architecture Setup

The Sustainable Fashion Marketplace uses a decoupled client-server architecture. The React frontend handles routing, Google OAuth login, Stripe card payment UI, and direct image uploads to Supabase Storage. The FastAPI backend exposes 15 REST API route modules covering clothing listings, swaps, cart, checkout, orders, reviews, payments, and sustainability impact calculations. Data is persisted in SQLite via SQLAlchemy with Alembic migrations. Payments are processed through Stripe Payment Intents, and shipping rates are generated via ShipStation/ShipEngine.



Sustainability Calculations

For each item that you list on our marketplace, we calculate its environmental impact across water, CO₂ emissions, and energy use, and compare it to buying it new.

For example: Sustainability calculations for producing a 100% cotton t-shirt that weighs 200g

Weight factor = Percentage of material / 100

Water saved:

$$\begin{aligned} & \text{Liters/kg} * \text{weight factor} \\ & = 13,500 \text{ liters/kg} * (100/100) = 13,500 \text{ liters/kg} \\ & \text{Liters/kg} * \text{garment weight in kg} \\ & = 13,500 \text{ liters/kg} * 0.2 \text{ kg} = 2700 \text{ liters of water saved} \end{aligned}$$

CO₂ saved:

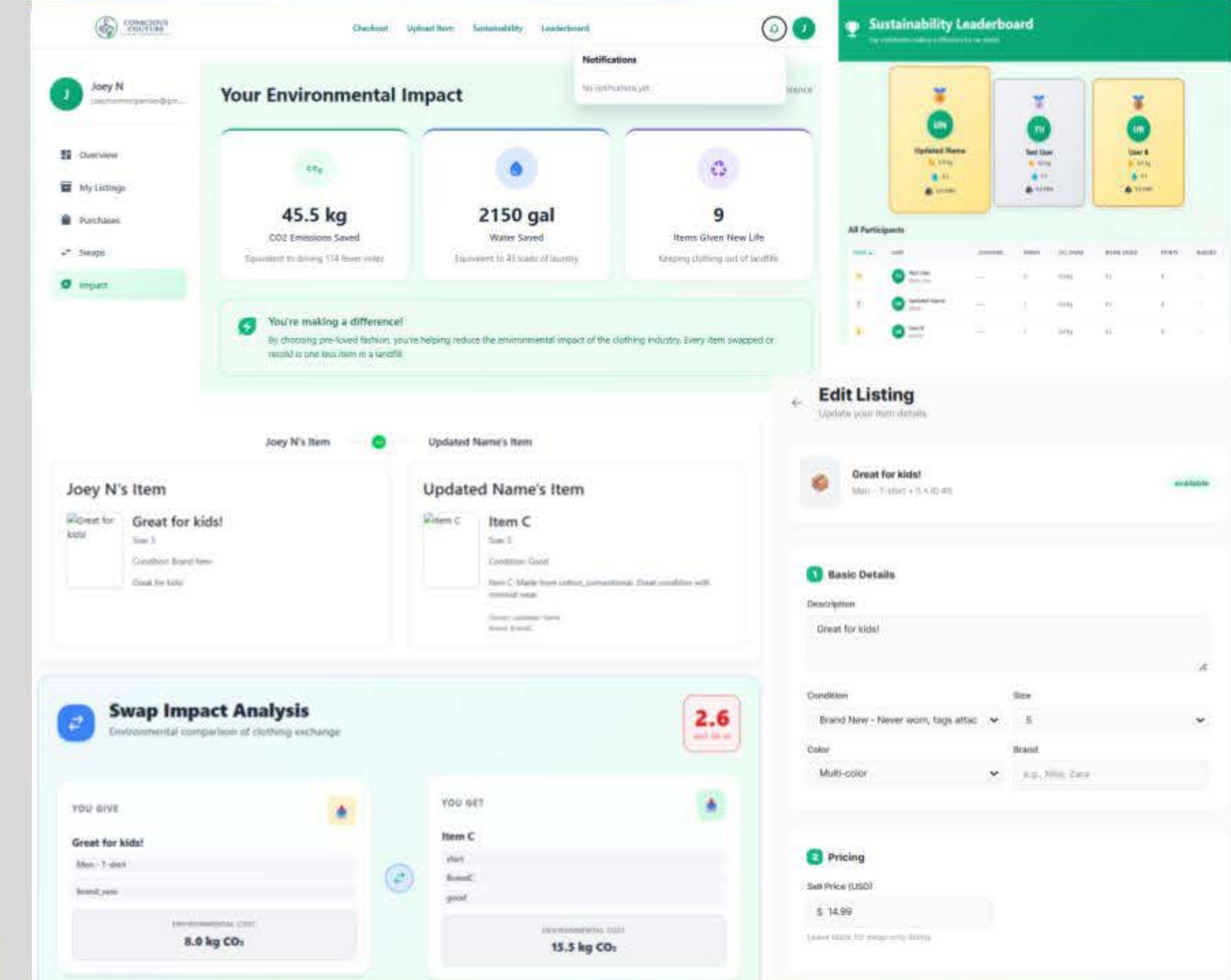
$$\begin{aligned} & \text{CO}_2 \text{ per kg} * \text{weight factor} \\ & = 35 \text{ CO}_2 \text{ kg} * (100/100) = 35 \text{ CO}_2 \text{ kg} \\ & \text{Total CO}_2 = \text{weighted_CO}_2 * \text{garment weight in kg} \\ & 35 \text{ CO}_2 \text{ kg} * 0.2 \text{ kg} = 7 \text{ CO}_2 \text{ kg} \\ & 7 \text{ CO}_2 \text{ kg} - .1 \text{ CO}_2 \text{ kg from shipping} = 6.9 \text{ CO}_2 \text{ kg avoided} \end{aligned}$$

Energy saved:

$$\begin{aligned} & \text{mj/kg} * \text{weight factor} \\ & = 25 \text{ mj/kg} * (100/100) = 25 \text{ mj/kg} \\ & (\text{Energy mj/kg} * \text{garment weight in kg}) / 3.6 \text{ to convert from mj to kWh} \\ & (25 \text{ mj/kg} * 0.2 \text{ kg}) / 3.6 = 1.38 \approx 1.4 \text{ kWh saved} \end{aligned}$$

TOTAL: 2700 liters of water, 6.9 CO₂ kg, 1.4 kWh

Experimental Results



Conclusions

The Sustainable Fashion Marketplace meets the goal we set out with: giving people a place to buy, sell, and swap used clothing while showing them exactly how much waste they're keeping out of landfills. Every listing on the platform runs through our sustainability engine, which pulls from a reference database of 14 textile materials to calculate water saved, CO₂ avoided, and energy conserved compared to buying that garment new. The swap feature takes this further, when two users exchange items, the system scores the trade on a 1–10 scale factoring in material impact, item condition, brand sustainability ratings, and even estimated shipping emissions.

The hardest part of this project was not any single feature but getting five separate third-party services to work together cleanly. Stripe handles payments, ShipStation and ShipEngine generate shipping rates and labels, Google OAuth manages login, and Supabase stores uploaded clothing images, each with its own authentication method, error handling, and data format.



References

1. Bick, R., Halsey, E. & Ekenga, C.C. The global environmental injustice of fast fashion. *Environ Health* 17, 92 (2018).
2. Turnberg, Summer Roslyn, "The Dangers of Fast Fashion: A Health and Environmental Analysis" (2021). *Global Honors Theses*. 79.