Lab 2 – Refill.Me Product Specification

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Table of Contents

List of Figures

List of Tables

1. Introduction

Packaging waste from mainstream grocery shopping causes pollution and contributes to climate change every year in the United States. Plastic releases greenhouse gas emissions whether it is accumulating in a land fill or being produced to serve as packaging. (Shen et al., 2020). Plastic also never biodegrades, an issue it shares in common with glass packaging (Carvalho et al., 2022). Yet another issue with plastic is that while it does not biodegrade, it does break down into microplastics that contaminate the food supply. Harmful chemicals from plastic packaging are also a hazard that leak into food products (Groh et al., 2019). Another material, like paper, is thought to be a better alternative for packaging material. However, paper packaging usually has plastic lining (*The Environmental Impact of Food Packaging,* 2018). Due to these issues, many consumers are concerned about the impact of packaging waste and want alternative options to reduce packaging materials.

Refill.Me is designed to reduce these problems by helping eco-conscious shoppers find package-free stores in their area. Necessary information about the kinds of containers shoppers should bring to do package-free shopping is also provided. These features, along with a reward system and shopping list feature, combine into a useful information hub that benefits both novice and experienced package-free shoppers.

1.1 Purpose

Refill.Me is a mobile application designed for package-free shoppers and package-free store owners. There are two interfaces, one for shoppers and the other for store owners. The interface for shoppers is optimized for smartphones. For store owners, Refill.Me is optimized for tablets.

Key features for shoppers include the Store Search, where shoppers can search for stores by enabling their location or by entering their zip code. The Product Search allows shoppers to search for loose products either by typing in a product's name, scanning the product's barcode, or by selecting the icon that represents the product. Basic information about container types is presented in the Container Guide, while the Container Recommendation feature provides a list of containers to bring for a particular shopping list. Reward.Me—the reward system—allows shoppers to collect points for package-free shopping that can be redeemed for coupons or discounts for participating stores. Shoppers can also input suggestions or corrections about products through the Lemme.Know feature.

Refill.Me's key features for store owners include the Product and Price dashboard, where unit prices can be updated and products can be added or removed. Store owners also have access to the Store Search and Product Search features, where they can check that their store's information is showing correctly. The Reward Point Conversion dashboard enables owners to add or remove awards that shoppers can redeem, and the Coupon dashboard shows owners what coupons have been used by their customers. With Refill.Me, owners can also see what products their customers have been searching for, as well as how their customers are rating their stores.

Refill.Me is not an online shop. Shoppers are able to create shopping lists, but they must complete their purchases in the stores, not through the application. Nor is Refill.Me intended to be an educational app. The application will not instruct its users about the environment or the impact of mainstream shopping. The aim is to make package-free shopping more accessible to eco-conscious shoppers, thus it is designed for shoppers who are already interested in package-free shopping.

1.2 Scope

The Refill.Me prototype will help package-free shoppers and store owners by making package-free shopping more accessible. To do this will require most of the key features of the real word product.

The prototype will allow shoppers to search for nearby stores and browse through their available products. Shoppers can also search for specific products that they are looking for. They will be able to access the Container Guide and receive container recommendations for their shopping lists, and collect points as well. Shoppers will also be able to access the crowdsourcing feature and provide their suggestions or corrections for products. The Refill.Me prototype will allow store owners to add or remove products from their store and update their unit prices. They will also be able to add or remove awards that can be redeemed by their customers. Store ratings and customer's search information will be available to store owners as well. These features will show the prototype to be a useful resource for package-free shopping.

1.3 Definitions, Acronyms, and Abbreviations

Amazon Relational Database Services (Amazon RDS): a web service to set up, maintain, and scale a relational database in the cloud.

Android: an open-source operating system used on mobile devices such as smartphones and tablets.

Application Programming Interface (API): a set of rules for two different programs to communicate with each other.

Amazon Web Services (AWS): a cloud computing platform.

Amazon Maps API: a programming interface that allows developers to add mapping capabilities like interactive maps and custom overlays to android applications.

Application Layer: a layer where an application can effectively communicate with other applications on different computer systems and networks.

Backend: a computer system or application that is not directly accessed by the users but rather responsible for storing and manipulating data.

Bauxite: a naturally occurring mineral.

Biodegrade: to decompose and become incorporated back into the environment.

Bulk section: an aisle where products are available in dispensers or bins, and the shoppers can buy the exact amount they desire.

Bring Your Own Container (BYOC): an initiative to encourage shoppers to bring their own containers with them to the store in order to avoid creating packaging waste.

Cascading Style Sheets (CSS): a stylesheet language used to create the design (fonts, colors, borders, etc.) of webpages.

Compostable: breaking down into organic matter and not producing any harmful chemicals during that process.

Container: an item such as a tote bag, produce bag, glass or plastic jar, glass or plastic box, glass or plastic bottle that can be used for package-free shopping.

Container Guide: a small lexicon providing an overview of different types of containers and the types of products that could be stored in them.

Container Recommendation Feature: a feature of Refill.Me that suggests specific containers for products based on the type of product such as liquid or solid.

Continuous Integration and Delivery (CI/CD): a method for automatically merging contributions and deploying new stable software to a production environment.

Customized Container Recommendation Feature: a feature of Refill.Me that suggests all needed containers for a particular shopping list based on the items added to the list by the shopper.

Crowdsourcing: a way to solicit user feedback using surveys (either paper based or online).

Database: an organized collection of structured information, typically stored electronically in a computer system.

Data Layer: a layer of the application/website which contains all of the data that is generated by users engaging with the application/website.

Django: a high-level Python web framework that enables rapid development of secure and maintainable websites.

Docker: a platform designed to help developers build, share, and run development processes.

EPA: United States Environmental Protection Agency.

Experienced package-free shopper: a shopper who has knowledge of package-free shopping.

Expo: an open source framework for creating mobile apps.

Farmers' market: a market where local farmers sell their products directly to consumers.

Frontend: a computer system of the website/application which is exposed to users for direct

interaction.

GitHub: a hosting service for version control and development of software.

GitHub Issues: a GitHub repository feature that tracks issues, team-members' work, and

development process of an application.

Google Maps: a web mapping platform and application that provides street maps, satellite

imagery, and real-time traffic information.

Greenhouse gas emissions: emissions of gasses (such as carbon dioxide and methane) that trap

heat in the earth's atmosphere, and thus directly contribute to climate change.

Hyper Text Markup Language (HTML): a programming language used to create websites.

Integrated Development Environment (IDE): an advanced code editor with syntax

highlighting, built-in debugger, and compiler.

iOS: a closed source mobile operating system used in iPhones and iPads from Apple Inc.

Javascript: a high-level client-side scripting language to implement functionality on websites.

Loose product: product sold without any packaging.

Mainstream grocery shopping: grocery shopping that does not follow sustainable practices,

thus, it entails buying packaged items, using plastic, and not considering environmental aspects.

Microplastics: tiny plastic particles that are less than five millimeters long and are created when

larger plastic pieces break down.

MySQL: a relational database that uses SQL as its database language.

Node Package Manager (npm): a software-sharing repository for software and packages that are used for software development, especially software written in Javascript.

Novice package-free shopper: a shopper who has no experience with, and thus, no knowledge of package-free shopping.

Optical Character Recognition (OCR): a software that recognizes and converts text from images to machine-readable format.

Package-free: without any packaging materials such as plastic, paper, cardboard, aluminum, or glass.

Package-free store (in the context of Refill.Me): a supermarket with a bulk section, a store exclusively selling loose products, and a vendor at farmers' markets.

Package-free shopper: a shopper who prefers to buy loose products by filling them into their own containers.

Package-free shopping: shopping using one's own containers. Thus, shopping without creating packaging waste.

Package Manager: a set of software tools that automates the installation, updating, configuration, and deletion of programs in a systematic way.

Packaging: material used to protect a product from any damage during transportation or storage.

Presentation Layer: a layer where functions like data conversion, data encryption and decryption as well as data translation take place.

Produce bag: a reusable bag, usually with a window and tare weight label, that is used for buying fruits/vegetables.

Python: a high-level programming language that supports multiple programming paradigms, including structured, and functional programming.

React Native: a framework that allows for the building of native mobile apps using the programming language React.

Relational Database: a type of database that stores and provides access to data points that are related to one another.

Rest Framework(s): an application programming interface that conforms to the constraints of REST architecture.

Single-use: designed to be used only once, and then to be discarded.

Structured Query Language (SQL): a widely used database language used for inserting, querying, and retrieving data from relational databases.

Tare weight: the weight of an empty container that should not be included when the price of the product is calculated.

Tote bag: a large bag, often made of cotton, used to carry many items.

Virtual Machine (VM): a digital version of a physical computer.

Visual Studio Code (VS Code): a source-code editor that can be used with a variety of programming languages.

Webpack: a software tool that bundles Javascript files to be used in a web browser.

Web Server: computer software and hardware that stores content for a website such as images, videos, and other data, and it operates on HTTP and other protocols to deliver the files for a website to clients who request it.

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1.5 Overview

This product specification provides the hardware and software configuration, interfaces, and features and capabilities of the Refill.Me prototype. The following sections will provide detailed descriptions of each feature and their requirements for the prototype's implementation.

2. General Description

The Refill.Me prototype will be developed as a web application with a database hosted on the ODU virtual machine. It will have two interfaces; one for shoppers designed for smartphone screens, and the other for store owners designed for tablets. Most of the major functionalities will be included in the prototype. However, it will differ from the real world product by including some reduced functionalities and simulated data.

2.1 Prototype Architecture Design

Third party software will be utilized to provide some functionalities for the prototype, such as Google Maps which will contribute location services for the store search feature. Old Dominion University's virtual machine will host the database using Docker containers. The architecture of the Refill.Me prototype will have three tiers, which include a presentation layer, an application layer, and a data layer. This design is shown in Figure 1.

Figure 1

Refill.Me Prototype Major Functional Component Diagram
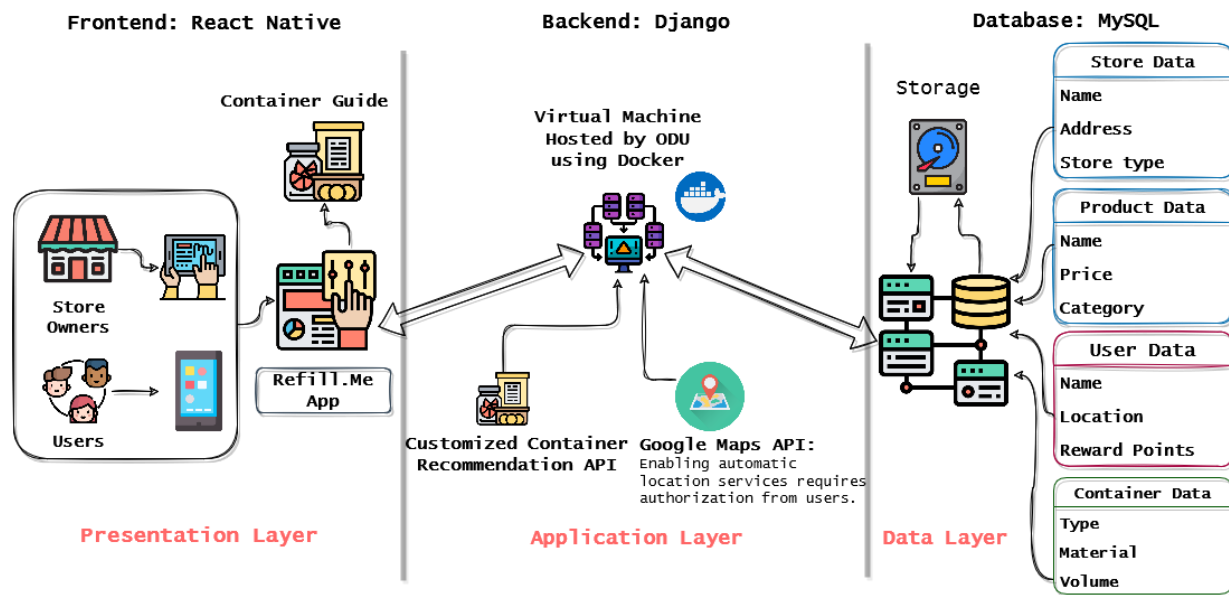
The presentation layer is where frontend development will take place using React Native to implement the user interfaces for shoppers and store owners. The languages used to build these interfaces will be HTML, CSS, JavaScript, and Python. The application layer features backend development with the Django framework to implement the algorithms for each functionality. The data layer is where database development will happen, utilizing MySQL to handle data pertaining to stores, users, containers, and products.

2.2 Prototype Functional Description

Most of the features of the real world product will be fully implemented in the prototype, as can be seen in Table 1. For shoppers, these features are account creation, store searches, the Container Guide, container recommendations, shopping lists, and being able to connect to advocacy and petition sites. For store owners, fully implemented features will include the Product and Price dashboard and the Reward Point Conversion dashboard.

Table 1

Refill.Me Feature Description and Prototype Implementation

Features	Description	Prototype Implementation
Account Creation	Users can create accounts to utilize Refill.Me's features	Fully Implemented
Store Search	Users can search for stores near their location	Fully Implemented
Container Guide	Shoppers can find information about container types	Fully Implemented
Container Recommendation	Shoppers can receive container recommendations for their shopping list	Fully Implemented
Shopping List	Shoppers can add desired products to a shopping list	Fully Implemented
Advocacy & Petition sites	Shoppers are connected with advocacy and petition sites if there are no stores near them	Fully Implemented
Product and Price Dashboard	Store owners can update products and prices in their stores	Fully Implemented
Reward Point Conversion Dashboard	Store owners can add rewards for their customers to redeem	Fully Implemented
Coupon Dashboard	Store owners can see what coupons their customers used	Eliminated
Store Rating Dashboard	Store owners can view their store rating	Partially implemented, ratings will be simulated
Search Information Dashboard	Store owners can view what their customers searched for	Partially implemented, search information will be simulated
Product Search		
Search by Icon	Users can search for products by clicking on an icon image representing the desired product	Partially Implemented, icons will not be implemented for every kind of product

Scan product's barcode	Users can search for products in Refill.Me by scanning the barcode of the desired product	Eliminated
Enter product's name	Users can search for products by typing in the product's name	Fully Implemented
Reward.Me		
Collect reward points	Shoppers can collect reward points for completing package-free shopping	Fully Implemented
Receive coupons	Shoppers can redeem reward points for coupons	Eliminated
Crowdsourcing		
Lemme.Know	Shoppers can suggest edits or corrections for products and prices.	Fully Implemented
Store rating	Shoppers can rate stores based on their services and give feedback.	Partially implemented, shoppers can only give a numeric rating; they will not be able to write in feedback.

The features for shoppers that will be partially implemented include the product search, Reward.Me, and crowdsourcing. The product search will include two ways to search, either by icon or entering the product's name. Searching by scanning a product's barcode will be omitted. Reward.Me will include full implementation for collecting reward points, but receiving coupons will be eliminated. Similarly, crowdsourcing will have full functionality for suggested edits, but rating stores will have reduced functionality and feature simulated data. The partially implemented features for store owners include the Store Rating dashboard and the Search Information dashboard. Both features will include simulated data, while the Coupon dashboard will be omitted entirely.

2.3 External Interfaces

The Refill.Me prototype will use hardware, software, and user interfaces to provide

functionality to the prototype's cross platform application.

2.3.1 Hardware Interfaces

The hardware required for the prototype is a computer with internet access with operating

systems of either Mac, Windows, or Linux.

2.3.2 Software Interfaces

The software required for the prototype includes a virtual machine hosted by ODU,

Docker containers, React Native, Django, MySQL, and the Google Maps API.

2.3.3 User Interfaces

To interact with the Refill.Me prototype will require a computer with internet access that

has a keyboard and mouse, or a WIFI enabled mobile device capable of typing.

2.3.4 Communications Protocols and Interfaces

The application will use HTTP for communication through web browsers and SMTP for

email communications.