Lab 2 – Refill.Me Product Description

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1. Introduction

Environmental pollution is one of the major concerns we face, throughout the decades there has been an increase in the amount of use of plastics, paper, and glass materials. Because of a burgeoning concern for the danger to the environment that is posed by these materials, a focus on recyclable and bio-degradable materials has increased as well. It has been stated that by 2023 the total packaging business can reach $1 trillion; companies are taking responsibility for the processing of packaging and interest has increased for more environmentally friendly packaging. (Abejón et al., 2020) In order to be more environmentally friendly, we have come up with other alternative solutions such as recycling.

The consensus is that if we can re-use the same packaging materials, we can assist in the effort of becoming more environmentally friendly. Unfortunately based on statistics and data, the answer is not so simple. According to Electronic Recycling & IT Asset Disposition (ITAD) Services (ERI), various recyclable goods can only be recycled so much before they are downcycled (recycled into a lesser value than original material). Metal and glass materials are different in that they can be recycled numerous times without risk of degradation, but plastic and paper have limited number of times that they can be recycled.

Plastics, even though recyclable, can be an unfriendly alternative choice of packaging. Because of various plastic packaging being equipped with many polymers, additives, adhesives, and coatings, it may be detrimental to the environment because of how toxic these materials are when broken down. (Hoover, A., 2022) A problem we are facing is how grocery markets are utilizing the same packaging materials in the goods they are selling.

1.1 Purpose

In order to store product and to be as environmentally friendly as possible the same materials are used to store the goods. Considering the amount and type of packaging being used, a more sustainable way of doing things is needed for the future. An ideal solution would be to ultimately re-use the materials we already own. If we are able to limit the usage of packaging, then a lot less harm will come to the environment.

1.2 Scope

This product is designed for shoppers who would like to reduce their packaging waste, transportation emissions and consume with consciousness. Based on a study, in the USA 87% of Generation Boomers, 79% Generation X, 83% Generation Millennials, and 85% of Generation Z are all concerning with package waste. Refill.Me is geared to these target groups, specifically to the women in these groups. The ideal target are users between the ages of 18 to 65, who reside on the east and west coast, come from diverse income levels, are educated and/or are passionate when it comes to environmental change.

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 mobile phone 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: 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: gasses (such as carbon dioxide and methane) predominantly emitted through human activities 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

Refill.Me is a mobile application that serves as an information hub and gives users features which would help to guide them in doing package-free shopping. The prototype of Refill.Me will display the core functionalities, along with additional functionalities that enrich the user experience.

2. General Description

Refill.Me is a mobile application that serves as an information-hub that allows users to find package-free shopping stores, guides them in usage of containers, and promotes the usage of package-free shopping. It will be a convenient solution that carries plenty of information, ease in product/store searching, guiding in container recommendation and even a reward system to boost motivation in this style of shopping. Key features include the Container Guide, Reward.Me system, Store search, product search, shopping-list creation, crowdsourcing and the ability to connect shoppers to advocacy and petition sites for package-free shopping.

2.1 Prototype Architecture Description

The application will use the popular React Native and Expo framework to consolidate the solution to a singular codebase, whilst allowing the distribution to several platforms such as Android, iOS and web application. Because of the nature of a singular codebase, features, the user interface and all functionalities will correspond to each available platform (with minor tweaking for device specific capabilities). In order to house user, product, store and container data, a MySQL database will be utilized alongside Amazon Relational Database Service (RDS). The solution is broken down into three layers: the Presentation Layer, the Application Layer, and the Data Layer. As stated before, React Native/Expo will be responsible for the UI/UX presentation layer. The Data Layer will be comprised of MySQL and AWS RDS, with routing from Express. And the Application Layer will utilize several Application Programming Interfaces (API) to enable key functionalities such as the Amazon Maps API, Amazon Data Kinesis, Scrapy, Tesseract 4, Barcode Detection API and Optical Character Recognition.

Figure 1 below demonstrates the MFCD of Refill.Me and the three layers: presentation layer, application layer, and data layer. The front-end will be built using the React Native and Expo framework. Since the Refill.Me solution will require deployment to different platforms of Android, iOS and web browsers, React Native and Expo will be used to satisfy this requirement. Furthermore, the application will be in a singular codebase, making development more efficient and reducing build errors. React Native is a modern web framework that also provides access to node package libraries and third-party API's such as Amazon Maps and BootStrap. The back-end layer will use a virtual machine provided by ODU and will be containerized using Docker. Docker provides containers as

services/technologies that can be spun up for use. MySQL will be used for storing Refill.Me data in multiple datatables such as Store Data, Product Data, User Data and Container Data.

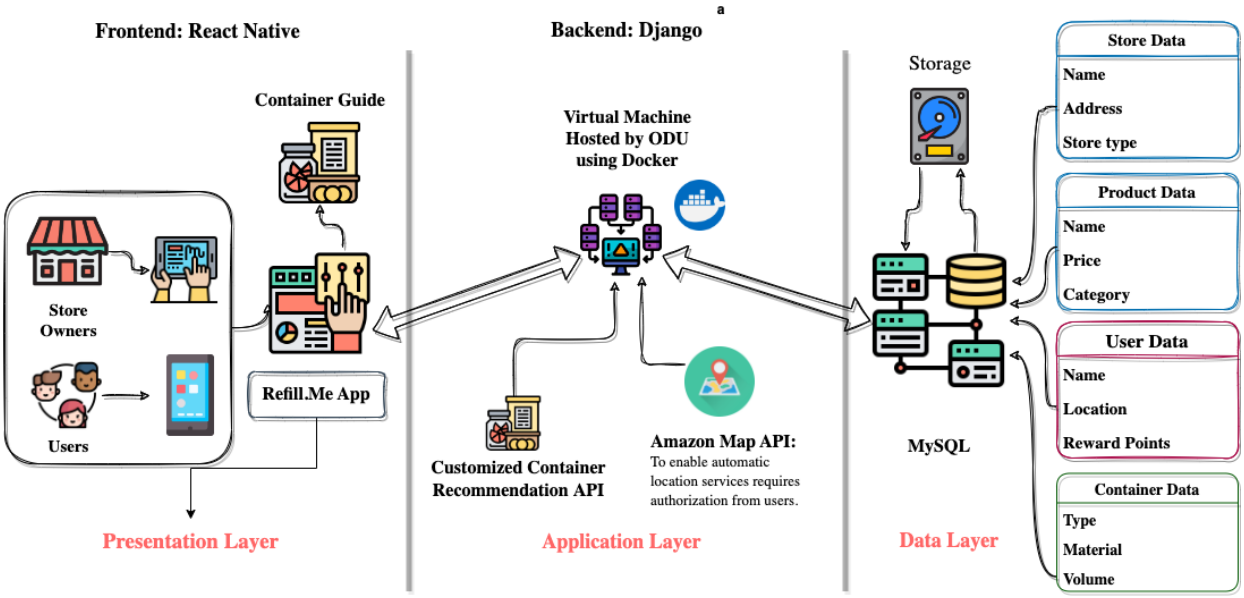

Figure 1. Major Functional Component Design of Refill.Me application

2.2 Prototype Functional Description

The features and capabilities of the Refill.Me solution are targeted towards shoppers and store owners. The following features that the prototype will fully implement for shoppers will be the ability of account creation, store searching, product search by name, the Container Guide, Container Recommendations, the ability to have shopping list within the application, ability to collect points towards the Reward.Me system. Partial implementation of product search by icon will also be available to shopper users. The following tables list the specific features for each user type.

Feature	Real World Product	CS411W Prototype
Account Creation	Fully Implemented	Fully Implemented
Store Search	Fully Implemented	Fully Implemented
Product Search		
Search by Icon	Fully Implemented	Partially Implemented
Scan product's barcode	Fully Implemented	
Enter product's name	Fully Implemented	Fully Implemented
Container Guide	Fully Implemented	Fully Implemented
Container Recommendation	Fully Implemented	Fully Implemented
Shopping List	Fully Implemented	Fully Implemented
Reward.Me		
Collect reward points	Fully Implemented	Fully Implemented
Receive coupons	Fully Implemented	
Crowdsourcing		
Suggested edits for products and prices	Fully Implemented	Fully Implemented
Store rating	Fully Implemented	Partially Implemented
Connect shoppers to advocacy and petition sites	Fully Implemented	Fully Implemented
Product and Price Dashboard	Fully Implemented	Fully Implemented
Reward Point Conversion Dashboard	Fully Implemented	Fully Implemented
Coupon Dashboard	Fully Implemented	
Store Rating Dashboard	Fully Implemented	Partially Implemented
Search Information Dashboard	Fully Implemented	Partially Implemented

Table 1. Real World Product vs. Prototype Features

2.3 External Interfaces

Refill.Me is a mobile application that is deployed in various platforms: Android, iOS and web. Any external interfaces capable of executing mobile applications and web browsers are capable of utilizing Refill.Me. Such external interfaces include desktop computers, laptops, mobile phones, and tablets.