LAB 2 - LIVELYSHELFS PRODUCT SPECIFICATION

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1   Introduction

Food waste is a significant and ongoing global issue that affects us financially, environmentally, and socially. In the US alone, 66.2 million tons of food waste were generated in 2019 (EPA, 2019). This waste can come from food that is left uneaten or spoiled, as well as from mishaps in the production process. Households are one of the leading producers of food waste, accounting for 40% of the total, highlighting the need for better management and awareness (EPA, 2019).

Globally, the monetary loss due to food waste is estimated to be around $940 billion annually, with the US responsible for $218 billion of this total (Shapiro, 2024). The average American consumer spends approximately $1,300 per year on food that ends up being wasted (Berard, 2020). This financial loss could be mitigated with a proactive approach to reducing food waste. Food waste not only leads to economic losses but also exacerbates other societal issues such as hunger and malnutrition. Despite the vast amount of food wasted annually, 783 million people were affected by chronic hunger in 2022 (Move for Hunger, n.d.).

The resources used to produce and transport food, such as water and energy, are also wasted when food is discarded. Agriculture accounts for 70% of global water usage, and the destruction of ecosystems to create farmland further harms the environment (Lewis, 2022). When food waste accumulates in landfills, it negatively impacts the environment by contributing to pollution and greenhouse gas emissions. The mass production and waste of food, coupled with the resulting environmental damage, creates a complex issue that requires urgent attention.

Food insecurity is a parallel problem to food waste. In 2023, 2.3 billion people experienced moderate to severe food insecurity, and in 2022, 2.8 billion people could not afford healthy diets, with a significant portion from lower-income countries (World Health Organization, 2024). The mass production of food and its subsequent waste aggravate food insecurity. The challenges of

reducing food waste and addressing food insecurity are multifaceted. Many existing solutions are not user-friendly and can be difficult for busy households and individuals to adopt. Without effective tools, it is hard for users to track food spoilage, save money, and promote sustainable practices. Additionally, there are few platforms that encourage community sharing of food to prevent waste and support those in need. Many people lack the knowledge and resources needed to preserve food and reduce waste, and users often struggle to understand their food waste patterns and the financial impact due to a lack of clear visualization. Reducing food waste and insecurity often requires collective effort, but there are limited ways to connect with others to share food and support each other. In face of such a significant issue with far-reaching impacts, LivelyShelfs can play a crucial role in successfully addressing these problems.

1.1   Purpose

Livelyshelfs is a web-based tool created to help households manage their food inventory and minimize waste. This document acts as a key resource for effective collaboration among project stakeholders throughout the planning, development, testing, and maintenance stages. It also ensures everyone involved has a clear understanding of the system's features and limitations.

The first screen users encounter is the login page, where they can register or sign in to their account. Next, they access the main dashboard, which includes tabs for inventory, calendar, data visualization, shelf friends, and settings. The inventory section provides details about the household's current food items, including quantities and purchase dates. Users can add recently acquired items to their inventory, or adjust quantities for food that has been consumed, spoiled, or donated.

The calendar tab allows users to view expiration dates for food items and track their status as they approach spoilage. By navigating across dates, users can access detailed information about the

condition of their inventory. Another feature is data visualization, where users can analyze trends such as food usage, purchase dates, quantities, and spoilage. This helps provide insights into spending patterns and consumption habits.

Lastly, the shelf friends tab connects users with their local community, enabling them to request or offer food from their inventory. They can create friend lists, send direct messages, or start group chats. Livelyshelfs does not process food purchases or store financial information, as its purpose is to simplify household management rather than support commercial activities. It is designed to alleviate daily stress through an efficient system for organizing food items.

1.2   Scope

Livelyshelfs is designed to help households cut down on food waste and expenses by providing an intuitive tracking and inventory system that's easy to understand.

Key features include an inventory tab where users can add or remove food items based on recent purchases, consumption, or spoilage. They can also search for specific items within their inventory to check availability before heading to the store. Another valuable feature is the calendar system, which tracks food expiration dates and displays statuses indicating how close items are to spoiling. This feature alleviates the burden of remembering expiration dates, quantities, and other details manually.

Additionally, the community feature connects users with neighbors, enabling them to share or exchange surplus food instead of throwing it away. Through these features, Livelyshelfs promotes both household efficiency and community collaboration.

1.3   Definitions, Acronyms, and Abbreviations

API: Also known as "Application Programming Interface" it is a protocol that allows for

different software applications to communicate with one another.

Community Hub: A feature within the LivelyShelfs app that allows users to share food and

resources with others in their community, fostering collaboration to reduce waste.

Environmental Sustainability: The responsible management of resources to meet current needs

without compromising the ability of future generations to meet their needs.

Food Insecurity: A condition where individuals or households do not have reliable access to a

sufficient quantity of affordable, nutritious food.

Informational Resources: Educational content provided within the LivelyShelfs app to help

users

keep groceries fresh, prevent spoilage, and make environmentally friendly decisions.

Machine Learning: A branch of artificial intelligence that involves the use of algorithms and

statistical models to enable computers to improve their performance on a task through

experience.

Major Functional Component Diagram (MFCD): A diagram that outlines the main

components

and structure of a software application, ensuring a modular and scalable architecture.

Prototype: An initial version of a product used to demonstrate its key features and

functionalities,

often used for testing and feedback purposes.

Community Hub: A part of LivelyShelfs that helps bring the community together and allows

user interaction to share sustainable habits and tips.

Database: An organized collection of information stored electronically.

Food Insecurity: Not having access to enough food to meet one's needs or not being able to access quality food to meet one's needs.

Food Waste: Food that isn't used for its intended purpose or is not used before spoiling. **GitHub:** A service that allows developers to collaborate on the development of projects and provides version control.

GitHub: A service that allows developers to collaborate on the development of projects and provides version control.

JUnit: A testing framework for Java.

Landfills: A site where waste is disposed of, typically the waste is covered by soil. **Spoilage Calendar:** An efficient and intuitive calendar provide by LivelyShelfs that notifies users of when their food is going bad

Landfills: A site where waste is disposed of, typically the waste is covered by soil. **Spoilage Sustainability:** A goal to avoid actions that harm the environment or deplete natural resources while still meeting one's needs.

Trello: A service that helps with project management and planning.

VSCode: Also known as "Visual Studio Code" it is a development environment used by the team that is compatible with many different languages.

Web Application Framework: Software platform intended to help developers in building web applications, providing access to pre-built tools and libraries.

1.4   References

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1.5   Overview

Livelyshelf's product specification outlines the essential functional components, including

hardware, software, interfaces, and product functions, in detail. The web application

encompasses the presentation, web, and database layers, which together explain the interaction of

information between the client and server sides, driven by user interactions. Key functionalities

such as login, inventory management, and waste management are described comprehensively.

2   Overall Description

2.1   Product Perspective

On the hardware side, users will access the application via a computer. Photos of food

items can either be captured directly or entered manually through the device. The data will be

stored on a local server to track inventories and calendar events. The software aspect involves

development tools like JavaScript, Node.js, Mocha, Vite, and React, with JavaScript chosen as

the main language to facilitate communication between the frontend and backend frameworks.

Node.js and Mocha will be used for unit testing, while also enabling pull requests and

communication within the web application. MySQL will serve as the database, and the frontend

will be designed using JavaScript, HTML, and CSS to ensure a user-friendly interface.

Major Functional Components Diagram
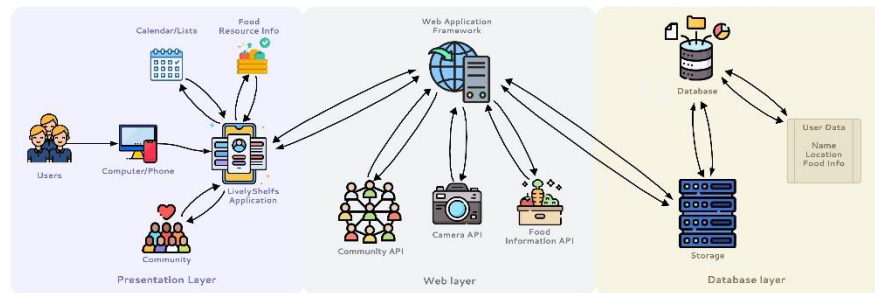
The three-tier architecture of our design includes the presentation, web, and database layers. The presentation layer, as depicted in Figure 1, serves as the interface through which users interact with the application. The web layer manages the connections and data flow between the presentation and database layers. The database layer is responsible for storing user inputs and processing data queries.

Development tools for the front-end include JavaScript, HTML, and CSS, which enable both aesthetic and functional user experiences. The web layer utilizes JavaScript and Python for backend processes, ensuring smooth data retrieval and handling. A Web Crawler/Information API is partially implemented to gather data and provide accurate details about food items. Additionally, Livelyshelfs incorporates a recommendations algorithm to analyze tracked food.

The database layer is constructed using MySQL, focusing on efficient data storage and retrieval on a local server. It handles critical information for user accounts, food inventory, and tracking systems, ensuring functionality across the web application.

2.2   Product Functions

Table 1:

Table of Comparison Between RWP and Prototype

Category	Features	Real World Product	Prototype	Reasoning
Account Management	Login/ Authenticate	Fully Functional	Partially Implemented	Limited time will not be dedicated to basic functionalities
	Location Usage	Fully Functional	Partially Implemented	Limited time will not be dedicated to basic functionalities
	Account Creation / Deletion	Fully Functional	Partially Implemented	Limited time will not be dedicated to basic functionalities
	Add / Remove Friend	Fully Functional	Fully Functional	
	Add / Remove Member	Fully Functional	Eliminated	Limited time will not be dedicated to basic functionalities
Inventory Management	Add / Remove Item	Fully Functional	Partially Implemented	Implement manual input, implement camera if we have time
	Track Item Expiration	Fully Functional	Fully Functional	
	Mark Items Shareable	Fully Functional	Fully Functional	
	Quantity Viewing	Fully Functional	Fully Functional	
	Purchase History	Fully Functional	Eliminated	Limited time and not an innovated feature
	Inventory History	Fully Functional	Eliminated	Limited time and not an innovated feature
Proactive Waste Management	Predictive Waste Analysis	Fully Functional	Fully Functional	Limited test data
	Shelf Friends Sharing	Fully Functional	Fully Functional	
	Recipe Recommendations	Fully Functional	Partially Implemented	Limited time will not be dedicated to web crawler functionalities
	Incentives	Fully Functional	Partially Implemented	Limited time will not allow for full reward
	Data Visualization	Fully Functional	Partially Implemented	Limited test data
	Sharing Analytics	Fully Functional	Partially Implemented	Limited test data

The Livelyshelf prototype will focus on three main features: account management, inventory tracking, and proactive waste management. Due to time constraints, account login authentication and account creation will be partially implemented, whereas the add/remove friends functionality will be fully developed. The option to remove members has been excluded, as its purpose overlaps with the friend management feature. Features like item expiration tracking, quantity viewing, and marking food as sharable will be fully implemented and accessible through the inventory and calendar tabs. Inventory and purchase-related functionalities have been omitted, as they are not innovative or necessary for the analysis.

The predictive waste analysis feature will be fully functional, along with the shelf friends sharing system, though these will be tested on limited datasets. Recipe recommendations will be partially implemented, with no dependency on the web crawler functionalities. Incentive features

and data visualization/sharing analytics will also be partially implemented, as user-provided test data remains limited.

2.3   User Characteristics

Livelyshelfs is designed for household members seeking a practical solution for managing food inventory and reducing waste. The target audience includes individuals with beginner to moderate technical expertise, ranging from basic computer literacy to average experience with web applications. The system is accessible to users from late teens and older, with a particular focus on individuals or families aiming to improve their food management efficiency. Users may interact with the application daily to update inventory or check expiration dates, or occasionally for features like data analysis and social interactions. Accessibility features, such as a user-friendly interface, ensure that the application accommodates users with limited technical skills or specific needs.

Community-oriented features also play a role in Livelyshelf's design, including the "Shelf Friends" food-sharing feature. This caters to users interested in social engagement and collaboration, enabling them to offer or request food items via tailored messaging capabilities. The application is exclusively for personal use, with no option for individuals to sell items. By addressing the diverse needs of individual households and small, interconnected communities, Livelyshelfs ensures a well-rounded experience for its users.

2.4   Constraints

N/A

2.5   Assumptions and Dependencies

 N/A