

**Lab 1 – Descriptive Paper**

Asia Gillispie

Old Dominion University

CS411W

Dr. Sarah Hosni

January 24, 2025

Version 1

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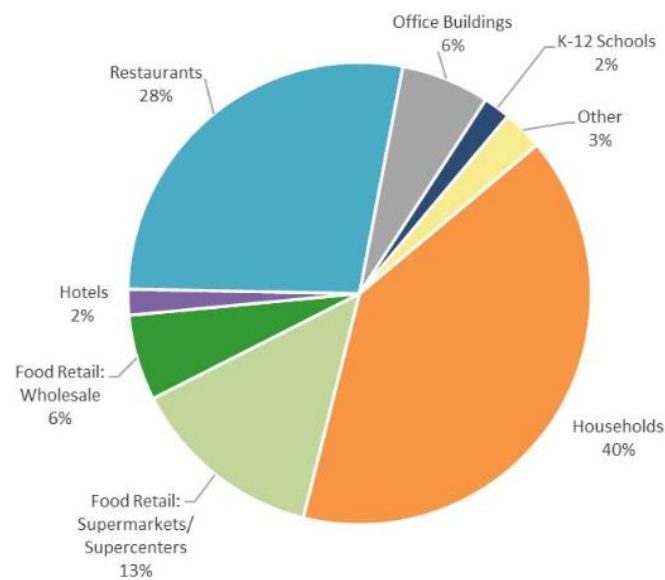
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## 1 Introduction

### 1.1 Problem Description

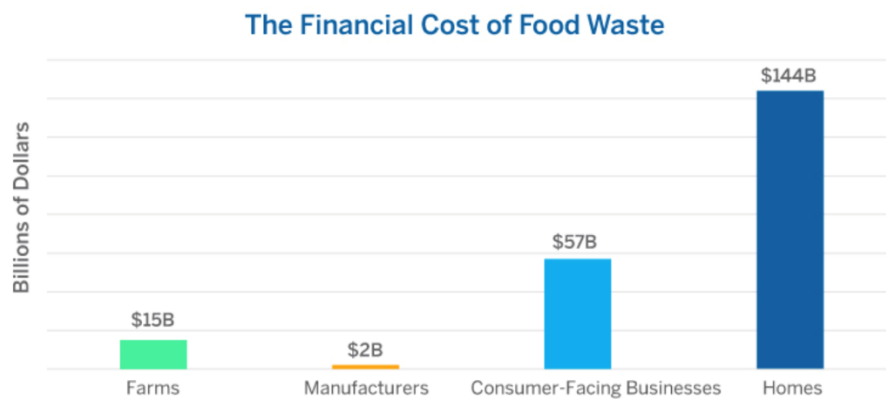
Food waste is a large and continuing global issue that affects many aspects of our lives such as environmentally, financially, and socially; One of the leading producers of food waste in the US are households, a 2019 report stated that household food waste accounted for 40% of total food waste, see Figure 1 (EPA, n.d.). According to the same 2019 report by the EPA, an estimated 66.2 million tons of household food waste was created (EPA, n.d.). The world mass produces food, but many are unaware of the issues caused by food waste, some are too busy to seek out ways to reduce their waste, and some lack the knowledge of how to reduce their food waste.



*Figure 1: Percentage of Wasted Food from Residential, Retail, and Service Sectors(EPA)*

Food waste created in sectors such as businesses and farming equate to a monetary loss, see Figure 2. Food products have monetary value, but it loses that value once it becomes waste. Every year there is about \$940 billion lost due to food waste, with the US being \$218 billion of that loss (Shapiro, 2024). In households, purchased food that goes to waste equates to a monetary

loss since the purchaser does not get to use all of what they paid for. According to a study, “the average American consumer spends roughly \$1,300 per year on food that ends up being wasted.” (Berard, 2020). Many are unaware of this loss since many people don’t usually track how much they lose based off what they throw away.



*Figure 2: Financial Loss Per Sector in the US (About Kitch...*

The creation of food can be resource intensive, over production of food deplete resources for vulnerable communities; Other aspects of food waste such as the environmental cost can also affect the welfare of people by contributing to pollution, affecting the land, and contributing to global warming. Food insecurity is also related to the societal cost of food waste; Large amounts of food is wasted every day, but many people still suffer from food insecurity.

The creation of food is resource intensive; Agriculture uses about 70% of all water use, and many ecosystems are destroyed to make place for more farmland (Lewis, 2022). The creation of food waste equates to wasting important resources used to make it and the needless destruction of ecosystems and its biodiversity. Food waste usually accumulates at landfills which negatively affect the environment. Landfills also require land, meaning ecosystems must be destroyed in the process of making them. Landfills are also the producer of 8% of global

greenhouse gas emissions, landfills produce emissions such as methane and carbon dioxide which contribute to global warming. (Move For Hunger, n.d.).

Even with the mass production of food and mass wasting of it, many people still suffer from food insecurity. It was reported that in 2023, 2.3 billion people suffered moderate to severe food insecurity (Berard, 2020); It was also reported in 2022 that 2.8 billion people couldn't afford healthy diets with a large percentage from lower income countries (World Health Organization, 2024).

## **1.2 Solution Description**

Our proposed solution to reduce food waste and reduce food insecurity is our application LivelyShelfs. LivelyShelfs is a proactive tool to aid busy household by helping in food waste management. LivelyShelfs helps in reducing food waste by providing a place for people to share food items instead of letting them go to waste. LivelyShelfs provides the user with information and recommendations to help them reduce their food waste and help the environment.

LivelyShelfs provides a way to track grocery spoilage, providing the user with a calendar and list to help provide a visualization of what they have and what nearing their spoil date. Based on user input and actions, a visualization of the user's trends is provided to show how well they are reducing their food waste and how much they have monetarily saved. LivelyShelfs has easy item logging through use of the camera. LivelyShelfs will provide the user with information such as food preservation and greener actions they can take. LivelyShelfs recommends the user recipes based on their food inventory and what items are nearing their spoil date. LivelyShelfs provides a community hub that allows friends and families to connect and share food items.

Our solution would reduce the creation of food waste, less food waste would be going into landfills which would help the environment. Users save money since purchased food items

wouldn't be going to waste. Our solution provides educational resources on the topics of food waste, and its effects on the environment; Our solution encourages users to make more environmentally friendly actions and spreads awareness on the effects of food waste and food insecurity. Our solution helps combat food insecurity by encouraging the sharing of food to those that need it while also tackling the problem of food waste.

### **1.3 Risks**

One risk is having users being too far from one another, this is mitigated by limiting the community hub to friends and family. Food information can be entered incorrectly due to errors on food labels and manufacturing errors, this is mitigated by encouraging that the incorrectly labeled food be used for composting. Users may ignore the spoilage calendar and its dates, this is mitigated by pushing multiple reminders to the user.

One risk is the lack of community engagement, this is mitigated by partnering with companies with green initiatives such as Kroger. The application may not adapt to competition, this is mitigated by allowing community feedback and making changes when needed. The application must comply with changing privacy laws, this is mitigated by updating the privacy conditions when necessary.

One risk is that the web crawler might give incorrect output, this is mitigated by reviewing all information before uploading it to the app. It is possible for a data breach through use of a buffer overflow with the API, this is mitigated by providing input validation. Integrating the API can become overly intricate, this is mitigated by studying the API's documentation and utilizing a platform for API integration.

## **2 LivelyShelfs Product Description**

### **2.1 Key Product Features and Capabilities**

The LivelyShelfs application will estimate and track the expiration dates of food items the user has inputted in their food inventory; Users can input items in their inventory manually or through use of the bar code scanner. The expiration dates will be shown visually through a calendar and list view. There will be visual indications of what food items are nearing their spoilage date by being color coded. The application will also track how the user has managed their grocery spoilage, this data will be used to create the visuals for the user's trends. Users will be notified of the food items nearing their spoil date and will be notified if they continue to buy specific food items and waste them based on their trends.

The LivelyShelfs application will provide the users with various kinds of information and will link the user to the source of the information. In the calendar and list view section of the application, selecting a food item shown will bring up information on the food item such as how it will spoil and the best-known way to preserve that food item; Links to where the food item information is pulled will be provided to the user. In the recommendation section, information about the green actions the user can take will be provided; Links to where information about the green actions the user can take will be provided to the user. Links to recipes recommended to the user will also be provided.

The LivelyShelfs application will provide the user with recommendations based on the state of their food item inventory, such as what food items are nearing its spoilage date. Depending on the types of the food the user has nearing the spoilage date and the food the user currently has logged, a recipe using those food items will be shown to the user. If the user does not want to cook food items nearing their spoilage date, the user will be recommended to use the



community hub, Shelf Friends. If the user ends up creating food waste, the user will be recommended greener ways to deal with food waste such as composting.

The LivelyShelfs application will provide a community hub called Shelf Friends, Shelf Friends will connect the user to other users they add to their Shelf Friends group. Shelf Friends is where the user will be able to share food items they are not going to use before their spoil date to others. In the food item inventory, there will be an option to set food items as sharable to show what food items will be available for sharing. Users will be able to message each other about food items they want to share to other users and users will receive notifications from other shelf friends.

## 2.2 Major Components (Hardware/Software)

The major functional components of LivelyShelfs as seen in Figure 3 is structured as a three-tier architecture. This architecture includes the presentation layer, web layer, and database layer. This gives an overview of the components that make up LivelyShelfs and how they will interact with each other.

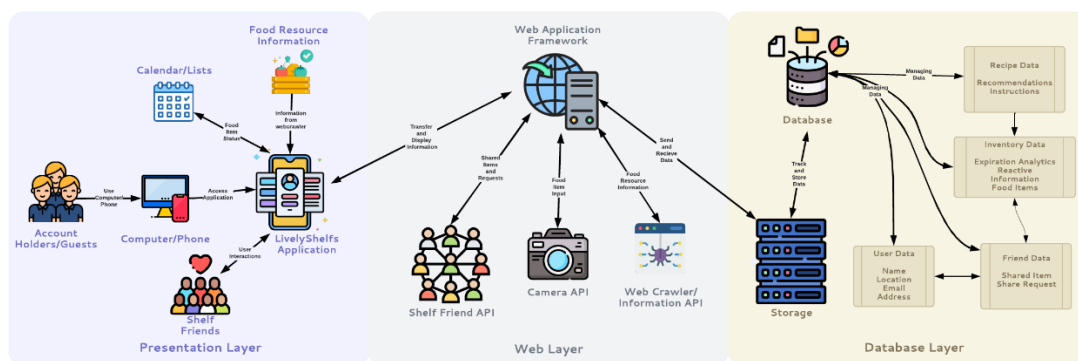


Figure 3: Major Functional Components Diagram

### 2.3 Three-tier Architecture

The presentation layer shows the parts and interactions between the user and the LivelyShelfs application, and the application's interaction with the web layer. Accounts holders and guest will be able to access the application through computer or phone. Input from the user in the LivelyShelf application regarding food items and its status will be shown from the calendar and list. Food resource information shows the sources of the information which will be grabbed by the web crawler and then presented to the user. Shelf Friend's interaction with the application is that the interactions between users and the user with the application is part of the information that will be shown to the user and a component of the application.

The web layer shows the parts and interactions between the APIs, the web application framework, and the other layers of the architecture. The web application framework will be transferring data needed for displaying information in the LivelyShelfs application in the presentation layer. The Shelf Friends API will be used for the functionality involving item sharing, requests, and shelf friend user interactions. The Camera API will be used for the logging methods that use the camera, such as the bar code scanner. The Web Crawler/Information API will be used to scour the web for the information regarding food items, recipes, and green actions people can take. The web application framework will send information to the storage in the database layer that is needed.

The Database Layer shows the parts and interactions between storage, the database, and the web layer. Information from storage will be sent to and received from the web application framework. Data in storage will be managed by the database. The main four sections of data that will be stored in the database is the user data, friend data, inventory data, and recipe data.

### **3 Identification of Case Study**

#### **3.1 Customer**

The target customer for LivelyShelfs are the heads of households that have the goal in reducing their food waste; Another target customer is anyone who cooks or purchases groceries. The app focuses in helping with food management and would help people that are too busy to manually manage their food and plan out what to do with it. Food is managed with the intention of reducing food waste and would provide these customers with recommendations with what to cook using older food items and how to deal with waste created in an environmentally friendly way.

#### **3.2 User**

The types of users that would use LivelyShelfs includes people who struggle in tracking and managing their groceries. LivelyShelfs helps in food item management with the grocery spoilage tracking and various visualization that are provided to the user. Another type of user that would use LivelyShelfs are those who want to minimize excess food purchases. Through grocery spoilage tracking, user trends are given to inform the user with how they have managed their food and how they can minimize buying excess that turns into waste. Another type of user that would use LivelyShelfs are those who would like recommendations of recipes, so food doesn't go to waste. The recommendations provided by LivelyShelfs provides this to the user based on their food item inventory and food item statuses.

#### **3.3 Stakeholder**

The potential stakeholders of LivelyShelfs are mainly those with the goal in reducing their food waste. Community groups that have the goal in reducing food waste and want the benefits of food waste reduction such as improving the local environment and helping those near who struggle with food insecurity. Business and Retailers who have the goal of reducing food waste

creation are potential stakeholders. Political organizations who oversee and are concerned with aspects of the environment such as the current climate crisis, pollution, and the destruction of ecosystems due to farming and landfills are potential stakeholders.

## **4 LivelyShelfs Product Prototype Description**

### **4.1 Prototype Architecture**

### **4.2 Prototype Features and Capabilities**

### **4.3 Prototype Development Challenges**

## **5 Glossary**

**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 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 ones needs or not being able to access quality food to meet ones needs.

**Food Waste:** Food that isn't used for it's 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.

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**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.

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**Sustainability:** A goal to avoid actions that harm the environment or deplete natural resources while still meeting ones 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.

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