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Software Requirements Specification
Stockpile

1. Introduction

1.1 Purpose

Stockpile is an application which updates and maintains a user's pantry. The user will be able to maintain their inventory by adding or removing items with built-in tools, such as a barcode scanner. The application will also assist in meal planning by suggesting recipes based on the items available in the user's inventory. Using both the pantry and meal planning functionalities, Stockpile will create and maintain a grocery list of what needs to be added to the inventory. Furthermore, the user will be able to schedule reminders to update their pantry.

1.2 Scope

"Stockpile" is a mobile Android application designed to allow users to catalog and track the contents of their pantry. Stockpile shall include multiple features such as the keeping track of all items in the pantry, providing statistics on grocery usage, and the option to generate a grocery list automatically. The application will suggest recipes based on the contents of the user's pantry and suggest additional ingredients for recipes where the user does not have required ingredients. Stockpile will utilize cloud-based storage in order to make user accounts that will be accessible on multiple Android devices.

1.3 Product Overview

1.3.1 Product Perspective

1.3.1.1 System Interfaces

In order to realize the requirements for Stockpile, the system will need to interface with a mobile device, a database, local grocery stores, and other supporting systems.

1.3.1.1.1 Mobile device interfaces

Stockpile shall interface with the mobile device by utilizing the architecture components of the Android operating system. These components include APIs (application program interfaces) for the various Android-provided functionalities. Stockpile shall:

- Interface with the device's display output.

- Interface with the device's touchscreen to accept user inputs.
- Interface with the device's onboard camera.
- Interface with the device's network connectivity.

1.3.1.1.2 Database interfaces

Stockpile shall connect to an online database, at login, to download user preferences, saved data, retail store information, and geographical information about the user. Data will also be stored on the device's local storage and memory for access. The local database will synchronize with the online database. The ability to interface with online databases will also ensure that users have access to the latest versions of Stockpile and receive relevant notifications.

1.3.1.1.3 Data Storage

Stockpile shall store user data such as login information and user preferences locally on the device. This data may include product names, expiration dates, images, prices, and product availability. In addition, Stockpile shall:

- Notify the user if there is insufficient memory on their device for storage.
- Interface with the device's shared preferences.
- Reserve a set amount of the device's memory for Stockpile.
- Store new data and overwrite obsolete data already in the device's memory.

1.3.1.1.3 Database Storage

Stockpile shall be hosted on and communicate with a server that will require an individual database instance. Stockpile shall have the following features:

- Interface with an online data storage service.
- Update, add, and remove data on the database.
- Retrieve information from the online database.
- Interface with the development company's database.
- Automatically download and install updates from the Android application distribution service.

1.3.1.2 User Interfaces

1.3.1.2.1 Greeting Message (Figure 1)

When opening Stockpile for the first time, the user will immediately see a menu with a heading message that reads, "Thank you for downloading Stockpile (version number)! Where should we begin?". This menu will display three selectable options labeled "Take a tour", "Create a Profile", and "Start Stockpiling!".

1.3.1.2.2 Take a tour (Figure 2)

When this option is selected, the user manual will appear. A button will be displayed at the bottom of the screen. Tapping this button will open the phone's

browser and connect to YouTube. Upon connection, a two-minute tutorial video will begin.

1.3.1.2.3 Create a profile (Figure 3)

Stockpile shall allow the user to create a profile to save preferences and store data. When this option is selected, the user will see a window prompting them to enter their email address and a password. This information will be associated with all saved files until the email address is changed.

1.3.1.2.4 Login (Figure 3)

If the user already has an account, Stockpile will allow the user to sign in using this account. The screen that is displayed to the user will look similar to the create a profile, but it will indicate that it is a login screen and not the create a profile screen. In addition, this menu will contain a checkbox with the text “remember me” next to it. When this box is checked, the information entered by the user will be stored in the device’s memory. The stored data will be used to automatically fill the fields each time Stockpile restarts. Entering an email address and password will allow the user to access all saved data associated with that profile.

1.3.1.2.5 Start Stockpiling

When the “Start Stockpiling!” option is selected, Stockpile’s main control panel will launch. This option will fire the main application activity bypassing all other options.

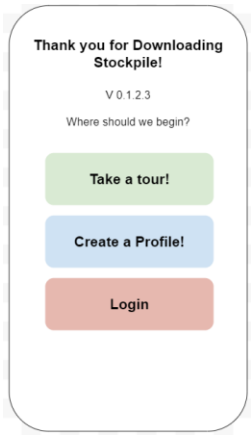


Figure 1

Figure 2

Figure 3

Figure 4

Note: Images are NOT prototypes and are intended for basic visual representation ONLY

1.3.1.2.6 Control Panel (Figure 4)

The control panel will act as the primary controller for Stockpile. From here, the user can make selections that lead to each list, including the pantry inventory list, the list of desired items to keep in stock, the grocery list, and the user’s meal planning list. This page will:

- Display the user's profile name at the top of the page next to the Stockpile logo.
- Contain four buttons that link to four different sections of Stockpile.

1.3.1.2.7 Keep in Stock (Figure 5)

The Keep in Stock place will allow the user to create a list of grocery items that they want to keep on hand at all times. This list will:

- Scroll up and down to display all items in the list.
- Implement a method to add and remove items and adjust the quantity of items.
- Respond to the screen resolution of the device and expand/shrink to accommodate the quantity of data being displayed.

1.3.1.2.8 Pantry Inventory (Figure 6)

The requirements for the 'Pantry Inventory' page contain all of the requirements for the "Keep in Stock" page as described in 3.2. Additionally, this page shall:

- Interface with the device's onboard camera.
- Interface with other application lists to add and remove items from the inventory.
- Alert the user when there are items in the list with expiration dates that are older than the current date.

1.3.1.2.9 Grocery List (Figure 7)

The requirements for the 'Pantry Inventory' page contain all of the requirements for the 'Grocery List' page as described in 1.3.1.2.7.

1.3.1.2.10 My Meal Plans (Figure 8)

The 'My Meal Plans' page will provide an expedited way for the user to add and remove items from their pantry and grocery list. Additionally, this page will assist the user in planning meals based on what items exist in their pantry. This page shall:

- Display a list of saved recipes.
- Display recipes that are possible to make based on the user's current pantry inventory.
- Display images of each item.
- Interface with the 'Grocery List', adding ingredients of selected meals.
- Interface with the 'Pantry List' removing ingredients of selected meals.

Figure 5 Figure 6 Figure 7 Figure 8

Note: Images are NOT prototypes and are intended for basic visual representation ONLY

1.3.1.3 Hardware Interfaces

N/A

1.3.1.4 Software Interfaces

Operating System:
Name: Android
Version: 7.0 / Nougat
Source: https://developer.android.com/docs/
Description: The Android operating system shall be the system used to host the app.

Programming Language:
Name: Java
Version: Java SE 8
Source: https://docs.oracle.com/javase/8/docs/
Description: The app shall be programmed in Java, as this is the primary Android development language.

Name: Structured Query Language
Mnemonic: SQL
Version: 3.8
Source: https://www.sqlite.org/docs.html
Description: The app shall use SQL when working with the SQL databases.

Databases:

Local**:**
Name: Structured Query Language Lite
Mnemonic: SQLite
Version: 3.8
Source: https://www.sqlite.org/docs.html

Description: The app shall use SQLite or RoomView for the database.

Name: Android Room
Version: Room 2.1.0-alpha01
Source: https://developer.android.com/topic/libraries/architecture/room
Description: The app shall use RoomView or SQLite for the database.

Cloud:
Name: Microsoft Structured Query Language Server
Mnemonic: Microsoft SQL Server
Specification Number: 13.0.4001.0
Version: SP13.1.
Source: https://support.microsoft.com/en-us/help/3177312/sql-server-2016-build-versions
Description: The app shall use Microsoft SQL Server as the database management system.

1.3.1.5 Communications Interfaces

Stockpile shall be capable of accessing the internet.

1.3.1.5.1 Wi-Fi Communications

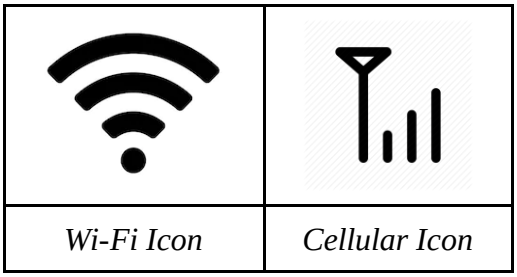
Stockpile shall have access to the internet via a local Wi-Fi access point where available, and according to the system preferences of the device.

1.3.1.5.2 Cellular Communications

Stockpile shall have access to the internet via a cellular internet connection on devices with cellular radios and an internet data plan according to the system preferences of the device.

1.3.1.5.3 Visual representation of communication interfaces

Stockpile shall at all times indicate to the user what network connection (Wi-Fi or cellular) is being used to access the internet. Figure 3.5 shows examples of the visual representations that may be used to indicate this.



Wi-Fi Icon	*Cellular Icon*

Figure 3.5

1.3.1.6 Memory Constraints

Stockpile shall use less than 2 mb of storage on the user's device since the majority of the data will be stored on Stockpile's servers. Data from a few features such as grocery lists and recipes will be stored on the user's device, but each of these files will be under 50 kb.

1.3.1.7 Operations

Stockpile shall be capable of an array of operations including updating the pantry database, setting reminders, sending notifications, and saving recipes and grocery lists.

1.3.1.7.1 Updating the database

Stockpile shall perform operations on the database based on user input. As the user updates (removes or adds) items in the inventory, Stockpile will perform the necessary operations to the database to reflect these changes. The database will also be utilized for saving recipes.

1.3.1.7.2 Setting reminders/notifications

Stockpile shall be capable of taking user input and sending notifications, reminders, or alarms based on that user input. For example, the user might want to be notified on only when their milk is about to go bad, Stockpile must therefore allow this operation to be done.

1.3.2 Product Functions

The user will be able to navigate to their pantry from the app. When the user accesses their pantry, they will see products they have added, images of added products, expiration dates, and when the item was added. From the pantry screen users will also have the ability to modify product information.

The user will be able to access a ‘grocery list’ function from the app. The grocery list will update automatically when a user removes or adds a record from the inventory list. It will display the product’s name and image. When the grocery list is accessed it will display all of the user’s desired items to purchase.

The app’s functionality will allow storing user and app data on a cloud service so that the user has the option to store all of their pantry data on Stockpile’s servers, whether that be for use directly from the server across multiple devices or for data backup.

Stockpile shall include a section where the user is able to create, add, or remove cooking recipes. When a user adds a recipe, the app will automatically compare it to the ingredients in the user’s pantry. If the ingredient is not there it will be automatically added to the user’s grocery list. The app will automatically display recipes that are possible with the user’s current pantry.

Stockpile shall contain analytics generated automatically from the user’s data. The analytics option will display the user’s most frequently bought items and track how much of a specific item they have bought per month. Using this data, the app will compile the user analytics and then create a personal preference for the user and suggest updates to their grocery list.

1.3.3 User Characteristics

There will be two types of users that interact with the system: household administrators and general users. These two types of users will utilize the app in different ways.

Each household will be permitted to have one household administrator. The administrative user will be the individual who created a household. The household administrator will have the ability to add users to the household's profile. The household administrator will also be responsible for approving or denying suggestions from the household's general users for items added to the grocery list and recipes added to "My Meal Plans" (as described in 3.1.12) from the Stockpile database. Additionally, an administrative user may transfer over their administrative permissions to a general user.

The general user will only have the ability to view the pantry inventory, remove items from it, suggest items to be added to the household grocery list, and suggest recipes to be added to the household meal plan. Only a household administrator has the permissions necessary to approve items added to the grocery list and recipes to the "My Meal Plan" section. Each household has a limit of 10 general users.

1.3.4 Limitations

This application will only run on Android devices. Another essential limitation is the current operating system and age of the device. Devices with Android version 3.2 and under could have unforeseen bugs that could render Stockpile in a disabled state.

The scanning function of Stockpile poses another potential limitation. If the device's camera is not working or does not take clear pictures, the scanning function will not work. As this function is planned to be the most efficient way to add items to the user's pantry, this poses a large limitation.

1.4 Definitions

Term	Definition
Administrator	The user with authorization and all system privileges in a given app.
Alert	A visual and/or auditory notification sent to the user that provides necessary app information.
Analytics	Statistics created using data gathered about items a user has purchased in the past month, 2 months, 6 months, year, or all-time.
Android Operating System	The software designed to run on Android devices for basic support functions.
Barcode	A unique symbology used by manufacturers to identify a product.
Barcode Scanner	A built-in software tool that utilizes the device's camera for scanning product barcodes.
Cellular Internet Connection	Internet availability on a device through a carrier company.
Checkbox	a small box on a form into which a check or other mark is entered to indicate selection
Cloud Storage	An external space for storing application data.
Control Panel	The application's main page that links to all other functions within the application.
Database	A structured set of data held in a computer, especially one that is accessible in various ways.
Display Output	The textual or visual information that the user sees on the screen of the device.
Encode/Encrypt	To convert information into another form, typically to a cipher for security purposes.
Encryption	Encoded data that is sent to and from the server for security purposes.
Expiration Date	A date indicating the last day that a product is safe to consume.
General User	A non-administrative user with limited privileges and authority.
Geographical Information	Information about the user's physical location such as city, state, and country.
Hash	Hashing refers to the encryption process of applying a transformation upon a string of characters (like a password) to change its value. A HASH is a transformed string that can only be decoded with the proper function.
Household	A collaborative user group in the application with up to eleven members; one administrator and ten general users.
Hyperlink	A link from a hypertext file to another location or file, typically activated by clicking

	on a highlighted word or image on the screen.
Inventory List	A list of the pantry items and their associated quantities.
Meal Planning Feature	The page on which the user has the ability to determine what meal he or she wants to prepare on one or more specified days.
Navigate	Traversing through different app menus/screens to locate desired information.
Onboard Camera	The internal camera on the device.
Online	Controlled by or connected to another computer or to a network.
Pantry Item	Food item in a user's virtual pantry that has properties such as an expiration date, price, nutritional information such as calories, carbs, fat, sugar, and protein content. Items have a picture and barcode associated with them. Pictures can be any standard image filetype. Barcodes correspond to a UPC number.
Plain Text	data that represent only characters of readable material that has not been specially formatted or written in code
Prototype	A partial or incomplete version of the system with some but not all app features met.
Query	An operation performed on a database used to retrieve information.
Recipe Box	A collection of recipes.
Recipe Suggestion	Recipes selected and displayed to the user based on similar previously used recipes and frequently used online recipes selected by other users.
Reminder	A scheduled notification intended to help the user remember the occurrence of an event.
Runtime Error	An error that can cause the application to stop running due to a flaw in the code or a conflict with multiple users.
Server	A computer program that provides a service to another computer program.
Grocery List	1.) A list of items to be purchased by the user and added to the inventory. 2.) The name of a page in the application.
Sync	An attempt to match local data modifications stored on the app onto data stored on the server, or vice versa.
Tour	Tour is a navigating guide explaining a user purpose of Stockpile and how to orient in the application. The guide is represented as a two-minute video.
Update	A change that builds upon the current system to fix and/or modify the system in a beneficial way.
User Preferences	Customizable settings that allow the user to personalize the appearance of the application.

User's Pantry	An inventory of all the food items currently in a user's home.
Wi-Fi	A trademarked term meaning IEEE 802.11x. A wireless connection to the internet.

2. References

N/A

3. Specific Requirements

3.1 External Interfaces

3.1.1 General

3.1.1.1 The system shall utilize the device's hardware for accepting input and displaying output.
3.1.1.2 Input for the system will come from the device's touchscreen, including the device's built in keyboard.
3.1.1.3 The system output will adapt on any given Android screen.
3.1.1.4 Positive integer values will be used to display all quantity information.
3.1.1.5 For all lists within Stockpile, the system will display a button that allows the user to select a grid view of their items or row view of their items.
3.1.1.5.1 If the user chooses to display list items in the grid view, the system will display a grid with three items per row, with each item occupying one grid space.
3.1.1.5.2 If the user chooses to display list items in the row view, the system will display one item per row.
3.1.1.6 For every list the system shall display information about each item.
3.1.1.6.1 The system shall display the name of each item.
3.1.1.6.2 The system shall display the quantity of each item.
3.1.1.6.3 The system shall display a picture of each item.
3.1.1.6.3.1 Each item image shall be clickable to allow the user to manually change or select an image file for each item.
3.1.1.7 The system shall display a sign-out feature that will log the user out of their account.

3.1.2 Greeting Screen

3.1.2.1 The system shall display a greeting screen to the user when Stockpile is opened for the first time.
3.1.2.2 The Greeting Screen shall include the options "Take a tour", "Create a Profile", and "Login".

3.1.3 Take a Tour

3.1.3.1 The system shall display to the user a user manual explaining Stockpile's options and how to use them.

3.1.3.2 The system shall display a hyperlink at the bottom of the window that will open the user's default browser and link to a video tutorial.

3.1.4 Create a Profile and Login Screen

3.1.4.1 If the user selects "Create a Profile," the system will display a screen that will allow the user to create an account.

3.1.4.1.1 The system shall display input fields for the user to enter a valid email and a password. (See sections 3.2.5.2 and 3.2.5.3 for details)

3.1.4.1.2 The system shall display a button labeled "Start Stockpiling" to complete the process of creating a profile.

3.1.4.1.3 The system shall display a message indicating whether the user's profile was created successfully.

3.1.4.1.4 Upon the successful creation of a profile, the user will be taken to the "Start Stockpiling" screen.

3.1.4.2 If the user selects "Login," the system shall display the login screen that will allow the user to login to an existing account.

3.1.4.2.1 The login screen shall display input fields for the email address, password, and a checkbox labeled "remember me"

3.1.4.2.2 If the user previously selected the "remember me" the email address will be displayed in plain text in its corresponding input field.

3.1.4.2.3 If the user previously selected the "remember me" the password shall be displayed as ellipses or asterisks (*) in its corresponding input field.

3.1.4.2.4 The system shall display a button labeled "Start Stockpiling" to complete the process of logging in.

3.1.4.2.5 The system shall display a message if the login was not successful.

3.1.4.2.6 Upon successfully logging in, the system shall direct the user to the "Start Stockpiling" screen.

3.1.5 Start Stockpiling

3.1.5.1 If the user selects the "Start Stockpiling" button from either the "Create a Profile" screen or the "Login" screen the system will display the "Start Stockpiling" screen.

3.1.5.2 The system shall display an option for the user to create a new household.

3.1.5.2.1 If the user creates a new household, the user will become the administrator for the household.

3.1.5.2.2 Once the user creates a new household, the system shall direct the user to the control panel

3.1.5.3 The system shall display the option for the user to choose to view households they are already part of.

3.1.5.3.1 If the user chooses to view a household that they are already part of, the system shall display those households.

3.1.5.3.2 Once the user selects a household from the displayed list, the system shall direct the user to the control panel.

3.1.6 Control Panel

3.1.6.1 Once the user creates or selects an existing household, the system shall display the control panel to the user.
3.1.6.2 The system shall display the following options as buttons to the user: “Pantry”, “Keep in Stock”, “Grocery List,” “Meal Planning”, and “Sign Out”.
3.1.6.3 When the user selects the “Pantry” button, the system will display the user’s pantry inventory list.
3.1.6.4 When the user selects the “Keep in Stock” button, the system will display a list of all the desired items that the user wishes to keep in stock.
3.1.6.5 When the user selects the “Grocery List” button, the system will display all the items added to the grocery list.
3.1.6.6 When the user selects the “Meal Planning” button, the system will display the meal planning screen.
3.1.6.7 When the user selects the sign out option, the system will log the user out of their account.

3.1.7 Keep in Stock

3.1.7.1 The system shall display a list of all the items that the user wants to keep in stock at all times.
3.1.7.2 When an item is selected the system shall display a submenu which will display available options for each item next to the user’s selection.
3.1.7.2.1 The submenu shall display the following options: “Delete item” and “Change Quantity”.
3.1.7.2.2 When “Delete item” is selected, the system will display a message to the user verifying that the user actually wants to delete the item.
3.1.7.2.3 When “Change Quantity” is selected, the system will display an input field allowing the user to enter in the new desired quantity.

3.1.8 Pantry Inventory

3.1.8.1 The system shall display a list of all the items in the pantry inventory.
3.1.8.1.2 In addition to the default item information, the system shall display an expiration date for each item.
3.1.8.2 When an item is selected the system will display a submenu to edit each item.
3.1.8.2.1 The submenu shall include an option for the user to change quantities of each item.
3.1.8.2.2 The submenu shall include an option for the user to edit the name of each item.
3.1.8.3 The system shall display a button which will allow the user to add items using the item’s barcode.

3.1.8.4 When the quantity of an item falls below of the desired “Keep in Stock” amount, the system shall display a message asking the user if they want to add an item to the grocery list.

3.1.9 Grocery List

3.1.9.1 The system shall display a list of items that the user wants to purchase during their next trip to the grocery store.

3.1.9.2 When an item is selected the system will display a submenu for each item.

3.1.9.2.1 The submenu shall display the following options: “Delete item” and “Change Quantity”.

3.1.9.2.2 When “Delete item” is selected, the system will display a message to the user verifying that the user actually wants to delete the item.

3.1.9.2.3 When “Change Quantity” is selected, the system will display an input field allowing the user to enter in the new desired quantity.

3.1.9.3 The system shall display a checkbox next to each item in the grocery list.

3.1.9.4 The Grocery List shall allow the user to sort the list alphabetically or by type.

3.1.10 My Meal Plans

3.1.10.1 The system shall display a list of recipes the user has selected from a list of user-added recipes.

3.1.10.2 The system shall display the name of each recipe.

3.1.10.3 The system shall display a picture of each recipe.

3.1.11 Barcode Scanner

3.1.11.1 When the user navigates to the barcode scanner from the pantry inventory screen, the system will display the camera screen to the user

3.1.11.1.1 The system shall display a rectangle on the camera screen showing the user where the barcode will be on the screen.

3.1.11.1.2 The system shall display a message instructing the user how to scan an item into their pantry.

3.1.11.2 The system shall indicate to the user if the item was successfully scanned in.

3.1.11.3 The system shall display a way for the user to update the quantity of an item after it is successfully scanned.

3.1.11.3.1 The system shall display the updated quantity of the item.

3.2 Functions

3.2.1 General List Functions

3.2.1.1 The system shall allow the user to manually adjust the quantity of each list item.

3.2.1.1.2 The system shall allow the user to add new items to the list.

3.2.1.1.3 The system shall allow the user to remove items from the list.

3.2.2 Pantry Inventory List

3.2.2.1 The inventory list shall interface with the grocery list to add items to the inventory list.

3.2.2.2 The system shall add an item to the inventory list when the user taps the item's checkbox in the grocery list and then taps the "add to pantry" button.

3.2.2.3 The System shall add items to the inventory list as an item's barcode is scanned.

3.2.3 Grocery List

3.2.3.1 The System shall automatically add items to the inventory list after certain events occur.

3.2.3.1.1 The system shall add items to the grocery list when the user indicates the items should be added after falling below the desired "Keep in Stock" amount. (see 3.1.8.4)

3.2.3.1.2 The system shall add items to the grocery list when recipes are selected. (see section 3.2.4.2.3 for more information)

3.2.4 Meal Planning

3.2.4.1 The system shall provide a way for the user to manually add recipes to their recipe box.

3.2.4.2 The system shall provide a way for the user to create a weekly or monthly meal plan.

3.2.4.2.1 The system shall provide existing recipes from the database that could be made with the user's current inventory.

3.2.4.2.2 The system shall determine which ingredients from a selected recipe are not available in the inventory

3.2.4.2.3 The system shall add the items from the recipe not found in the pantry to the grocery list when a recipe is selected.

3.2.5 User Account

3.2.5.1 The system shall require an account to login for use.

3.2.5.1.1 A verification email will be sent to verify the validity of an email address.

3.2.5.1.2 Strong passwords should consist of at least one capital letter, at least one lowercase letter, at least one number or special character (! ? - @ ~), and be between 8-15 characters in length.

3.2.5.1.3 Passwords shall be unique from any passwords previously used by an individual user.

3.2.5.1.4 The system shall verify a user's identity with an email address and a password against previously saved credentials.

3.2.5.1.5 Unless the user specifies "remember me," any saved credentials will be forgotten when the user signs out, requiring the user to re-enter their credentials to log back in.

3.2.5.2 The system shall allow administrative privileges to one user per household.

3.2.5.2.1 The system shall allow the administrator to grant or revoke access to the household's inventory for general users.

3.2.5.2.2 The system shall allow the administrator to approve or deny items added to the grocery list by users and the recipe planning feature.

3.2.6 Analytics

3.2.6.1 Stockpile shall provide analytical data to the administrative user.
3.2.6.2 Stockpile shall provide data about purchases.
3.2.6.2.1 Stockpile shall provide data about quantities of items purchased.
3.2.6.3 Stockpile shall provide data about the household's inventory.
3.2.6.3.1 Stockpile shall provide data about inventory items removed from the inventory list including the date of removal, the user who removed it, and the quantity of items used.
3.2.6.4 Stockpile shall display suggestions of items that could be added to the grocery list.

3.2.7 Barcode Scanner

3.2.7.1 The system shall use the device's camera to scan a barcode.
3.2.7.2 The system shall search for the product using the item's UPC in a database.

3.3 Usability Requirements

3.3.1 The system shall be operable through the touchscreen of any Android device.
3.3.2 The system shall keep a searchable list of all the users' pantry items in the Stockpile database.
3.3.2.1 The system shall allow the user shall to enter the name of the item through the on-screen keyboard in order to see the current amount of the item in stock.
3.3.3 When the remember me button is checked and upon successful login (after pressing the login button), the credentials of the user will be saved locally to the device.

3.4 Performance Requirements

3.4.1 The system shall support up to four users.
3.4.2 The system shall present the welcome screen to the user after no more than 2 seconds.
3.4.3 Transitions between screens shall happen after no more than 2 seconds.
3.4.4 Stockpile shall not exceed an active memory usage greater than 512 MB.
3.4.5 Stockpile shall not exceed 5 GB (gigabytes) of installation space.
3.4.6 95% of the time requests to and from servers shall be processed in less than 3 seconds.
3.4.7 If the system fails, it shall allow users to restart Stockpile after no more than 10 seconds.
3.4.8 The system shall be available 98% of the time the user attempts to access it.

3.5 Logical Database Requirements

3.5.1 Stockpile shall save data in a database hosted on a cloud storage service and in local memory.

3.5.1.1 The local database and cloud database system shall store user account information including login information and user preferences.

3.5.1.2 The cloud database system shall store pantry items, grocery lists, and custom recipes for each household.

3.5.1.2.1 The cloud database shall store the item name, item quantity, and expiration date for each pantry item.

3.5.1.2.2 The cloud database shall store the item name, item quantity, expiration date, price, item availability, and item image for each pantry item.

3.5.1.3 The cloud database should provide at least 300 default recipes for use by the household.

3.5.2 The system database shall allow write, read, update, and delete abilities for the household administrator of an account.

3.5.2.1 The system database shall allow read-write abilities for the general user of an account.

3.5.3 The system database shall remain synchronized across all devices tied to the user's account.

3.5.3.1 The system shall allow the user to specify if the cloud database should be synchronized using a cellular internet connection.

3.6 Design Constraints

3.6.1 The system shall require the device to be connected to the internet before the system attempts to sync data to and from the server's database.

3.6.1.1 The system shall load app data to on-device storage when the app is opened.

3.6.1.2 When the device has re-established an internet connection, on-device app data will synchronize to the online app database.

3.6.2 The system shall request and obtain access to the camera from the user before the barcode scanner feature is enabled.

3.6.2.1 The barcode scanner feature shall be disabled if the user denies the app access to the device's camera.

3.7 Software System Attributes

3.7.1 The system shall interface with an image scanner API

3.7.1.1 The system shall use a picture of the barcode to get the UPC and return product information.

3.7.2 The system shall interface with the Microsoft SQL Server database to periodically synchronize all of the user's local database data to the cloud.

3.7.2.1 The system shall allow the user to specify how often data is synchronized.

3.7.2.2 The system shall allow the user to manually request a synchronization of their local database to and from the cloud

3.7.3 The system shall interface with a recipe API

3.7.3.1 The recipe API will take in the name of a recipe (i.e. "Enchiladas") and return the resulting recipes that are found.

3.7.4 Information sent to and from the server shall be encrypted using a symmetric block cipher algorithm such as AES-256.

3.7.4.1 Log in communications shall be encrypted to prevent others from getting email addresses and passwords from those communications

3.7.4.1.1 Plaintext passwords shall not be stored in the database or locally on the device.

3.7.4.1.2 Password hashes shall be stored in the database and locally on the device.

3.7.4.1.3 Password hashes shall only be stored on the device if the user checked the “Remember me” checkbox on the login screen.

3.7.5 The system shall implement HTTP/2 (H2) protocol to maximize efficiency, with the capability of making several processing requests to and from the server.

3.7.6 Stockpile should be simple to extend.

3.7.6.1 Code should be organized in a manner that allows for functions to be added without significantly altering the original code.

3.8 Supporting Information

3.8.1 Extended definitions/descriptions

3.8.1.1 Analytics - Once Stockpile has acquired enough information, approximately a month’s worth of data, then analytical information will become available to the administrator.

- Analytics shall enable the administrator to view collected Stockpile data, so the administrator can gain insights into such information as eating, spending, and other pantry-related habits.
- For the app to obtain these analytics, the following data will serve as inputs: names of purchased items, dates of purchase, and quantities of purchased items.
- The outputs of Stockpile are as follows: a list of the top ten purchased items in a given month in descending order, the quantities of each purchased item, and a list of the most frequently purchased items in descending order.
- While these inputs and outputs serve as a requirement for the analytics, this description of the aforementioned analytical data is not limited to this base requirement. Stockpile will need to determine how these inputs can be transformed into meaningful outputs.

3.8.1.2 Cloud Storage - Cloud storage is the chosen medium for database operations. While a specific cloud storage service has not been determined, the information stored in cloud storage will be as follows: user credentials, inventory information, recipes, and grocery lists.

- The key purposes of the cloud storage are as follows: to enable multiple users to access a given instance of an inventory (recipes, pantry items, and grocery lists), backup user data in case of data loss, and to enable a user to access inventory information across multiple devices.
- Information will be added to the cloud storage as it is entered, therefore the app will update in “real-time”.

3.8.1.3 Inventory List - This list is also known as “the pantry list” because it contains records of individual items stored in the pantry.

- Items on this inventory list can be both added and removed.
- The quantity and description of each item on this list can also be dynamically changed according to the needs of Stockpile user.
- The app assumes that if an item is on the inventory list, it has already been purchased. This means that items added to the inventory list will be used for analytical purposes.

3.8.1.4 Meal Planning

- For inputs, the meal planning feature takes the pantry items and the grocery list.
- For outputs, this feature will produce possible meals from existing items in the pantry and from items on the grocery list.
- Both lists of potential meals will be separately maintained, to ensure the user will not be given a recipe for pantry items they do not have.

3.8.1.5 Login - The login feature shall enable the user to access a household’s inventory. The login feature will also enable the user to invite others to view and/or modify the user’s personal pantry.

- Email Address and Password
    - The login feature shall include an email address and password. When the user is typing the email address, the characters will be visible to the user. When the user is typing the password, the characters of the password will be displayed as asterisks (‘*’) or ellipses. A login button will enable the user to submit their credentials to the database and will either log the user in or return a “login error”.
- Remember Credentials
    - This allows the user to open the app and access user specific information without having to re-enter their credentials. By default, this checkbox shall be left unchecked.
- Login Error
    - When the database returns an unsuccessful login message, that message shall not indicate which credential, the email address or password, was invalid. A generic message shall be returned to the user indicating that either the email address or the password was incorrect. This extra layer of security prevents malicious behavior like guessing email address and/or passwords.
- Additional Features
    - When a user is logged in the system shall enable extra functionality in the app. The additional functionality includes the ability to join another pantry and invite other users to user’s personal pantry.

3.8.1.6 Sign out - The system shall require a sign-out button to enable users to sign out of the current account.

- Restrictions
    - The system shall require that if no user is currently logged in, the sign out feature will not be visible to the user.

- The system shall require that only one user shall be logged in or out at any time. This means that the user cannot be logged into multiple accounts at once.

3.8.2 Problems Solved

3.8.2.1 Stockpile aims to simplify lives by organizing information into one place and reduce the time and effort spent by consumers when keeping track of their pantry.

- Users should be able to view their entire pantry with a single button tap.
- Food should be better preserved as the application should help remind the user what items they have in their pantry.
- Stockpile users should also save money as the app's analytical data will show trends in spending, enabling users to see where they can save money.
- The potential for food preservation can also play an environmental role as less food is wasted from spoiling or from under-utilization.

3.8.2.2 Building grocery lists, managing ingredients, and creating grocery lists are all everyday tasks, but there is a common tendency for people to become forgetful and complacent when performing these tasks. It is difficult to balance the workload of maintaining a pantry in addition to the daily routine of life.

- Stockpile can save the user time as the number of unnecessary trips to the grocery store can be reduced. Stockpile users do not have to remember what they need as the app will manage that information for them.
- Even while the administrator is shopping, instead of having to call or send a text about an extra grocery item that is needed, a general user could simply access the app and add the item to the grocery list. Especially for people with busy schedules, this usability feature is essential.
- Another common difficulty is that individuals and families alike struggle to know what to cook. Since Stockpile will produce recipe suggestions, choosing delicious, new recipes can be simple and far less time-consuming.
- Enabling Stockpile to create recipe suggestions also helps encourage the user to prepare home-cooked meals, rather than going out to eat, making frozen dinners, or making any other "quick and easy" meals.

4. Verification

If any of the following statements are met, verification for that requirement fails.

4.1 External Interface Verification

4.1.1 General Interface

4.1.1.1 The system is unable to utilize the device's hardware to display the output and accept input.

REF: 3.1.1.1

4.1.1.2 The system is unable to use the devices touchscreen.

REF: 3.1.1.2

4.1.1.3 The system is unable to adapt the application's content to fit on any given Android screen.

REF: 3.1.1.3

4.1.1.4 The system accepts any number that is not a positive integer.

REF: 3.1.1.4

4.1.1.5 The system fails to provide the user with either the grid view or the row view

REF: 3.1.1.5

4.1.1.6 The system fails to display the required information about an item.

REF: 3.1.1.6

4.1.1.7 The system fails to provide an image of each item.

REF 3.1.1.6.3

4.1.1.8 The system fails to provide a functionality to allow the user to change an item's image with a click on an image.

REF 3.1.1.6.3.1

4.1.1.9 The system fails to provide a sign-out feature for the user to sign out of their account.

REF: 3.1.1.7

4.1.2 Greeting Screen

4.1.2.1 The system fails to display the greeting screen or any of the specified options including the "Take a tour", "Create a Profile", and "Login".

REF: 3.1.2

4.1.3 Take a Tour

4.1.3.1 The system fails to display the manual to the user.

REF: 3.1.3.1

4.1.3.2 The system fails to provide the user a functional hyperlink to the video tutorial.

REF: 3.1.3.2

4.1.4 Create a Profile and Login Screen

4.1.4.1 The system fails to display a screen to the user when the "Create a Profile!" button is selected.

REF: 3.1.4.1

4.1.4.2 The system fails to provide the proper input fields for registration.

REF: 3.1.4.1.1

4.1.4.3 The system fails to provide the “Start Stockpiling” button to complete the process of creating a profile or logging in.

REF: 3.1.4.1.2, 3.1.4.2.4

4.1.4.4 The system fails to display a message if the user’s profile has been created successfully.

REF: 3.1.4.1.3

4.1.4.5 The system fails to direct the user to the “Start Stockpiling” screen upon successful creation of the profile or when the user successfully logs in.

REF: 3.1.4.1.4, 3.1.4.2

4.1.4.6 The system fails to display a login screen when the “Login” button is selected.

REF: 3.1.4.2

4.1.4.7 The system fails to display the proper input fields or the “remember me” checkbox for logging in.

REF: 3.1.4.2.1,

4.1.4.8 The system fails to display the saved email address or password if the user previously selected the “remember me” checkbox.

REF: 3.1.4.2.2

4.1.4.9 The system displays the saved password as plain text instead of as ellipses or asterisks.

REF: 3.1.4.2.3

4.1.4.10 The system fails to display a message if the login was not successful.

REF: 3.1.4.2.5

4.1.5 Start Stockpiling

4.1.5.1 The system fails to display the “Start Stockpiling Screen”

REF: 3.1.5.1,

4.1.5.2 The system fails to display an option for the user to create a household.

REF: 3.1.5.2

4.1.5.3 The system fails to assign the creator of a household as the administrator.

REF: 3.1.5.2.1

4.1.5.4 The system fails to display an option for a user to view households they are part of.

REF: 3.1.5.3

4.1.5.5 The system fails to display the households a user is part of.

REF: 3.1.5.3.1

4.1.5.6 The system fails to direct the user to the control panel upon successfully creating a new household or selecting an existing household.

REF: 3.1.5.2.2, 3.1.5.3.2

4.1.6 Control Panel

4.1.6.1 The system fails to display the control panel to the user after creating or selecting an existing household.

REF: 3.1.6.1

4.1.6.2 The system fails to display any or all of the following options as buttons to the user: “Pantry”, “Keep in Stock”, “Grocery List,” “Meal Planning” and “sign out”.

REF: 3.1.6.2

4.1.6.3 The system fails to display the user’s pantry inventory list when the “Pantry” button is selected.

REF: 3.1.6.3, 3.1.8.1

4.1.6.4 The system fails to display a list of desired items to the user upon the selection of the “Keep In Stock” button.

REF: 3.1.6.4, 3.1.7.1

4.1.6.5 The system fails to display the grocery list to the user upon the selection of the “Grocery List” button.

REF: 3.1.6.5, 3.1.9.1

4.1.6.6 The system fails to display the meal planning screen to the user upon the selection of the “Meal Planning” button.

REF: 3.1.6.6

4.1.6.7 The system fails to logout the user out of their account upon the selection of the “Sign Out” button.

REF: 3.1.6.7

4.1.7 Keep in Stock

4.1.7.1 The system fails to display a list of all the items that the user wants to keep in stock at all times.

REF: 3.1.7.1

4.1.7.2 A submenu and the appropriate options are not displayed when an item is selected from the “Keep in Stock” section.

REF: 3.1.7.2

4.1.7.3 The system fails to display the following options: “Delete item” and “Change Quantity”.

REF: 3.1.7.2.1

4.1.7.4 When “Delete item” is selected, the system fails to display a message to the user verifying that the user actually wants to delete the item.

REF: 3.1.7.2.2

4.1.7.5 When “Change Quantity” is selected, the system fails to display an input field allowing the user to enter in the new desired quantity.

REF: 3.1.7.2.3

4.1.8 Pantry Inventory

4.1.8.1 The system fails to display a list of all the items in the pantry inventory.

REF:

4.1.8.2 The system fails to display any available expiration dates on items in the inventory.

REF: 3.1.8.1.2

4.1.8.2 A submenu and the appropriate options are not displayed when an item is selected from the pantry.

REF: 3.1.8.2

4.1.8.3 The system fails to allow the user to change item quantity in the submenu.

REF: 3.1.8.2.1

4.1.8.4 The system fails to allow the user to edit the name of each item in the submenu.

REF: 3.1.8.2.2

4.1.8.5 The system to display a button to add items using the item's barcode.

REF: 3.1.8.3

4.1.8.6 When the quantity of an item falls below of the desired "Keep in Stock" amount, the system fails to display a message asking if the user would like to add an item to the grocery list.

REF: 3.1.8.4

4.1.9 Grocery List

4.1.9.1 The system fails to display a list of items that the user wants to purchase during their next trip to the grocery store.

REF: 3.1.9.1

4.1.9.2 A submenu is not displayed when an item is selected from the grocery list.

REF: 3.1.9.2

4.1.9.3 The system fails to display the following options on the grocery list's submenu: "Delete item" and "Change Quantity".

REF 3.1.9.2.1

4.1.9.4 When "Delete item" is selected, the system fails to display a message to the user verifying that the user actually wants to delete the item.

REF 3.1.9.2.2

4.1.9.5 When "Change Quantity" is selected, the system fails to display an input field allowing the user to enter in the new desired quantity.

REF: 3.1.9.2.3

4.1.9.6 A checkbox is not displayed by each item in the grocery list.

REF: 3.1.9.3

4.1.9.7 The user is unable to sort list items in the grocery list.

REF: 3.1.9.4

4.1.10 My Meal Plan

4.1.10.1 The system fails to display a list of selected recipes and the required information about those recipes to the user.

REF: 3.1.10.1, 3.1.10.2, 3.1.10.3

4.1.11 Barcode Scanner

4.1.11.1 The system fails to display the camera screen to the user upon selection of the barcode scanner feature in the pantry.

REF: 3.1.11.1

4.1.11.2 The system fails to provide a rectangle on the camera screen.

REF: 3.1.11.1.1

4.1.11.3 The system fails to display a message with instructions on how to use the barcode scanner feature.

REF: 3.1.11.1.1

4.1.11.4 The system fails to indicate to the user if the barcode was scanned in successfully.

REF: 3.1.11.2

4.1.11.5 The system fails to allow the user to update the quantity of an item.

REF: 3.1.11.3

4.1.11.6 The system fails to display the updated quantity of an item.

REF: 3.1.11.3.1

4.2 Function Verification

4.2.1 General Functions

4.2.1.1 The user is unable to manually adjust the quantity of a list item.

REF: 3.2.1.1

4.2.1.1.2 The user is unable to add a new item to a list.

REF: 3.2.1.1.2

4.2.1.1.3 The user is unable to remove an item from a list.

REF: 3.2.1.1.3

4.2.2 Pantry Inventory List

4.2.2.1 A grocery list item is not added to the user's inventory list when the corresponding checkbox is tapped.

REF: 3.2.2.1

4.2.2.2 The system fails to update the pantry list when the user checks an item's checkbox in the grocery list and taps the "add to pantry" button.

REF: 3.2.2.2

4.2.2.2 An item is not added to the inventory list when it's barcode is scanned.

REF: 3.2.2.3

4.2.3 Grocery List

4.2.3.1 The system does not add a "keep in stock" item to the grocery list after the value falls below the desired value and the user indicates it should be added.

REF: 3.2.3.1.1

4.2.3.2 The system does not add required items to a user's grocery list when a recipe is selected by the user.

REF: 3.2.3.1.2

4.2.4 Meal Planning

4.2.4.1 The user is unable to manually add a recipe to his recipe box.

REF: 3.2.4.1

4.2.4.2 The user has no way of creating a weekly or monthly meal plan.
REF: 3.2.4.2
4.2.4.3 The system fails to provide existing recipes from the database that could be made with the user's current inventory.
REF: 3.2.4.2.1
4.2.4.4 The system fails to determine which ingredients from a selected recipe are not available in the user's inventory.
REF: 3.2.4.2.2
4.2.4.5 The system fails to add missing items to the user's grocery list when the user selects a recipe.
REF: 3.2.4.2.3

4.2.5 User Account

4.2.5.1 The user is able to access the system without an account.
REF: 3.2.5.1
4.2.5.2 No verification email is sent upon registration.
REF: 3.2.5.1.1
4.2.5.3 Strong password requirements are not set in place.
REF: 3.2.5.1.2
4.2.5.4 The system allows the user to change their password to one that has already been used by that user.
REF: 3.2.5.1.3
4.2.5.5 The system is unable to verify a user who is attempting to login using correct credentials.
REF: 3.2.5.1.4
4.2.5.6 When a user logs out, their credentials are stored on the device, even though the user did not specify that their credentials should be remembered with the "remember me" check box at the login screen.
REF: 3.2.5.1.5
4.2.5.7 More than one user is granted administrative privileges for one household inventory.
REF: 3.2.5.2
4.2.5.8 An administrator is unable to grant or revoke user access to the household inventory.
REF: 3.2.5.2.1
4.2.5.9 An administrator is unable to approve or deny items added to the grocery list by users and the recipe planning feature.
REF: 3.2.5.2.2

4.2.6 Analytics

4.2.6.1 The system fails to provide analytical data to the administrative user.
REF: 3.2.6.1
4.2.6.2 The system fails to provide the user with data about purchases.
REF: 3.2.6.2
4.2.6.3 The system fails to provide the user with data about quantities of items purchased.
REF: 3.2.6.2.1
4.2.6.4 The system fails to provide the user with data about the household's inventory.
REF: 3.2.6.3

4.2.6.5 The system fails to display data to the user regarding dates of item removals and quantities of items used.
REF: 3.2.6.3.1
4.2.6.6 The system fails to display suggestions to the user of items to add to the grocery list.
REF: 3.2.6.4

4.2.7 Barcode Scanner

4.2.7.1 The system does not allow a user to use his device's camera to scan a barcode.
REF: 3.2.7.1
4.2.7.2 The system does not allow a user to search for a product in a database using its UPC in a database.
REF: 3.2.7.2

4.3 Usability Verification

4.3.1 The user is unable to access the app via the touchscreen of the device.
REF: 3.3.1
4.3.2 The system fails to keep a record of the users' pantry items in the database.
REF: 3.3.2
4.3.3 The user is unable to enter the name of an item to see the current amount in stock.
REF: 3.3.2.1

4.4 Performance Requirements

4.4.1 Runtime errors are reported when four or fewer users access their household's pantry inventory simultaneously.
REF: 3.4.1
4.4.2 The system does not display the welcome screen upon opening Stockpile to the user after 2 seconds.
REF: 3.4.2
4.4.3 Transitions between screens take longer than 2 seconds.
REF: 3.4.3
4.4.4 Stockpile's active memory usage exceeds 512 MB.
REF: 3.4.4
4.4.5 Stockpile's installation exceeds 5GB.
REF: 3.4.5
4.4.6 More than 5% of requests to and from the server take longer than 3 seconds to be processed.
REF: 3.4.6
4.4.7 After a system failure, the system takes longer than 10 seconds to allow the user to restart Stockpile, or it never allows the user to restart Stockpile.
REF: 3.4.7
4.4.8 The system is unavailable for more than 2% of the time.
REF: 3.4.8

4.5 Logical Database Requirements

4.5.1 The system fails to save data on a cloud-stored database and in local memory.
REF: 3.5.1

4.5.1.1 The system fails to store login information and user preferences in local and cloud databases.
REF: 3.5.1.1

4.5.1.2 When a user modifies their pantry inventory, grocery lists, or recipes, the system does not store this information.
REF: 3.5.1.2

4.5.1.2.1 The local database fails to store the item name, item quantity, and expiration date for each pantry item.
REF: 3.5.1.2.1

4.5.1.2.2 The cloud database fails to store the item name, item quantity, expiration date, price, item availability, and item image for each pantry item.
REF: 3.5.1.2.2

4.5.1.3 The cloud database fails to provide at least 300 default recipes.
REF: 3.5.1.3

4.5.2 The system database does not allow write, read, update, and delete abilities for the household administrator.
REF: 3.5.2

4.5.2.1 The system database does not allow a general user is able to write, read, nor a household administrator to update, or delete information in the database.
REF: 3.5.2.1

4.5.3 A user's device does not synchronize with the household information stored in the database when the user's device is connected to the internet.
REF: 3.5.3

4.5.3.1 The system fails to notify the user that there is insufficient memory on their device for storage.
REF: 3.5.3.1

4.5.3.2 The system fails to allow the user to indicate whether or not information can be synchronized using cellular data.
REF: 3.5.3.1

4.6 Design Constraints

4.6.1 The system attempts to sync data even though there is no internet connection.
REF: 3.6.1

4.6.2 The system fails to load data to on-device storage.
REF: 3.6.1.1

4.6.3 The system fails to synchronize on-device data after reconnecting to the internet.
REF: 3.6.1.2

4.6.4 The system fails to request access to the camera from the user or the system accesses the camera without permission from the user.

REF: 3.6.2.1

4.6.5 The system fails to disable the barcode scanner feature if permission to use the device's camera is not granted.

4.7 Software System Attributes

4.7.1 The system fails to communicate with the image scanner API

REF: 3.7.1

4.7.2 The system fails to get the UPC and return product information using a picture of an item's barcode.

REF: 3.7.1.1

4.7.3 The system fails to interface with the Microsoft SQL server database.

REF: 3.7.2

4.7.4 The system does not allow the user to specify how often data is synchronized.

REF: 3.7.2.1

4.7.5 The system does not allow the user to manually request a synchronization of their local data to and from the cloud.

REF: 3.7.2.2

4.7.6 The system fails to communicate with the Recipe API.

REF: 3.7.3

4.7.7 The system fails to return results of a search using the name of a recipe.

REF: 3.7.3.1

4.7.8 Information sent to and from the server is not properly encrypted.

REF: 3.7.4

4.7.9 Plain text passwords are stored in the database and/or the device's local storage.

REF: 3.7.4.1.1, 3.7.4.1.2

4.7.10 Password hashes are stored on the device even though the user did not check the "Remember Me" checkbox.

REF: 3.7.4.1.3

4.7.11 The system does not properly implement HTTP/2 (H2) protocol.

REF: 3.7.5

4.7.7 Additional functions are difficult or impossible to add to the program without significantly altering the original code.

REF: 3.7.6

4.8 Supporting Information Verification

N/A

5. Appendices

5.1 Assumptions and Dependencies

5.1.1 Assumptions

5.1.1.1 Skill

The nature of this project will involve development and programming. We assume that we will either have a team with the required knowledge or training will be provided so our team will have the skills needed to write the software. This knowledge will be focused on application development on the desired operating system.

5.1.1.2 Tools

It will be expected that during the course of the project we will have the software to create applications as well as access to a database where information will be securely stored.

5.1.1.3 User

It is assumed that a typical user will have a general understanding of how to operate common GUIs.

5.1.2 Dependencies

5.1.2.1 Internal

The Barcode Scanner relies on the functionality of the Pantry. Due to its manipulations of this data, the Pantry will need to be finished or nearly finished before the majority of the Barcode Scanner development can be started.

5.1.2.2 External

Approval to upload app to safe source (Google Play Store, Apple App Store, etc.) to be circulated to users. By not meeting the requirements these sources state we will not be able to distribute our product.

5.1.3 Apportioning of Requirements

The below table describes the order each major feature of Stockpile will be implemented and the justification for this decision.

	Description	Dependencies	Reasoning	Order
1	Cloud Storage	- -	Creating a Cloud Storage System first would allow the development of steps 2 - 4 without	1

			the need to adjust them to accommodate different methods of storage.	
2	Development of Pantry	1	The development of the Pantry and grocery list will not need to share interactions until the end of each stage of development, so they can be started simultaneously.	2
3	Development of grocery list	1		2
4	Meal Planning Utility	2	While not every function of this step will rely on the completion of the Pantry, the more fundamental aspect will.	3
5	Barcode Scanner	2	Implementation requires the ability to store data in the Pantry so its development must be completed first.	4
6	Analytics	2, 3, 4	Analytics will pull data from the pantry, grocery list, and recipes so they must be completed, however the barcode scanner can be completed simultaneously.	4

5.2 Acronyms and abbreviations

Acronym/ Abbreviation	Definition
API	Application Program Interface - Code that allows software programs to communicate with each other.
GUI	Graphical User Interface - Allows the user to interact with the device through graphical icons and visual indicators.
REF	Abbreviation for "References"
SQL	SQL (structured query language) describes a technology that is used to manage modern relational databases
UPC	Universal Product Code - A set of numbers commonly found alongside a barcode used by manufacturers to identify products.