

Using Technology to Alleviate Food Waste Produced in Households.

Abstract:

In this paper, I present an application that aims to undertake the issue of global food wastage. The project is a mobile app named FoodWise. It tracks the food inventory of a household, automates the process of creating a grocery list, and ultimately helps mitigate food waste produced at a household level. The underlying goal of this study is to raise awareness about the ongoing problem of food wastage, and harness the power of technology to develop an applicable solution. This paper dives into the creation of this mobile application and the steps taken for its development. Furthermore, this paper elaborates on the food waste crisis, explores previous solutions, and explains why a solution like FoodWise is needed. Finally, it explains the future potential of the mobile app and how its development with time will add to the efficiency of the overall design.

Introduction:

Each year, around 1.3 billion tonnes of food is lost or wasted. This number accounts for a third of the food produced every year for human consumption. ^[1] With over 300 million people suffering from food insecurity, global food wastage is a dire problem in need of solving. ^[2] Beyond social concerns, food waste poses an environmental concern as well. When large amounts of food are thrown into landfills, methane is produced, a greenhouse gas 25 times more potent than carbon dioxide, contributing to global warming and climate change. ^[3]

For an issue as wide-spread as food wastage, the solution must be scalable and easy to implement. FoodWise is one such solution. FoodWise is a mobile app that aims to reduce food waste produced at a household level. Around 47% of food waste is produced in households due to overbuying, and improper planning. FoodWise is an app that resolves these two difficulties, ultimately aiding in reducing the global problem of food waste.

Literature Review:

Before solving the problem, it is important to understand the root of the issue and the measures being taken to combat it. The journey of all food can be seen as a chain - beginning on farms, being distributed to retail stores, and finally, our homes. Food is lost at every stage in this food chain. ^[4] Starting with the farm level, food waste can occur for a variety of reasons. Market

prices and consumer satisfaction, for example, can cause farmers to throw away edible food. If the market prices for a specific crop are low, farmers tend to leave the crops unharvested rather than investing time and money for the crops' transportation and distribution. Other factors like weather, pests, and disease can also contribute to crops going to waste. ^[4] Currently, there are steps being taken to mitigate on-farm food waste. One possible solution is a practice called gleaning. This practice consists of organizations collecting leftover crops - produce that is edible, but not fit for market due to low prices, cosmetic irregularities, etc. - and donating them to food banks. Another solution is converting leftover crops into biomass, biofuels, fertilizer, and feedstock. ^[5] From an economic standpoint, both these solutions require substantial capital investment, hindering implementation. While both these solutions are effective in the long run, their widespread application has not yet been reached.

Moving down the chain, stores and restaurants are responsible for the majority of food waste compared to all other stages. Stores can contribute to food waste by over-stocking their shelves, improper planning when sorting inventory, and discarding fruits and vegetables that have irregularities. Restaurants also waste food by erroneous inventory management and oversized serving portions, causing the leftover food to end up in the garbage. Solutions for food waste at this level include smaller serving portions in restaurants, causing less food to be thrown out by the customers. ^[6] For grocery stores, using technology to manage expiration dates can be deemed beneficial, considering that around 87% of food waste from grocery stores is because the food has exceeded its expiration date. ^[7] Just like farm-level solutions, these solutions are not being implemented in too many areas, mainly due to economic and business-related reasons.

Lastly, over 30% of food waste comes from households. Once again, the cause for food waste at this level can be attributed to over buying, and flawed planning and inventory management. There are many things that households can do to mitigate food waste produced at home, including the following:

- 1) Keeping track of current inventory to prevent overbuying.
- 2) Only buying new food once the current food is fully eaten.
- 3) Donating edible food rather than throwing it away.

^[8] As simple as some of these steps sound, people in this day and age are already bombarded with plenty of responsibilities, making these steps seem like an unnecessary hassle. This is where the power of technology can come in handy. There are already a few apps that have been made to automate these tasks, 'NoWaste', 'Kitche', and 'OLIO' for example. NoWaste tracks the expiration dates of the foods and sends the user a notification when a food item nears its expiration date. Kitche is a similar app that tracks the current inventory of the user. OLIO allows the user to connect with their community to give away food they don't plan to eat anymore. All three of these apps serve one collective goal – to alleviate food wastage, but they each have their own limitations. NoWaste, for example, works passively. It gives a notification,

but does not take any further steps. With the constant notifications popping up on phone screens, there is a chance the notification may go unnoticed. Another limitation of these apps is that they all endorse only one food waste mitigation technique. Kitche can only keep track of inventory, and OLIO can only help with donations. For a user, maneuvering multiple different applications to achieve the same ultimate goal can be tedious, preventing them from taking any action at all.

App Description:

FoodWise is an android app, which limits food waste produced at home. The app contains three main features: an automated list generator, a current inventory management tool, and a donation service. As mentioned, the app focuses on streamlining the process of at-home food management, ensuring a satisfying experience. By providing the three features listed above, the app will allow the user to utilize multiple food-waste-prevention techniques, enhancing the efficiency of the application. The automated list guides the user in the grocery store, signaling them to buy only what they need. The inventory page displays the user's current inventory. This helps the user visually keep track of the food items they already have. Lastly, if there is an item in the user's inventory that they would like to donate, the app provides an option to add that item to the 'donation list'. Furthermore, FoodWise uses the Google Maps API to show the user the nearest food donation centers to make the process easier for the user. All these features work collectively to solve the issue of food waste, and do so in a neat and concise manner.

Methodology:

This section dives deep into the development phase of this app, explaining each section of the app. I made this app using Flutterflow, a low-code platform to create mobile applications using an interactable UI. For the backend database, I used Firebase for its uncomplicated syntax and orderly data storage.

A. Backend Data Storage

The Firebase database stores all of its data in the cloud, and does so using Documents and Collections. Unlike traditional databases, Firebase does not use tables to store the data. Rather, it creates Collections - folders that can store niche documents. Inside the Collections are Documents, which store the data using Fields.

The FoodWise app uses three collections: currentList, inventoryStock, and foodType. The currentList Collection stores the food items that are in the user's grocery list. Each Document in this collection has four Fields: itemName, itemType, itemDate, and foodLife. These Fields store the name of the food, the food category, the date the item was added to the list, and the shelf life of the food respectively. The inventoryStock collection contains all the food items that the user

currently owns. The Documents in this Collection have the same Fields as currentList. The last Collection is a static collection, meaning it does not have documents appended or deleted from it. This Collection stores thirteen of the most common types of foods people purchase at stores (Ex: produce, dairy, grains, frozen foods). Each document in this Collection also contains a Field called 'foodLife'. This Field holds the shelf life of each type of food. The foodLife is a negative number that is used when the app automatically renews the current list of the user. These three Collections work synchronously to store and track user data.

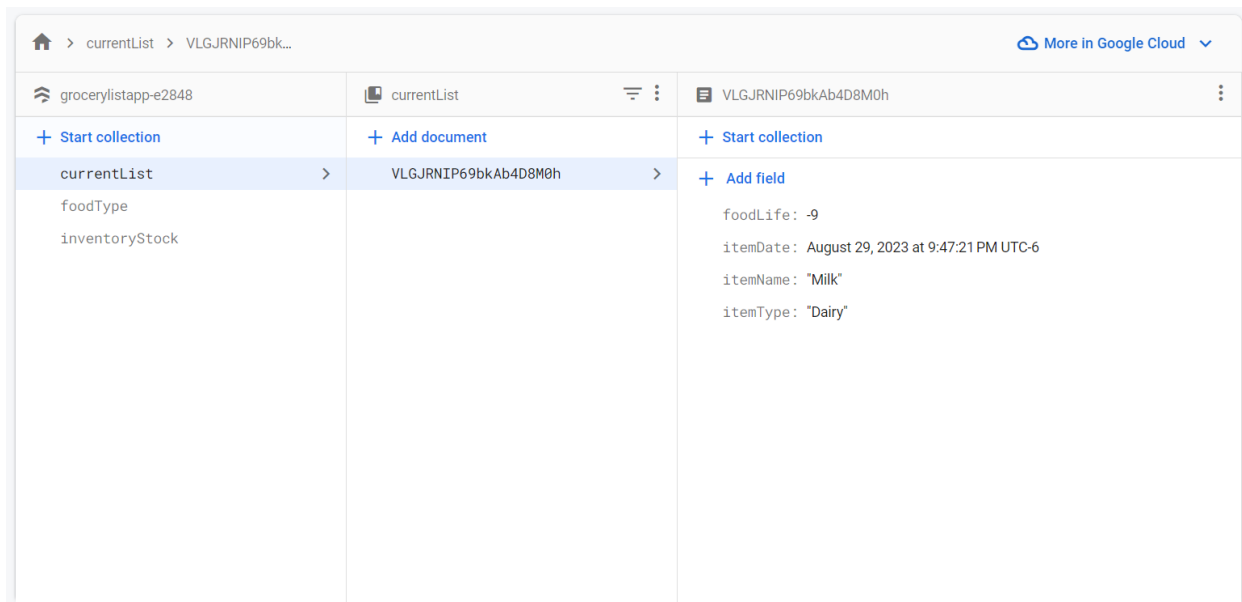
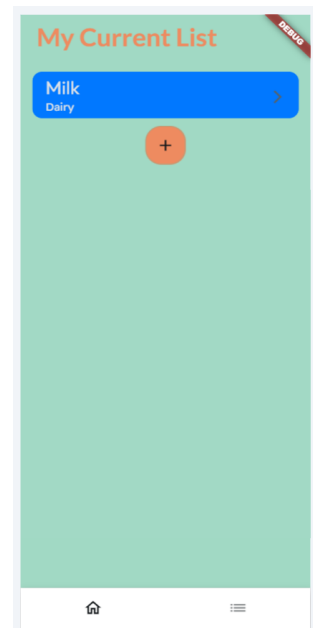


Fig. 1: Screenshot of the Firebase database

B. Home Page

Upon opening the app, the user is greeted with a page that displays the user's current list. The list presented on this page is queried from the currentList Collection. Each food item that the user enters into their current list is displayed in a container, presenting the name of the food, and the food type. Each container is swipeable, and on swiping left, the user is given two options: they can either 'check off' the item, or delete it. If the item is 'checked off' it indicates that the user has bought the item and the item is deleted from the currentList Collection and added to the inventoryStock Collection. If the user wishes to delete the item, the item is simply deleted from the currentList Collection. This page has a minimalist aesthetic, with only three colors on the screen. The reason behind this is to provide a better user experience. All the important



information is clearly visible to the user, making app navigation easier.

To add an item, there is a button at the bottom of the displayed list. When the user presses that button, they are redirected to an AddItem page. Here, the user is prompted to enter the name of the food item, and select the food type from a searchable dropdown menu. When the user pressed the 'Add' button, a new Document is created in the currentList Collection to store the newly added item. The input widgets in the AddItem page are used to fill in the itemName and itemType Fields. The itemDate is taken from the global variable 'Current Time', which stores the date and time the item is added. Lastly, the foodLife Field is determined based on the itemType, since each food type has a different shelf life.

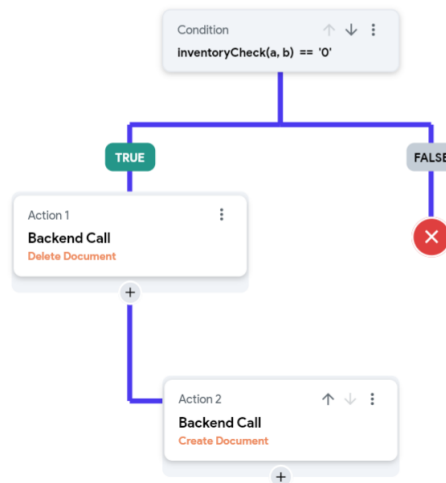
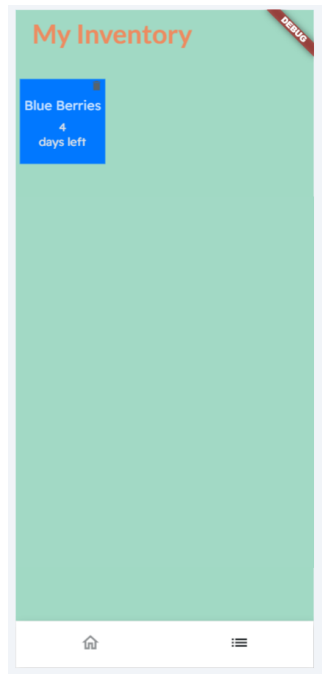
C. Inventory

The Inventory page shows the user the food items they currently have. It also displays the amount of days each food item has left before it is added back into the user's current list. Each item is displayed in a square container, saving space and maintaining the page's elegance.

Every container in this page is assigned a conditional action - a task that must be completed based on set circumstances. The action is modeled like an "if-then statement" in programming, where if the food item in the inventory passes its shelf life, then the food item should be added to the grocery list. The conditional statement uses a function called "inventoryCheck" and takes in two parameters: itemDate, and foodLife. Here is how it works:

- 1) Firstly, it uses another function called "ShelfLifeFunction" to determine how many days it has been since the item was purchased.
- 2) Then it calculates the difference between the absolute value of the foodLife and the return value of the "ShelfLifeFunction"
- 3) If the difference is equal to zero, it means the shelf life of that item has been reached.

If the action determines that the shelf life for an item has been reached, the item is deleted from inventoryStock and added to currentList.



Results and Conclusion

In the end, I am satisfied with the outcome of this app. I created it to fill the void of having a system to manage food at a household level to mitigate food waste. Upon completing the development of this app, I believe that it has the potential to meet my goal.

There are many things I am pleased with regarding this app that make it stand out from its counterparts. Firstly, the neat user interface and uncomplicated design makes it easier to navigate the app. Secondly, this app actively helps the user manage their food items. It does this by automatically adding items to the user's current list. This limits the amount of effort the user has to make to regulate their food habits. I believe that this app does indeed streamline the process of food management and makes it as easy as possible for the user.

There are a few things this app can improve upon. For example, the shelf life of each item is determined by the type of food that item is and each food type has a preset shelf life. This limits each individual item from having an exact shelf life, and rather assigns the food item a shelf life depending on the type of food that item is. I could add a feature for the user to manually add the expiration date of each item, but that would defeat the purpose of having an automated system where the user does not have to track their food items themselves.

As mentioned before, this app's efficacy will enhance through time and revision. In the future, I would wish to incorporate a machine-learning model to identify food items and assign tailored expiration dates for each food item. Machine learning could also be used to track how much food is being saved and what steps can be taken to reduce food waste further. This paper and this app are a starting point to overcome the gargantuan problem of global food wastage. The potential of using technology to create innovative solutions is endless. Building on the concepts presented in this paper, I will strive to create better, more effective solutions that span beyond just the household level.

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