



**University of Arkansas – CSCE Department**

**Capstone II – Final Report – Spring 2021**

# **Receipt\$ave**

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## **Abstract**

Have you ever been in a situation where you don't know how much you are spending a month? We are going to solve this problem. For this capstone project, our group is creating a mobile application to help organize your receipts to track what you spend. Take a photo of the receipt to help you organize your grocery items in the application. Also, the app will allow you to search for recipes based on the items you select.

The objective of this mobile app is to help people save time and stress when it comes tracking all the grocery items you currently have. By being able to scan your receipts and keep track of them in one app, you won't have to worry about what items you currently have or don't have.

## **1.0 Problem**

In some cases, food ingredients in cans and freezers are too old to know when they were bought. People are uncomfortable with expired food and are nervous about eating it. They need to help to manage food ingredients easily. People spend a lot of time thinking about what food to cook.

Many people do not know how much they spend every month. It would be nice for everyone to spend systematically within their income, but some people spend more than they earn every month. If consumption continues to exceed income, the ending may not be good.

When people buy an electronic product, they do not know the exact date of the purchase, so when it breaks down, they pay for it and fix it even though the item is still under warranty. In other cases, all manufactured goods have a holding period of the performance parts. For example, if a consumer purchases a Toshiba computer, Toshiba will have to store the main components for seven years from the day the consumer purchased them, even if the computer is discontinued [1]. Consumers must keep receipts to prove their purchases, but otherwise they may not be guaranteed a holding period of the performance parts.

## **2.0 Objective**

The objective of this project was to create an app where you can keep a record of all your receipts in one place. The app will transform the receipt into text which can be easily put in a Database to be able to track your spending.

With the receipt information in the app, this can be used to know the groceries you have and those you don't hence you can shop according to this list. By assigning the groceries expiry dates, you will be able to keep track of the groceries you might need to use immediately. Those items that reach their expiry dates will be deleted automatically. The current groceries can then be used to search up the recipes from the app. You will be able to see also past scanned receipts from the app itself.

## **3.0 Background**

### **3.1 Key Concepts**

The first key technology related to this project is Optical Character Recognition (OCR). OCR is the conversion of images of printed letters into editable text forms. Our project captures images of printed receipts on mobile phones, recognizes text from the images, and manages users' food inventory based on their content. We used Firebase ML-KIT Text Recognition APIs to implement the conversion of image to text.

The second key technology related to this project is Realtime Database. A real-time database [2] is a database system that uses real-time processing to handle workloads whose state is constantly changing. In this project, we used Firebase Realtime Database [3] which is a cloud-hosted database. Data is stored as JSON, and the database supports data synchronization. The information from the scanned receipt and Images of receipts are stored and managed in the real-time database.

The other key technology related to this project is Firebase Cloud Messaging (FCM). FCM is a cross-platform cloud solution for messages and notifications for Android, iOS, and web applications. In this project, we send notification messages using FCM.

## 3.2 Related Work

There are applications that have achieved some of the functions that our group intends to implement in this project area. The first application is Expensify: Receipts & Expenses [4] that is an application for managing receipts that allows you to capture photos of receipts, manage expenditures, and create financial reports. The other application is Forks Plant-Based Recipes [5] that is a recipe-recommending application that allows you to enter and search the name of the dish you want, show a list of different recipes, and add food ingredients to your food shopping list through the app.

Our ReceiptSave application not only provides expense management but also allows users to manage food items and search cooking recipes based on the user's food inventory. Furthermore, it encourages users to manage food items by notifying users that an expiration date of food is approaching. Users can also easily check the list of food items they already have through the application, so it helps users avoid unnecessary spending.

## 4.0 Design

### 4.1 Requirements and/or Use Cases and/or Design Goals

- **Application Requirements**
  - The user is able to capture a picture of the receipt using a smartphone camera or select an image from the gallery.
  - Users can edit the item names and select the expiration dates from the dropdown menu.
  - Item information is added correctly in the database.
  - Receipts can be saved as images in the database.
  - Users can check the expiration date of the food items.
  - Users can search food recipes based on their selections on a food item list.
  - Application gives notifications to users to manage their food items.
  - The user interface is neat and easy to use.

- **Use Cases**

This application allows users to search food recipes that can be cooked based on the ingredients in the house. The application helps reduce the waste of food items by providing users with a list of food inventory and notifications that encourages users to manage their food ingredients. It also allows users to scan important receipts and store them on a database to help users not lose receipts and to check receipts anytime, anywhere.

- **UI Designs**

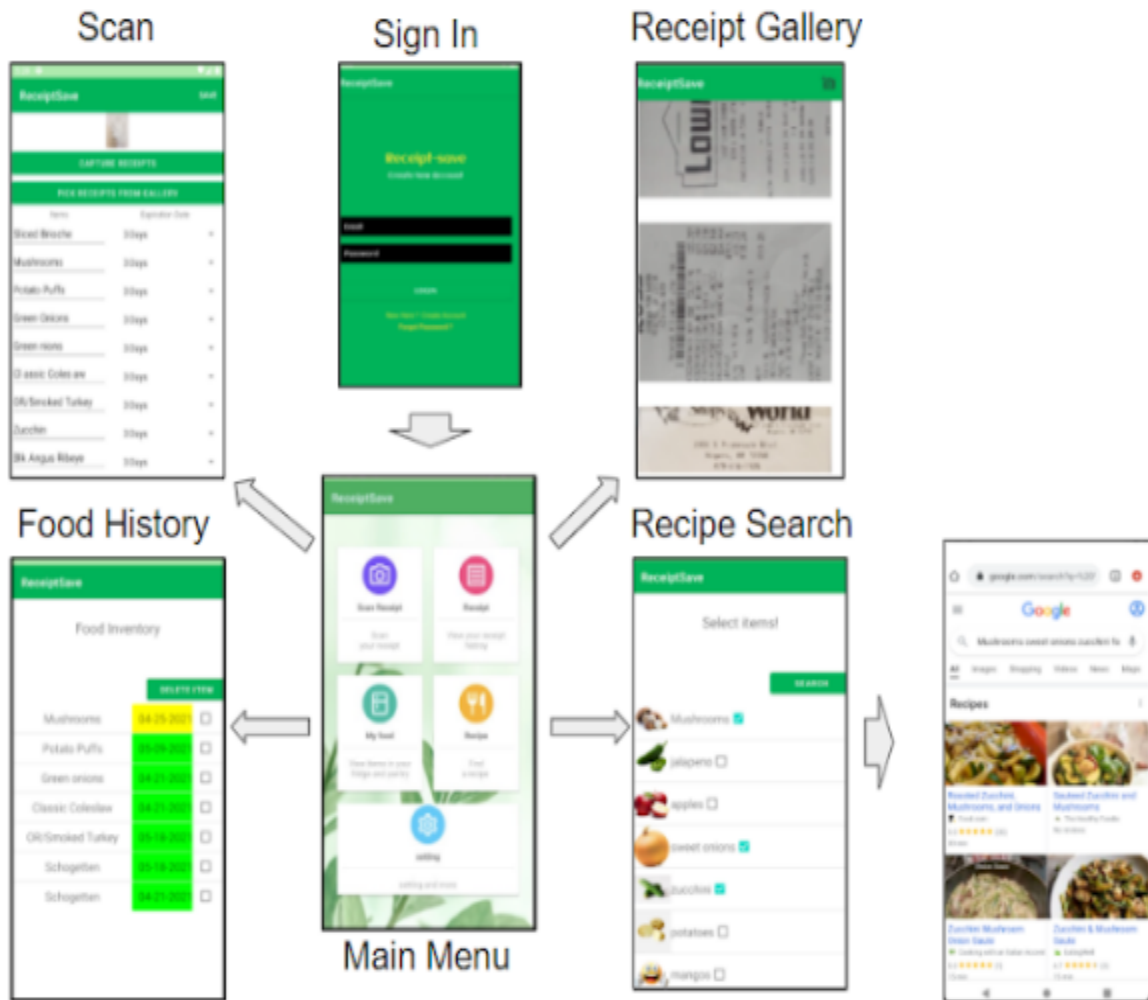


Figure 1: UI Design

## 4.2 Detailed Architecture

### Sign In Page:

Sign in page allows the user to sign in or register for the first time if the user is new. We used the image and downloaded it as the background image. We used the google firebase for authentication purposes This will allow the user to save the item in the appropriate database. We used different types of color and background to make them more attractive. We have implemented different functionality users can login using their credential, or they can reset password. Google firebase provides multiple services. In this case we used firebase authentication service and cloud messaging service but for this instance we used firebase authentication service only. We used Java and XML to take the input user string which is email and password. We extended one implemented class from android studio. And implemented with our own using the given methods and classes.

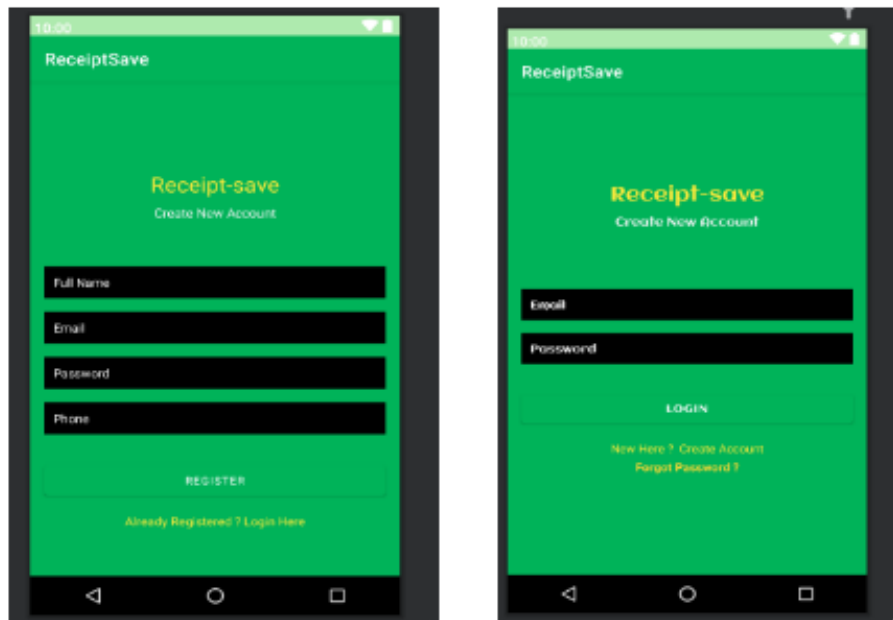


Figure 2: Sign-In page

### Main Menu page:

The main menu page shows icons for all the features on the application. The first icon is the Scan Receipt. Users can either take a picture or select a picture from the photo gallery to scan receipts. The second icon is called Receipt. It shows users the list of all the receipts they have. The my food icon is designed to show users all the grocery items they have with quantities and expiration dates. The Recipe icon is a very convenient feature for users to find recipes. Finally, the Setting icon is where users can find the expiration date notification settings on the app.

The implementation of the main menu used GridLayout and CardView. GridLayout helps display the contents easier and CardView provides the section for each item including the shadows and margins. The implemented layout technics makes the entire user-interface more clear, balanced, aesthetically pleasing, simple and stylish with good usability.

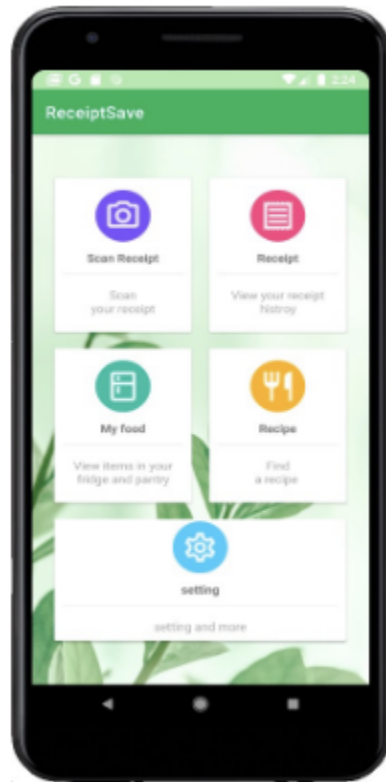


Figure 3: Main Menu page

### Scan Receipt Page:

The scan receipt pages allows you to be able to scan a receipt and then store the food items into the database. You will have a choice of capturing the receipt using the camera or picking the receipt from the gallery. After choosing the image, the app will use google's Machine learning Kit to generate the names of the items that are on the receipt and they will be displayed on the page. You will have a choice of correcting some of the spelling of the item in case the algorithm spelled them wrong.

The Food item will be assigned a 3 day expiry date but by clicking the drop menu on the expiry date you could choose a date that is in line with the current food item. You will also have a choice to pick a date from the calendar. After reviewing the food items and the expiry dates, you can click the save button for the food items to be saved in the database.



User login to the application and they will be able to authenticate the application using the firebase authentication. Firebase stores the authentication automatically, but we can go and manage the system manually. When the user enters the information it will take the main application.

Main Application: When the user enters the main application user has multiple choices. For this instance we will assume that the user is new and the user will scan the receipt and it will add to the database. Now the user has the full recipe in the hand in a graphical way. It not only helps users to collect receipts, it also helps the user to read receipts in a more meaningful way.

**Receipt History Page:**



Figure 6: Receipt History page

As you can see above is a screenshot of the Receipt History page. The receipt images url stored in the database are stored in a list and then displayed on the screen. The most recent ones are displayed at the top. In the top right hand corner, there is a button that allows the user to scan another receipt. This button works very similar to the scan receipt page. We decided to put that button here, so if someone wanted to they could scan a receipt on the page where they could view all of their receipts.

**Food History Page:**

My Food page is bringing items and related information from the Firebase database and shows them to users. Each item has an expiration date, and the color of the date section is different depending on the expiration date. Red means the expiration date is over, yellow means the expiration date is close, and green means the expiration date is more than a week away. Users can select the checkbox of the items they want to delete and press the Delete button, then the items will be deleted from the database.



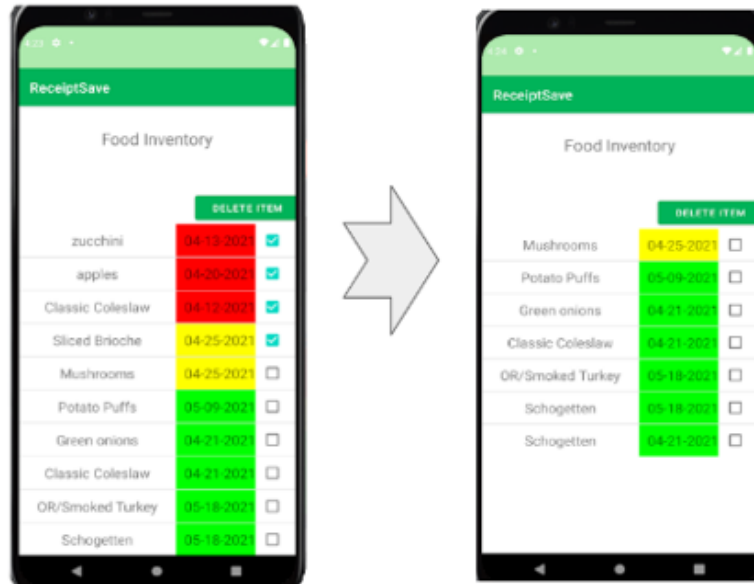


Figure 7: Food History page

### Recipe Search Page:

Recipe search page allows users to check what they have and search for recipes based on what they select. It shows a list of food items stored in the database with food images that matches the item name. To search for recipes, the user is required to click one or more checkboxes next to each item name and click the search button. Then it moves to the Google Internet page and it shows the results of the search.

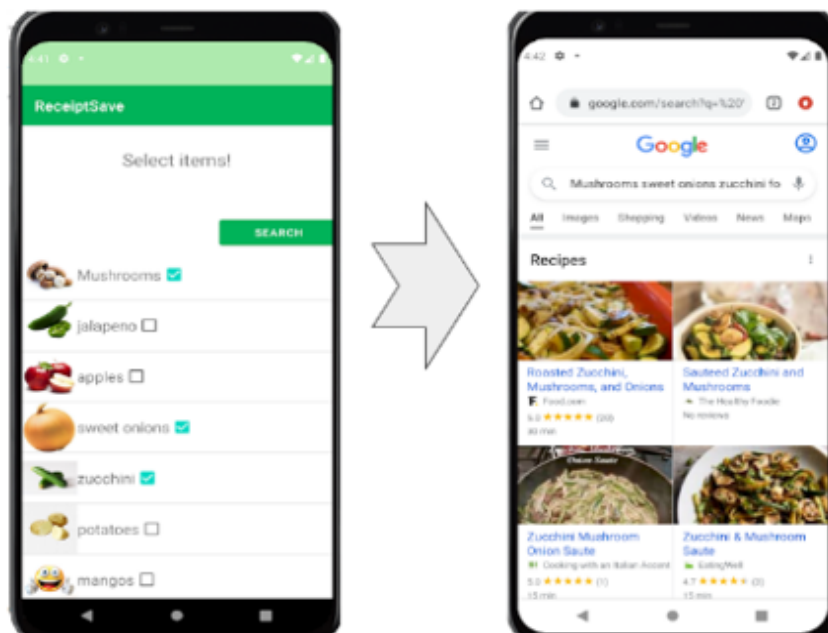


Figure 8: Recipe Search page

## Future Works

- This application allows users to keep track of the total monthly spending and set a target of how much they would like to spend in a month and the application shows users how much of that has been used and how much is remaining.
- On the food history page, items will be sorted by the expiration date so that users can understand and visualize easier.
- After the conversion of a receipt image to text, the user can delete unnecessary items.

## Potential Impact:

The potential impact of our app could help cut down on food waste. If people were to know what items they have and when they expire all in one app, they would be less likely to buy more than they need. They would only buy items when they are about to run out of them, rather than buying more than they need and some of the items expire and go bad.

## 4.3 Risks

Risk	Risk Reduction
Unwanted text	We used the google machine learning to reduce the unwanted text while scanning the application and user can also manually delete the data
Data lost	We have made the changes that will not be deleted without admin access in the database
Update	Application is needed to get updated as required with the update of an operating system

## 4.4 Tasks

1. Project planning and distribution of the task
2. Design of UI design
3. Implementation of scan receipt
4. Implementation of User authentication system

5. Handling of the database management and connection of the rest of the application with appropriate database
6. Testing of the application functionality in different kinds of devices
7. Management of the presentation
8. Ways to improve the application and taking part in future update

#### 4.5 Schedule

Task	Dates
<ul style="list-style-type: none"> <li>● Develop Final Proposal</li> <li>● Background Analysis.</li> </ul>	11/25/2020 - 12/5/2020
<ul style="list-style-type: none"> <li>● Set up team environment</li> <li>● Develop Database Schema</li> <li>● Get familiar with using Firebase</li> </ul>	1/11/2020 - 1/24/2021
<ul style="list-style-type: none"> <li>● Develop a cloud-hosted NoSQL database that lets you store and sync data between your users in real-time, Firebase Realtime database.</li> <li>● Implement functionality to recognize text in a receipt image using API of the ML kit in Firebase and display the converted text.</li> <li>● Develop the Main menu page.</li> </ul>	1/25/2021 - 2/7/2021
<ul style="list-style-type: none"> <li>● Document database schema, tables, and API to interact with and update the database.</li> <li>● Develop a cooking recipe recommendation function.</li> <li>● Implement functionality that allows users to import pictures from the gallery.</li> <li>● Implement functionalities that allow the user to select dates in the Expiration Date field and to save items and expiration dates.</li> </ul>	2/8/2021 - 2/21/2021

<ul style="list-style-type: none"> <li>● Implement display grocery items with expiration dates in the database.</li> <li>● Implement functionality that deletes items from the database.</li> <li>● Create a sign-in page and implement sign-in functionality.</li> <li>● Implement function to store receipt images in the database</li> </ul>	2/22/2021 - 3/7/2021
<ul style="list-style-type: none"> <li>● Implement picture upload function</li> <li>● Develop OCR to recognize receipts and store data to database</li> </ul>	3/8/2021 - 3/21/2021
<ul style="list-style-type: none"> <li>● Develop grocery spending analysis function.</li> <li>● Continue to implement receipt image display function.</li> <li>● Continue to develop notification functionality using FCM.</li> </ul>	3/22/2021 - 4/4/2021
<ul style="list-style-type: none"> <li>● Implement functionality that adds colors on expiration dates on MyFood page</li> <li>● App UX &amp; UI design and implementation</li> <li>● Testing</li> </ul>	4/5/2021 - 4/18/2021
<ul style="list-style-type: none"> <li>● Document</li> </ul>	4/19/2021 - 4/29/2021

#### 4.6 Deliverables

- Database scheme: FireBase realtime database
- Code: Mobile UI code and backend Java code
- Final Report

### 5.0 Key Personnel

**Michael Panis** – Panis is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas. He has completed many relevant computer science courses through his education journey such as Big Data, Database Management Systems, and Software Engineering to name a few. Over this past summer, he was an Information Technology Intern at Phillips 66. Panis gained relevant, real-work experience that

he can build off of in the future from the internship. He learned to use data analytic tools such as Alteryx and Tableau. During this semester, Spring 2021, Panis was a Software Engineering Intern for Marshalltown. He gained valuable knowledge and is looking forward to entering the industry upon graduation. He has experience with C++, Java, Python, Javascript, MySQL, HTML, and C#. He worked on the database, backend of the app, as well as testing of the app.

**Ailin Zhang** – Zhang is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas. She has completed Software Engineering, Database Management Systems, Computer Networks, and Artificial Intelligence. She had an internship experience as a Software Developer Intern at Koch Industries during summer 2020. She has experience with C++, Java, Python, Javascript, MySQL, and HTML. She worked on the UX and UI design, frontend development, and testing the app.

**Dilendra Khanal** – Khanal is a senior Computer Engineering major in the Computer Science and Computer Engineering Department at the University of Arkansas. She has completed Software Engineering, Database Management Systems, Data Mining, and embedded systems. She has experience in Java, C++, MySQL, Javascript, Python, and HTML. In this capstone project, he worked on backend and front end development of the android mobile app.

**Hwajin Jeon**– Jeon is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas. She has completed Software Engineering, Database Management Systems, Big Data Analytics, and Computer Graphics. She has experience in Java, C++, MySQL, Javascript, Python, and HTML. In this capstone project, she worked on backend development of the android mobile app.

**Jaei Ryu**– Ryu is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas. He has completed Software Engineering, Database Management Systems, Computer Graphics and Big Data Analytics. He has experience in Java, C++, Python, MySQL, Javascript, and HTML. In this capstone project, he worked on backend development of the android mobile app.

**Fred Shumbusho** – Shumbusho is a senior Computer Science major in the Computer Science and Computer Engineering Department at the University of Arkansas. He has completed Software Engineering, Data mining and Database Management Systems. He has experience in Java, C++,MySQL, Python, Javascript, and HTML. In this capstone project, he worked on backend development of the android mobile app.

## 6.0 Facilities and Equipment

The equipment we used was our own personal computers/laptops. The facilities we used were our own homes/apartments. Hopefully next semester we will be able to meet on campus if

need be, but if we are still in a pandemic meeting virtually online will do. We will be using a database on the backend, and the frontend will be creating the interface of the application.

## 7.0 References

[1] TOSHIBA, <http://business.toshiba.com/downloads/KB/f1Ulds/13073/contents/09-037.htm>

[2] Realtime Database, [https://en.wikipedia.org/wiki/Real-time\\_database](https://en.wikipedia.org/wiki/Real-time_database)

[3] Firebase Realtime Database, <https://firebase.google.com/docs/database>

[4] Expensify, <https://use.expensify.com/mobile>

[5] Forks Plant-Based Recipes App, <https://www.forksoverknives.com/app/>