Ingredible - The Ingredient Scanner App

Team: Ingredible Mobile App

Members:

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Introduction

Based on research done by WHO and the Department of Nutrition at the North Carolina University, more than 60% of people in North America are eating potentially carcinogenic or other harmful products every day[1][2] and 200,000 people require emergency medical care for allergic reactions to food[3]. We can proactively prevent this by - **Ingredible** which is an easy-to-use mobile application that filters out the potential carcinogenic or harmful products based on FDA recommendations and personal allergies and preferences and also recommends similar healthy products to the users.

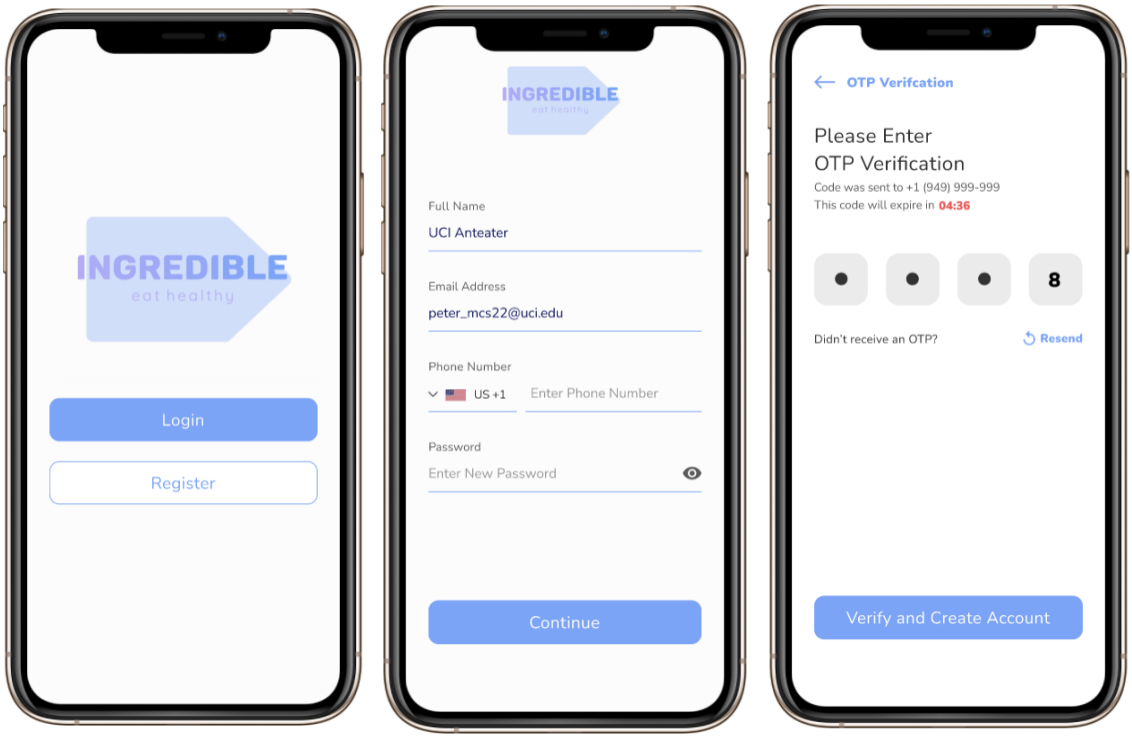
Our app provides additional functionalities like filtering of custom allergic ingredients for the user and recommends similar products based on harmful and allergic ingredients which provides a competitive edge over other apps in the market.

Features

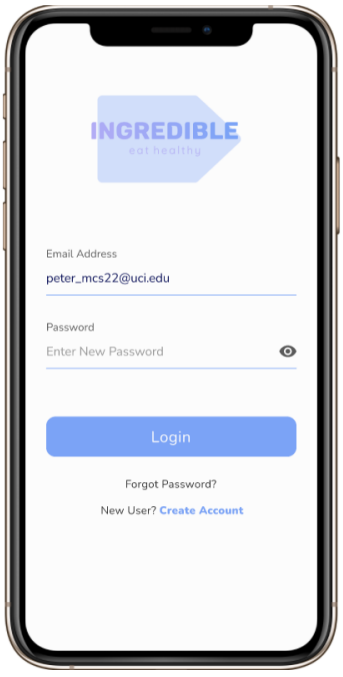
1. **FDA-based filtering:** Scans the ingredient labels of food or cosmetic products and alerts the user if carcinogenic/harmful ingredients are found.
2. **Allergy Detection:** Users can add custom ingredients they are allergic to, and the app will highlight if the label contains those ingredients.
3. **Similar Product Recommendation:** Recommend similar products that are safer instead of a product that contains harmful/allergic ingredients.

Interface

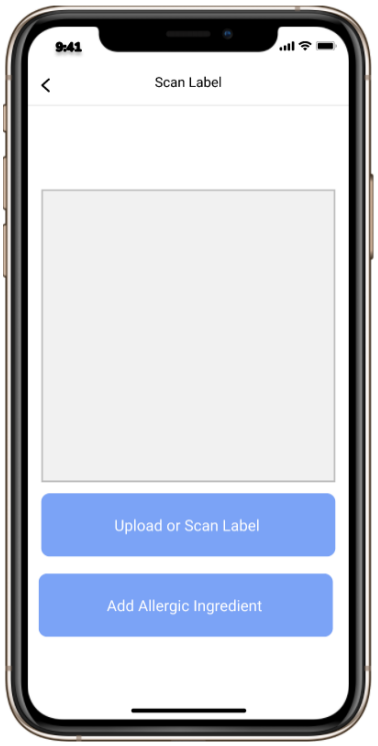
Signup

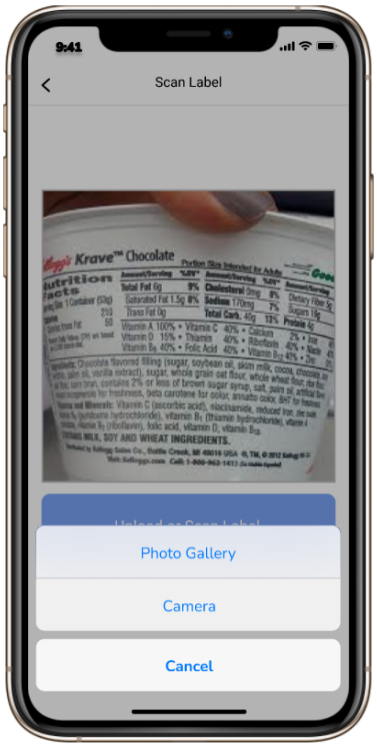


Login



Scan Labels


9:41
Scan Label
Upload or Scan Label
Add Allergic Ingredient


9:41
Scan Label
Photo Gallery
Camera
Cancel

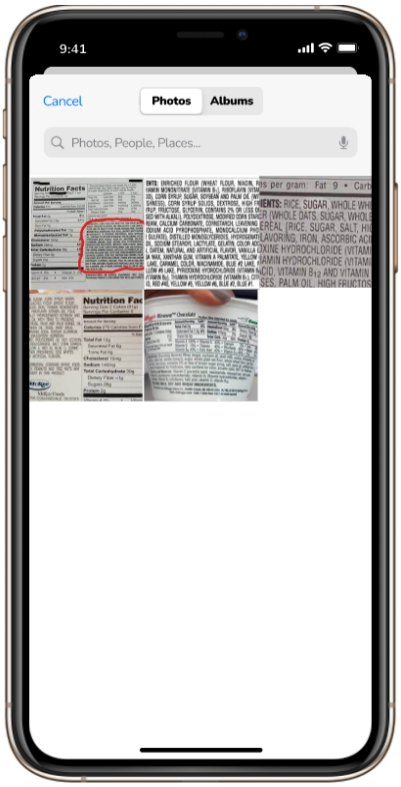
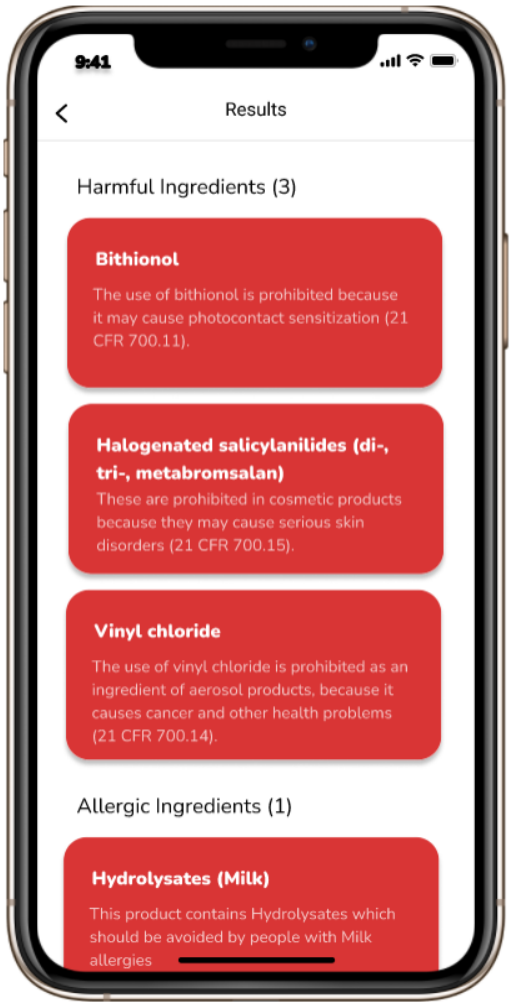
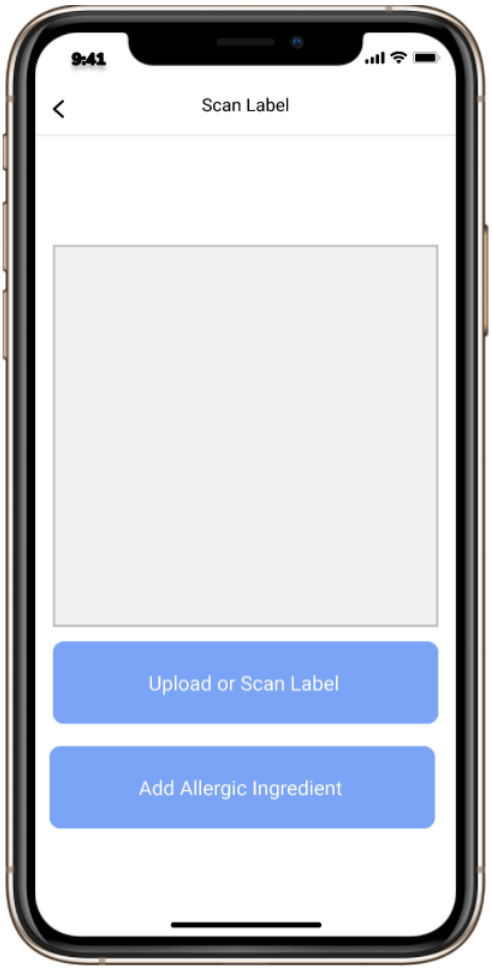

9:41
Cancel
Photos
Albums
Photos, People, Places...

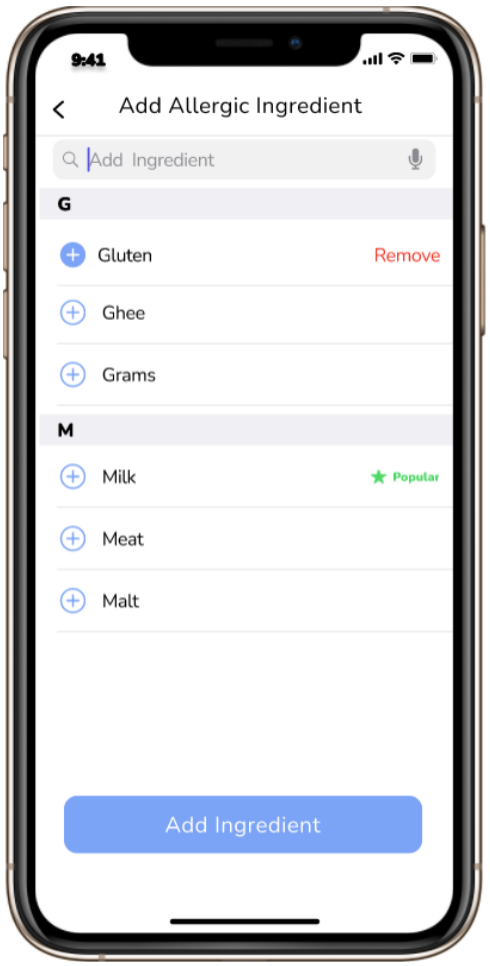

PHOTO
Cancel

Result Page

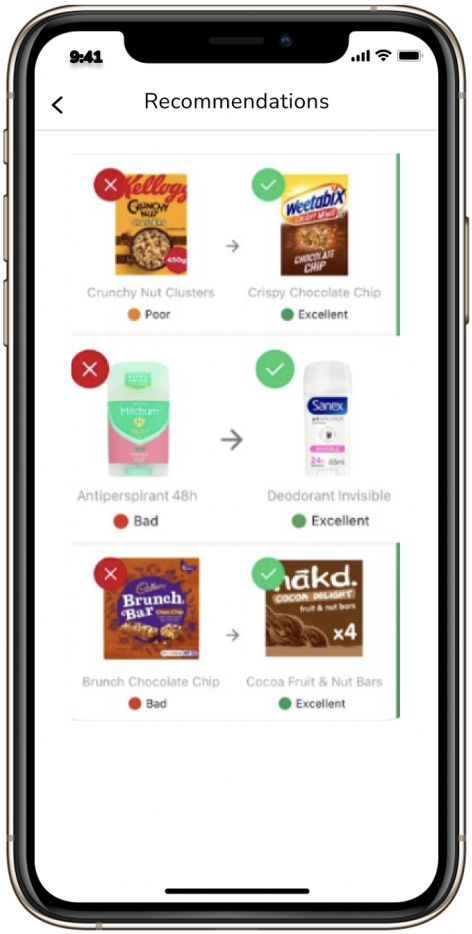

9:41
Results
Harmful Ingredients (3)
Bithionol
The use of bithionol is prohibited because it may cause photocontact sensitization (21 CFR 700.11).
Halogenated salicylanilides (di-, tri-, metabromsalan)
These are prohibited in cosmetic products because they may cause serious skin disorders (21 CFR 700.15).
Vinyl chloride
The use of vinyl chloride is prohibited as an ingredient of aerosol products, because it causes cancer and other health problems (21 CFR 700.14).
Allergic Ingredients (1)
Hydrolysates (Milk)
This product contains Hydrolysates which should be avoided by people with Milk allergies

Add Custom Ingredient





Recommender Page



Architecture

- A Total of 11 components
- 6 Frontend
- 5 Backend

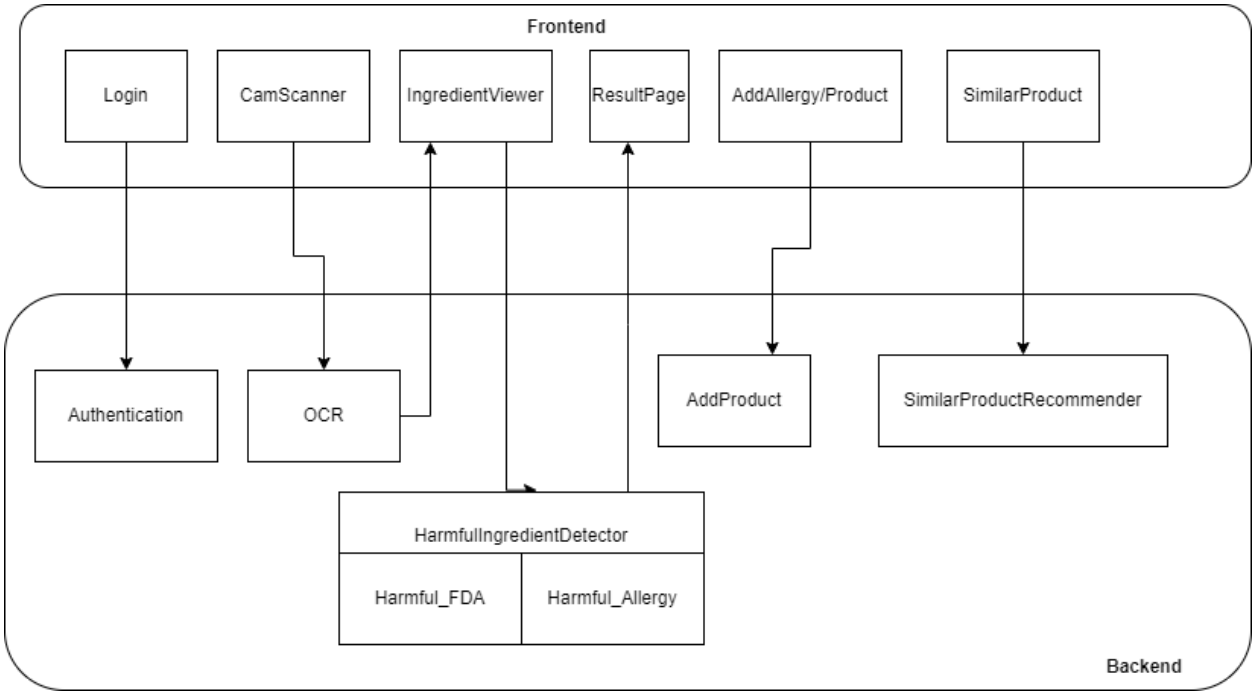


Figure 1: Architecture Diagram

From the diagram above, we can see that all the components are independent of each other and are being used for different purposes. This de-coupled design will help us scale the application in the long run. It will also make the application more

1) Maintainable and testable enabling faster development and deployment
2) Loosely coupled with other components enabling a team to work independently
3) Independently deployable enabling a team to deploy their service without having to coordinate with other teams

Component	Functionality	Stack
Login	Responsible for login of users in the frontend(UX) and then validating the user credentials	Frontend
CamScanner (Frontend)	Using the camera to scan the image	Frontend
OCR (Backend)	Runs OCR based algorithms to detect the text in the scanned image.	Backend
IngredientConfirmationPage	Ingredients detected by the OCR screen	Frontend
HarmfulIngredientDetector	Detects the harmful ingredients based on FDA and Allergy	Backend
Harmful/Allergic Results Page	A front-end component that displays a list of ingredients - harmful or allergic(user-specific) ingredients	Frontend
Add Allergies/Product	Add custom allergies of a user or add a product in the list of products if not already present	Frontend
SimilarProduct/SimilarProductRecommender	Show similar products with the preferences the user has given to the app	Backend

Table 1: Component Summary

Login/Authentication

Description

As can be seen from Figure 2 below, this component will be responsible for login of users in the frontend(UX) and then validating the user credentials against the credentials stored in the user database. These components will help us make the complete app customized and personalized to each user as every user will have his/her own allergies and preferences.

Communication

- Receive from: The UI component will get user details (login and PWD)
- Send results to: The backend component for authentication purposes.

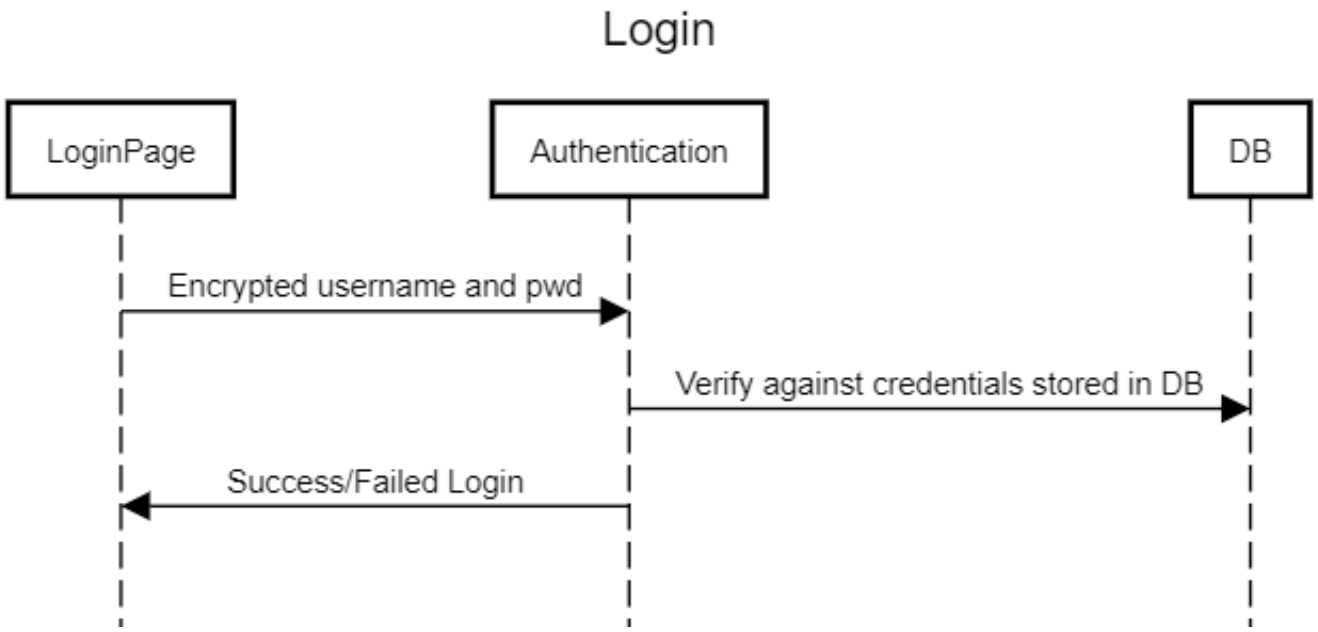


Figure 2: Login Page Sequence Diagram

CamScanner (Frontend)

Description

As can be seen from Figure 3 below, CamScanner Screen is responsible for using the camera to scan the image and shows the user what it is sending. This component is necessary to take the image of the label and send it to the backend for ingredient detection

Communication

It communicates with the OCR component in the backend which sends the scanned images.

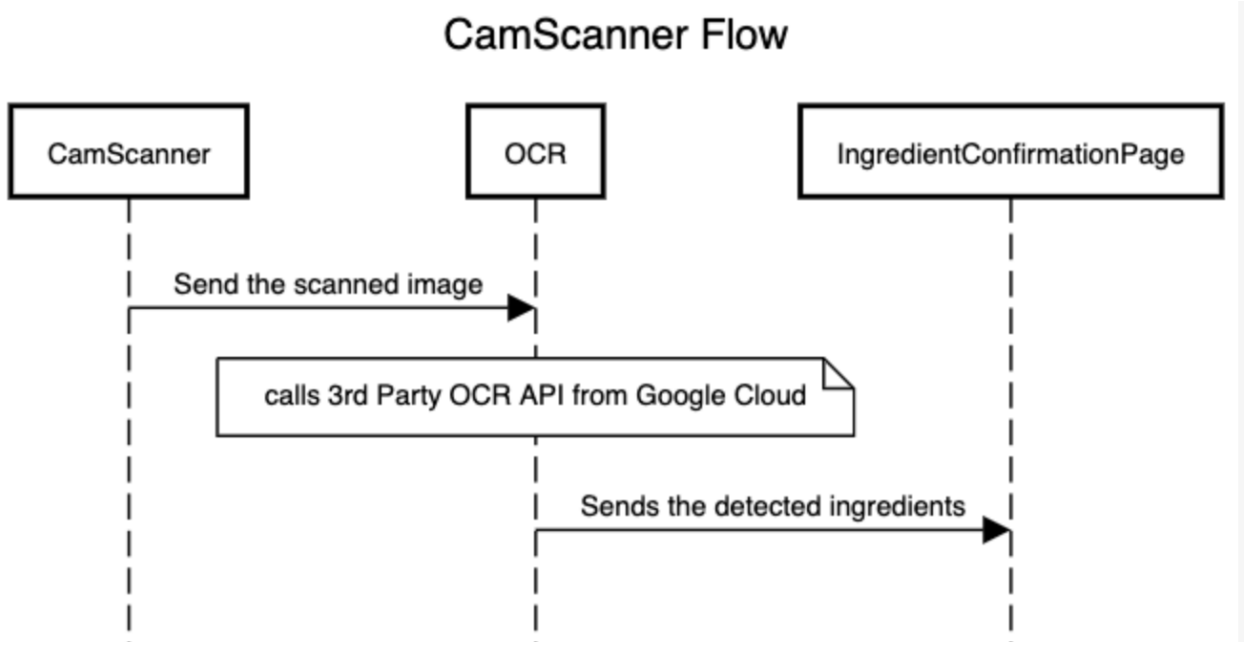


Figure 3: Ingredient CamScanner Sequence Diagram

OCR (Backend)

Description

As can be seen from Figure 4 below, CamScanner Screen is responsible for using the camera to scan the image and shows the user what it is sending.

Communication

- It receives the images from the Cam Scanner in the frontend and calls the 3rd Party API from Google Cloud to get the text mentioned in JSON format.
- It updates the data model to send the information about the same to IngredientConfirmationPage in the frontend.

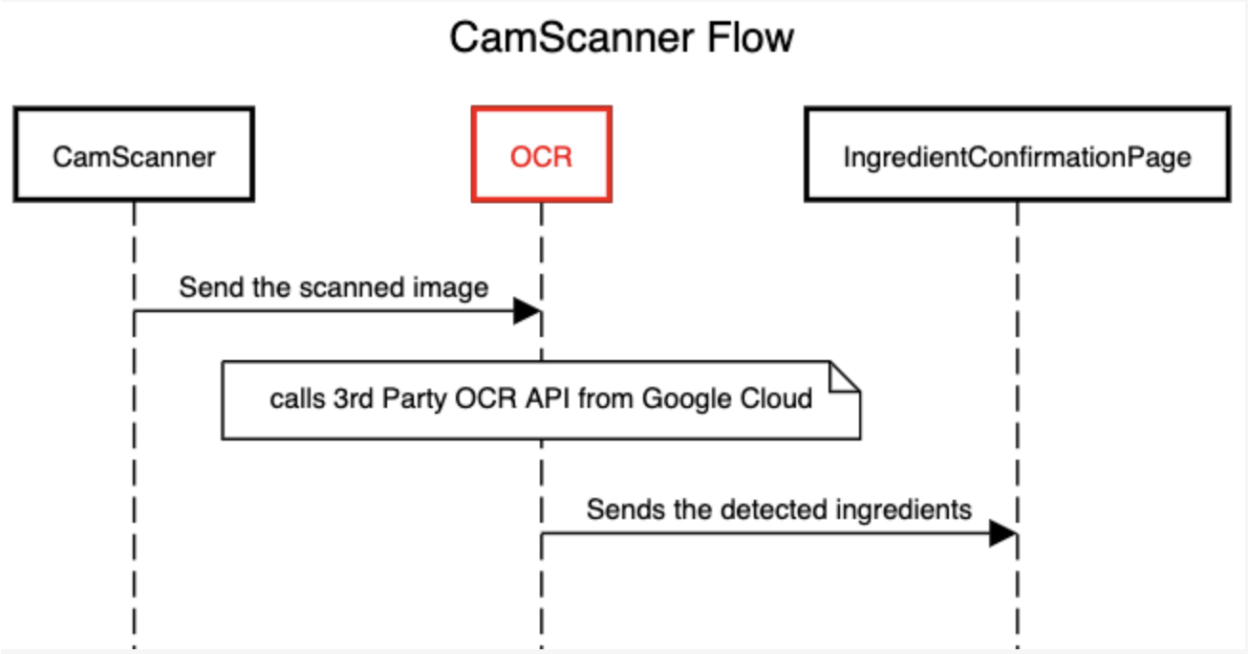


Figure 4: Ingredient OCR Sequence Diagram

IngredientConfirmationPage

Description

As can be seen from Figure 5 below, a front-end component shows the results of the OCR to the user. The results are just all the ingredients detected by the OCR model. This component will also allow the user to confirm the ingredients/add more ingredients/remove ingredients - basically, it acts as a fail-safe when the OCR model fails to detect ingredients correctly. Without this component, there might be a chance that the OCR incorrectly recognizes some ingredients and the user is forced to go ahead with the incorrect results.

Communication

- Receive from: The UI component will be stateless and will receive data from the Backend OCR model.
- Send results to: All the confirmed ingredients will be sent to the HarmfulIngredientDetector Backend.

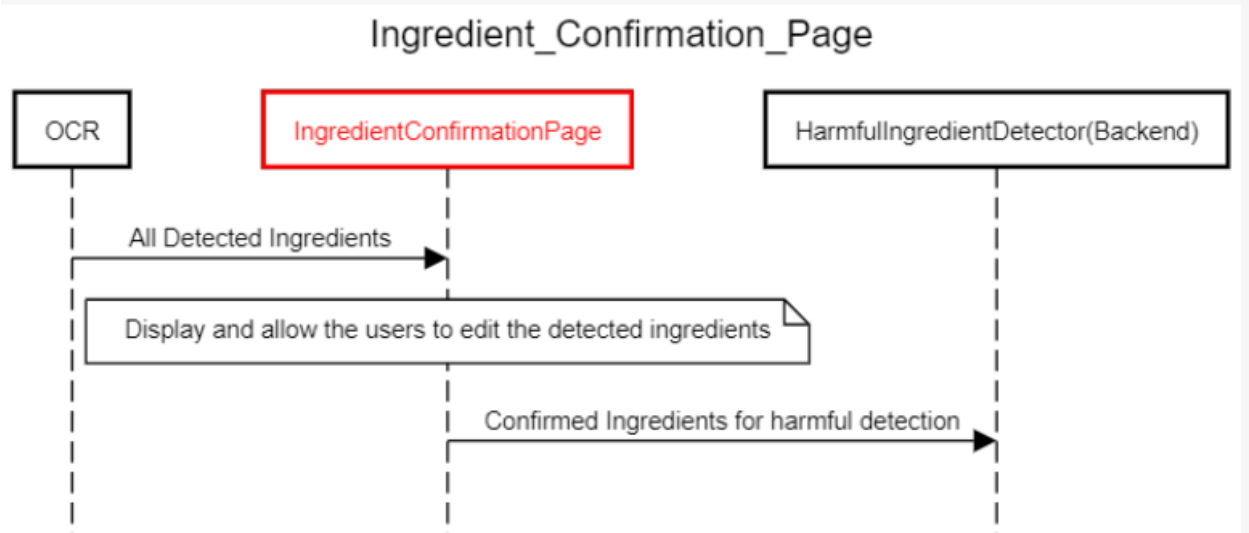


Figure 5: Ingredient Confirmation Sequence Diagram

HarmfulIngredientDetector (Backend)

Description

As can be seen from Figure 6 below, HarmfulIngredientDetector detects the harmful ingredients based on FDA and Allergy. It has two child components, one for FDA-based detection and another one is for Allergy based detection. HarmfulIngredientDetector is the core business logic behind the app. It handles all the scraping and maintaining the database of the Allergies of every individual user.

For FDA-based detection

- A scheduled pipeline to scrap the data from the FDA website. Keeps the data up to date.
- Maintains the list of harmful chemicals in its own database.

For Allergy based detection

- A database of allergies pertaining to every individual user.
- Can be accessed by the Add Allergy method in the frontend to add allergy for the user.

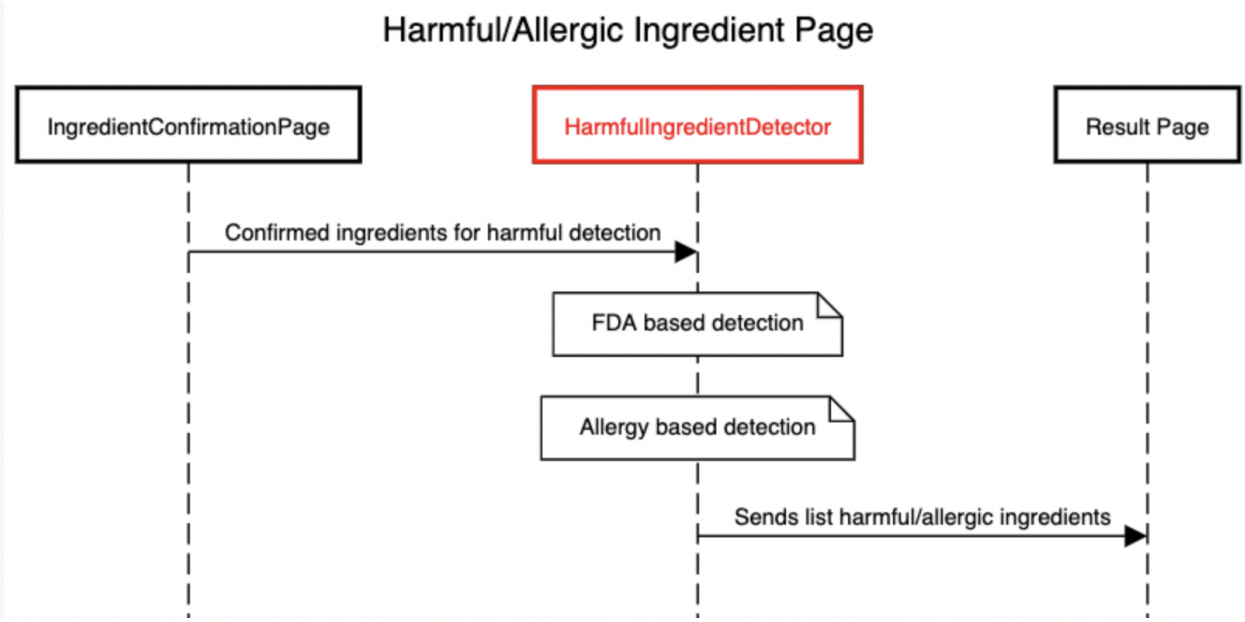


Figure 6: Harmful Ingredients Detector Sequence Diagram

Harmful/Allergic Results Page

Description

As can be seen from Figure 7 below, a front-end component that displays a list of ingredients - harmful or allergic(user-specific) ingredients will be listed on top and highlighted in Red, followed by healthy and recommended ingredients. The user will have an option to click on each ingredient and get a detailed description as to why this particular ingredient was marked harmful/healthy. This UI component will act as the main communicator to the user and hence is very essential for the app.

Communication

This component will receive results from the harmful ingredient detector backend component.

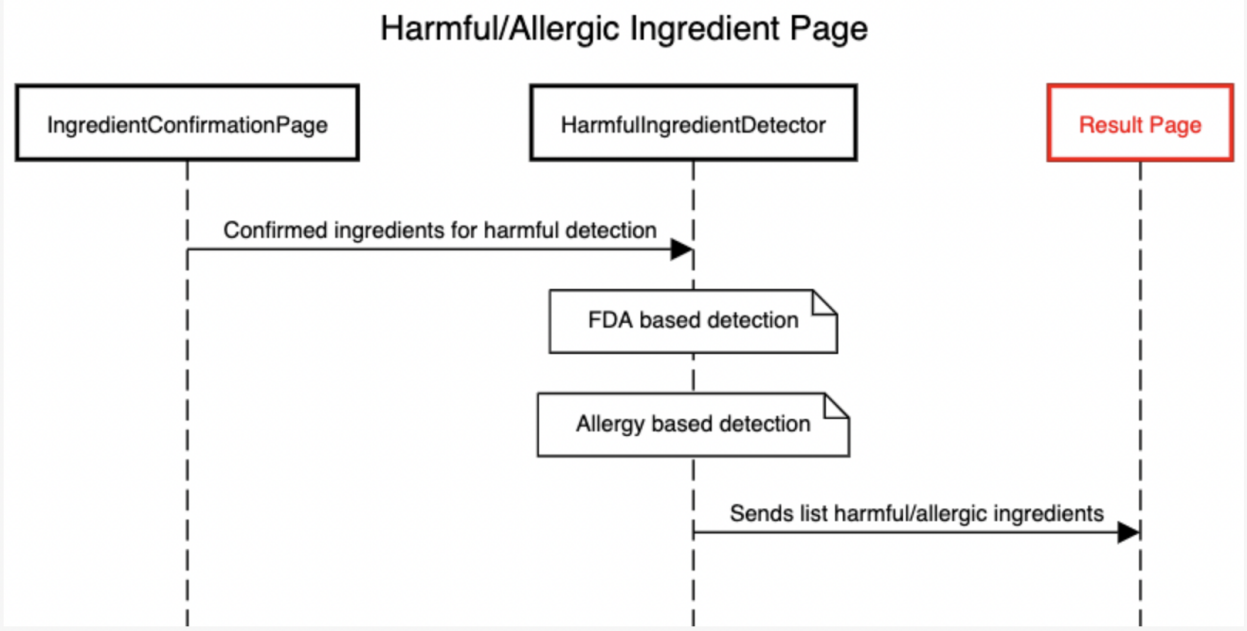


Figure 7: Results Page Sequence Diagram

Add Allergies/Product

Description

As can be seen from Figure 8 below, A front component with two options - add custom allergies of a user or add a product in the list of products if not already present. If the user wants to add his/her custom allergies so it's helpful later to detect their allergies.

Communication

Gets results from the add product backend service and displays results to the user.

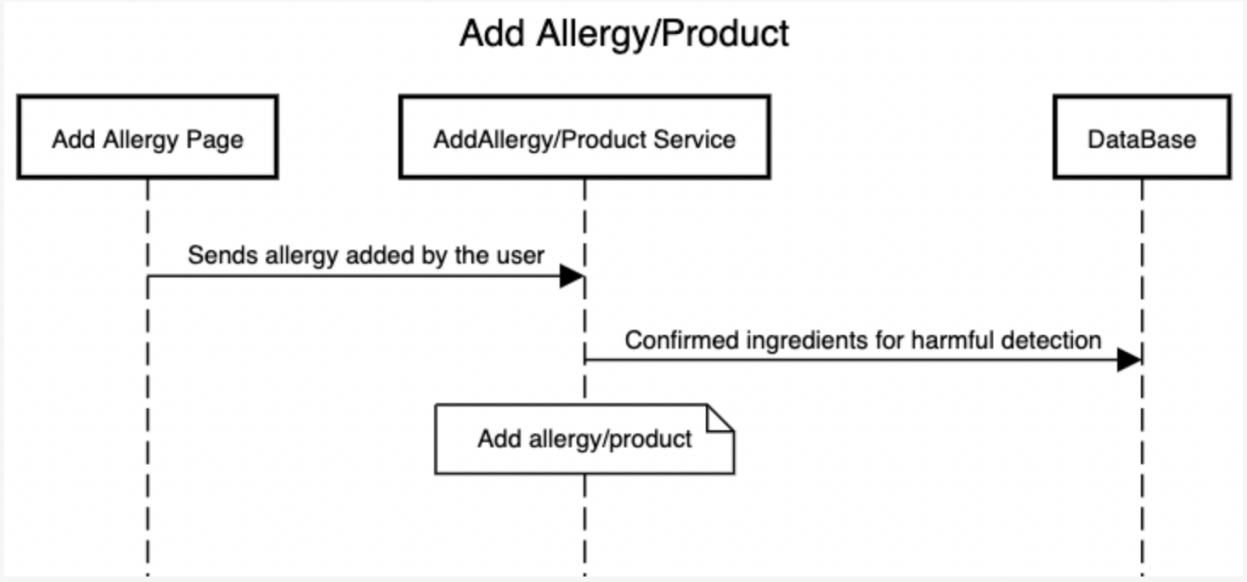


Figure 8: Add Allergy/Product Sequence Diagram

SimilarProduct/SimilarProductRecommender

Description

As can be seen from Figure 9 below, This page will show similar products with the preferences the user has given to the app earlier. The backend component with the database will store the products that are similar but have different safer ingredients. The user will be given personalized recommendations with similar products that have safer/consumable ingredients.

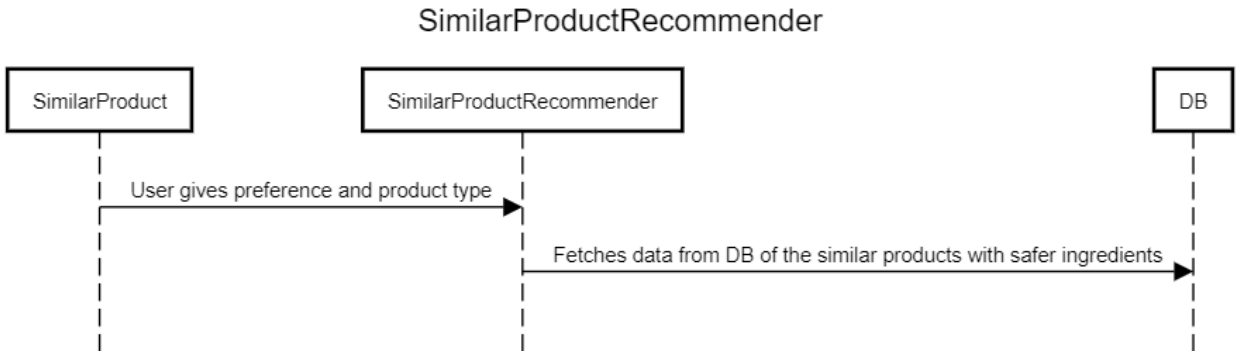


Figure 9: Similar Product Recommender Sequence Diagram

Feature Map

The feature map on this page lists all of our features, as well as the subcomponents that implement them. It's being used for bridging the semantic divide between design requirements and software architecture.

Feature	Frontend Component	Backend Component
FDA based filtering of ingredients	● CamScanner ● IngredientViewer ● Result Page	● OCR ● HarmfulIngredientAnalyzer
Allergy Detection	● Add/Remove Allergy ● Result Page	● HarmfulIngredientAnalyzer
Similar Product Recommendation	● Similar Product	● SimilarProductRecommender

Table 2: Feature Map

Database Schema

UserDetails

User_id INT - **Primary Key**

User_name VARCHAR(64),

First_name VARCHAR(64),

Last_name VARCHAR(64)

Password VARCHAR(64)

UserAllergy

User_id INT,

Ingredient VARCHAR(64),

Id+ingredient - **Primary Key**

UserPreferences

User_id INT,

Ingredient VARCHAR(64),

Id+ingredient - **Primary Key**

FDA

HarmfulIngredients - VARCHAR(64)

Product

ProductID - INT (**Primary Key**)

ProductName - VARCHAR(64)

ProductType - VARCHAR(64)

ProductIngredients

ProductID - INT (**Primary Key**) (Foreign Key)

Ingredients - VARCHAR(64)

References

1. Frank, Sarah M et al. “Patterns of Red and Processed Meat Consumption across North America: A Nationally Representative Cross-Sectional Comparison of Dietary Recalls from Canada, Mexico, and the United States.” International journal of environmental research and public health vol. 18,1357. 5 Jan. 2021, doi:10.3390/ijerph18010357
2. WHO carcinogenicity of process mears: https://www.who.int/news-room/questions-and-answers/item/cancer-carcinogenicity-of-the-consumption-of-red-meat-and-processed-meat
3. https://www.foodallergy.org/resources