Functional Specification

CA400 - 4th Year Project

Project Title:

'MyAllergyAssistant - Android app to scan food ingredients for allergens'

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Functional Specification Contents

0. Table of contents

1. Introduction

1.1 Overview

Provides a brief overview of the system / product to be developed. It should include a description of the need for the system, briefly describe its functions and explain how it will work with other systems (if appropriate).

The system to be developed is an Android application built to assist people with food allergies. The app will help reduce the likelihood of an allergic reaction by allowing the user to scan products quickly of the many products they buy. This can be done by the user either using Optical Character Recognition (OCR) technology or barcode scanning. In the case of barcode scanning, when a barcode is scanned, a request will be made to some external database or API such as Open Food Facts to retrieve the product's information. Users will be able to report the product by scanning its barcode, this will be stored in our database. This will remind the user and other users with similar allergies that it may cause an allergic reaction. The system's backend will be built and hosted on the cloud through AWS Lambda, this will be used for user authentication, and use or store data that will support the functionality of the app.

We believe there is a need for this app because it will help keep users more informed about the products that they purchase and consume, as users will be able to scan a product's ingredients or barcode and see if it contains any of their allergens, or if the product has been reported by other users for containing any additional allergens not listed on the packaging. We hope that by keeping users informed about the products in this manner, that this app will help prevent consumers from having allergic reactions.

The system will require some initial information of the user's allergens, access to the user's camera and a working internet connection in order for the app to function as intended.

1.2 Business Context

Provides an overview of the business organization sponsoring the development of this system / product or in which the system / product will / could be deployed. *Note - may not be applicable to all projects*

This development of this application is not sponsored by any business organisation.

This system may be deployed using Docker and on the cloud through AWS.

1.3 Glossary

Define and technical terms used in this document. *Only include those with which the reader may not be familiar.*

Docker - platform used for packing applications into containers.

React Native - framework made for making cross-platform mobile applications without having to rewrite code for each platform and without needing to write native code.

AWS - Amazon Web Services; cloud computing platform and APIs hosted by Amazon, which we will be using for the backend of this project.

API - Application Programming Interface; used for communications between different applications.

Barcode - a visual code that represents data that can be scanned, usually found on food packaging.

Optical Character Recognition (OCR) - The process of extracting text from images. Also referred to as 'text-recognition'.

Open Food Facts - Open Food Facts is a food products database, that we will use to identify products (https://world.openfoodfacts.org/)

2. General Description

2.1 Product / System Functions

Below is a list of functions that our app will use.

- Register
- Login
- Input selection of user allergies
- Scan ingredients text
- Scan barcode
- Report product
- Edit selection of user allergies
- Edit account information
- Delete account

2.2 User Characteristics and Objectives

The users of the application will be people with Android phones, people who may have food allergies, or may want to be informed about whether or not a given food product contains any allergens.

From the user's perspective, this app should allow them to create an account, and store their allergy information. It should allow the user to take a picture of either the ingredients or the barcode on food packaging, and should display to the user whether the product is safe to eat or may contain any of their allergens. After scanning a product's barcode, the user should also be able to see if the product has previously been reported by another user for containing traces of an allergen not listed on the food's ingredients list.

Some additional features that may be on a user's wishlist are:

- The ability to edit account information at any time.
- The ability to view the products that you have previously scanned.
- The ability to search for a product by name, instead of scanning.

These potential features on the above wishlist are features that will not be prioritised initially, but will be explored provided we have the core functionality of the app completed and have enough time.

2.3 Operational Scenarios

A list of operational scenarios is given below to show, from the user's perspective, how the system will be used in different situations.

1. **User starts the application**

   The app's UI will load, if the user has not given permission, the app will ask for access to their camera. If the app is able to access the camera, then it will show an authentication component to login/register if they haven't logged in before for some time.

2. **User registers**

   If a user doesn't have an account, they can register by clicking the register button. They will input their information in the register form, and then submit. If submission is successful, their account will then be created in our database. If the submission fails, an error message is displayed to the user.

3. User login

A user can log into their account, provided that they already created an account through the registration process. If a user tries to login to an account using invalid details, they will receive an error message.

4. User selects allergens

If the user wants to select/change their allergens, they can go into account information, and tap to edit them. A list of allergens they have selected and not selected will then pop up where they can select/unselect and submit.

5. User scans ingredients

A user can scan a product's ingredients by pressing the 'Scan Ingredients' button. The app will then use the user's camera to scan the ingredients on the product packaging. The user will receive a warning message if the app cannot recognise any text from the image (if the image is too blurry etc). A message will then be displayed to the user indicating that the product is either safe to eat, or may contain one of their allergens.

6. User scans product barcode

A user can scan a barcode by pressing the 'Scan Barcode' button. The app will then use the user's camera to scan for the barcode on the product packaging. If detected, the app will make a request for the product's information to an external API/database such as Open Food Facts. If found, a result will be returned to the user whether it is safe to eat or not, potentially including any other product information if available. If not found, a user will receive a warning message saying the product could not be found.

7. User reports product

A user can report a product if the product caused them to have an allergic reaction to an allergen that wasn't listed on the product's ingredients list. When another user then scans the product's barcode, they will be warned that the product was reported by another user.

2.4 Constraints

A list is given below of the constraints put on the design team:

- This application should be compatible with all Android phones, provided they have a working camera and an internet connection.
- The app should take no longer than 10 seconds to scan the ingredients of the product. An additional 10 seconds should be accounted for if translation is required.
- The app should take no longer than 10 seconds to retrieve the product information after scanning the barcode.
- The team has no prior experience with technologies such as OCR, barcode scanning, AWS Lambda, and machine learning, time will be needed to learn these.
- The development of this app is constrained by time, as the final deliverables for this project are due on the 28th of April 2023.

3. Functional Requirements

Below is a list of the functional requirements for our application to work as intended.

3.0. Set app permissions

Description

The user must be able to accept permissions from the app to access their camera and/or photo library. If the app is missing a permission, the app must ask the user for permission in order to continue using the app.

Criticality

This requirement is a high priority, app permissions are required in order for the app to function properly. The app needs access to the photo in order to scan the product.

Technical Issues

May need to check if a user is potentially able to remove a required permission while using the app in order to prevent bugs.

Dependencies with other requirements

N/A

3.1. Register

Description

The user must be able to register for an account by pressing the 'Register' button on the home screen. They will then have to fill in the registration form with their details including their name, email address and password. Provided the details provided are valid, the user's account will then be registered and added to our database. If their details are invalid, then an error message will be displayed to the user.

Criticality

The registration functionality is critical for this application to authenticate our users, and for them to be able to login to the app. We will work on the registration and login functionality together at the beginning of the development process.

Technical Issues

AWS is a new technology to the development team, so they will have to learn how to implement user authentication using AWS as a backend,

Users' account information, such as email and passwords, will need to be stored securely.

Dependencies with other requirements

The registration and login functionality goes hand in hand for user authentication, so we will focus on these at the beginning of the development process. Users must have accepted their permissions, see requirement 3.0.

3.2. Login

Description

After having registered their account, the user must be able to login into their account through the login component, the component must be accessible to the user through the authentication screen, by the user tapping the login button or the app starting at the login component. The login component must have a form where the user should be able to enter and submit their login credentials, and then log the user in if their credentials are correct as in the database. If the credentials provided by the user are incorrect then an error message should be displayed.

Criticality

This function is required otherwise the user would not be able to log back into the app and use its features. We will work on the registration and login functionality together at the beginning of the development process.

Technical Issues

AWS is a new technology to the development team, so we will have to learn how to implement user authentication using AWS as a backend.

Users' account information, such as email and passwords, will need to be stored securely.

Dependencies with other requirements

The login and registration functionality goes hand in hand for user authentication, so we will focus on these at the beginning of the development process. Users must have accepted their permissions, and registered, see requirements 3.0 and 3.1 respectively.

3.3. Select user allergies

Description

When the user logs in to their account for the first time, they will be prompted to input their allergy information by selecting the food allergens that affect them. The user will have the ability to add and remove allergens linked to their account at any time through the settings screen.

Criticality

It is critical to the core functionality of our app that the user is able to select their allergens. The application will search for these allergens in the scanned product's ingredients.

Being able to update their allergens is of medium priority, as it doesn't affect the core functionality of the app.

Technical Issues

We must ensure that a user's allergy information is kept securely in our database, if necessary.

Dependencies with other requirements

The user must have accepted permissions, and be logged in to their account in order to select their allergens. See requirements 3.0 and 3.2 respectively.

3.4. Take/select image for scan

Description

Users must have the ability to take a picture using their camera, and also be able to select an image from their photo gallery on their phone. This image will then be used by the app to scan product ingredients or a barcode.

Criticality

This functionality is of critical importance, as the app needs to be able to get an image from the user.

Technical Issues

We will need to ensure that the image selected by the user is clear enough for the OCR to work. If the app cannot detect a barcode or any ingredients, then an error message will be displayed to the user.

Dependencies with other requirements

The user must have accepted permissions, and be logged in to their account in order to select their allergens. See requirements 3.0 and 3.2 respectively.

3.5. Scan product barcode

Description

With the user's inputted image, the app should be able to recognise the barcode that the user provides. Using the barcode information, the app must try to retrieve product information through an external database (Open Food Facts API), find any allergens, if any, and give the user their scan results (see requirement 3.7.).

Criticality

This functionality is of critical importance, as the app needs to be able to scan products to tell the user if it is safe to eat or not.

Technical Issues

The user is responsible for the image/camera to be in a well-lit environment, in focus, and with the barcode being displayed in full flatly enough to be recognised. If the app cannot detect a barcode, then an error message must be displayed to the user.

The app may need to manipulate the image in order to improve accuracy. If product information is retrieved, it may need to be translated if it is in a foreign language.

Dependencies with other requirements

The user must have inputted a photo and the results of the scan must come after scanning the barcode. See requirements 3.4. and 3.7. respectively.

3.6. Scan product ingredients

Description

With the user's inputted image, the app should be able to recognise the text which potentially contains ingredients, find any allergens, if any, and then give the scan results (see requirement 3.7).

Criticality

This functionality is of critical importance, as the app needs to be able to scan products to tell the user if it is safe to eat or not.

Technical Issues

The user is responsible for the image/camera to be in a well-lit environment, in focus, and with the product ingredients being displayed in full flatly enough to be recognised. If the app cannot detect any ingredients, then an error message must be displayed to the user.

The app may need to manipulate the image in order to improve accuracy. If product information is retrieved, it may need to be translated if it is in a foreign language.

Dependencies with other requirements

The user must have inputted a photo and the results of the scan must come after scanning the ingredients. See requirements 3.4. and 3.7. respectively.

3.7. Get results of scan

Description

Once the app has completed the scan, it should display the results of the scan to the user. The result should show the user if the food product scanned is safe to eat or if it contains one of their allergens. It should also display if the product has previously been reported by another user. If no ingredients can be detected, then an error message will be displayed to the user.

Criticality

This is of critical importance, as it is essential to the functionality of our app that the user is informed if the product is safe to eat or if it contains one of their allergens, or if the product has previously been reported by another user.

Technical Issues

The result of the scan should be clearly displayed to the user, so that if a product contains a user's allergen there cannot be any confusion.

If no ingredients can be detected, then an error message should be displayed to the user.

Dependencies with other requirements

The user must be logged in, and have inputted a photo to be scanned. See requirements 3.2 and 3.4. In order for the results of the scan to be shown to the user, the scan must first have taken place. If the user has scanned a product that has been reported by at least one other user, the result should mention this in the result. See requirements 3.5, 3.6, and 3.8.

3.8. Report product

Description

If the user experiences an allergic reaction to a product that doesn't list any of their allergens in the product ingredients, the user should be able to report the product by pressing the 'Report product' button in our app. The app should then store the product information and user allergens involved in our database.

Criticality

This functionality is of medium priority, as it is a key feature of the application, however the other key features would still work without it.

Technical Issues

We will need to research if reporting a product can be supported, by scanning the product barcode or inputting the product name or both.

Dependencies with other requirements

The user must be logged into their account, in order to report a product. See requirement 3.2.

3.9. Update account

Description

A user should be able to update their account details, such as resetting their password at any time through the settings screen. The user should receive a verification email when updating their account information.

Criticality

This is of low priority, as it doesn't affect the core functionality of the application.

Technical Issues

We must ensure that the user's details are stored securely when updating their account information.

Dependencies with other requirements

The user must be logged in to their account, in order to change their account information, such as email and password. See requirement 3.2.

3.10. Delete account

Description

A user should be able to delete their account at any time, which would remove the user's account from our database.

Criticality

This is of low priority, as it doesn't affect the core functionality of the application.

Technical Issues

We need to be careful when deleting a user's data from our database, that any unrelated data doesn't accidentally get deleted.

Dependencies with other requirements

The user must first be logged in to their account, in order for them to be able to delete it. See requirement 3.2.

4. System Architecture

Below is a graphical representation of the architecture behind our application.
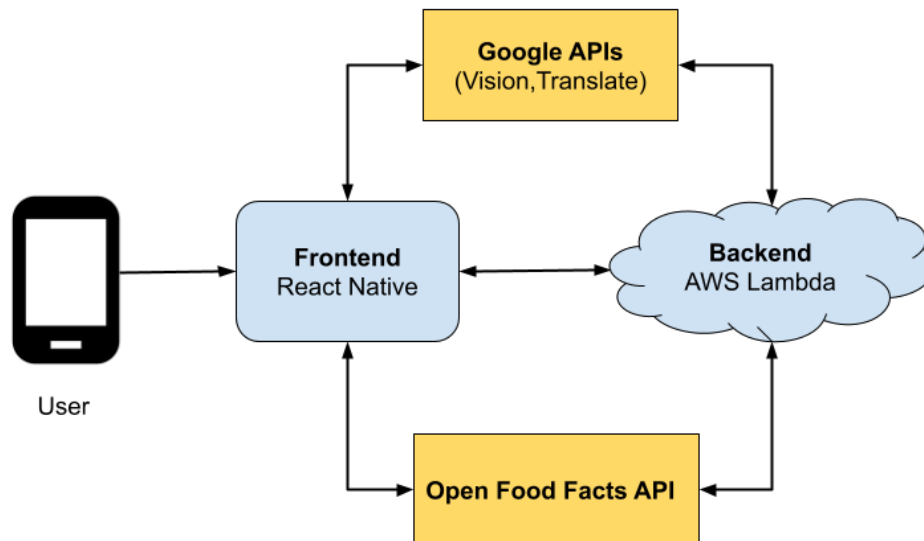
Frontend
We will be using React Native for the frontend development of our system. It will be used to create the UI for the Android application and will communicate with the backend and third party components using API calls.

Backend

AWS Lambda will be used for our backend development of the system. We plan to use DynamoDB for our database, Cognito for user authentication, and any other useful AWS technologies.
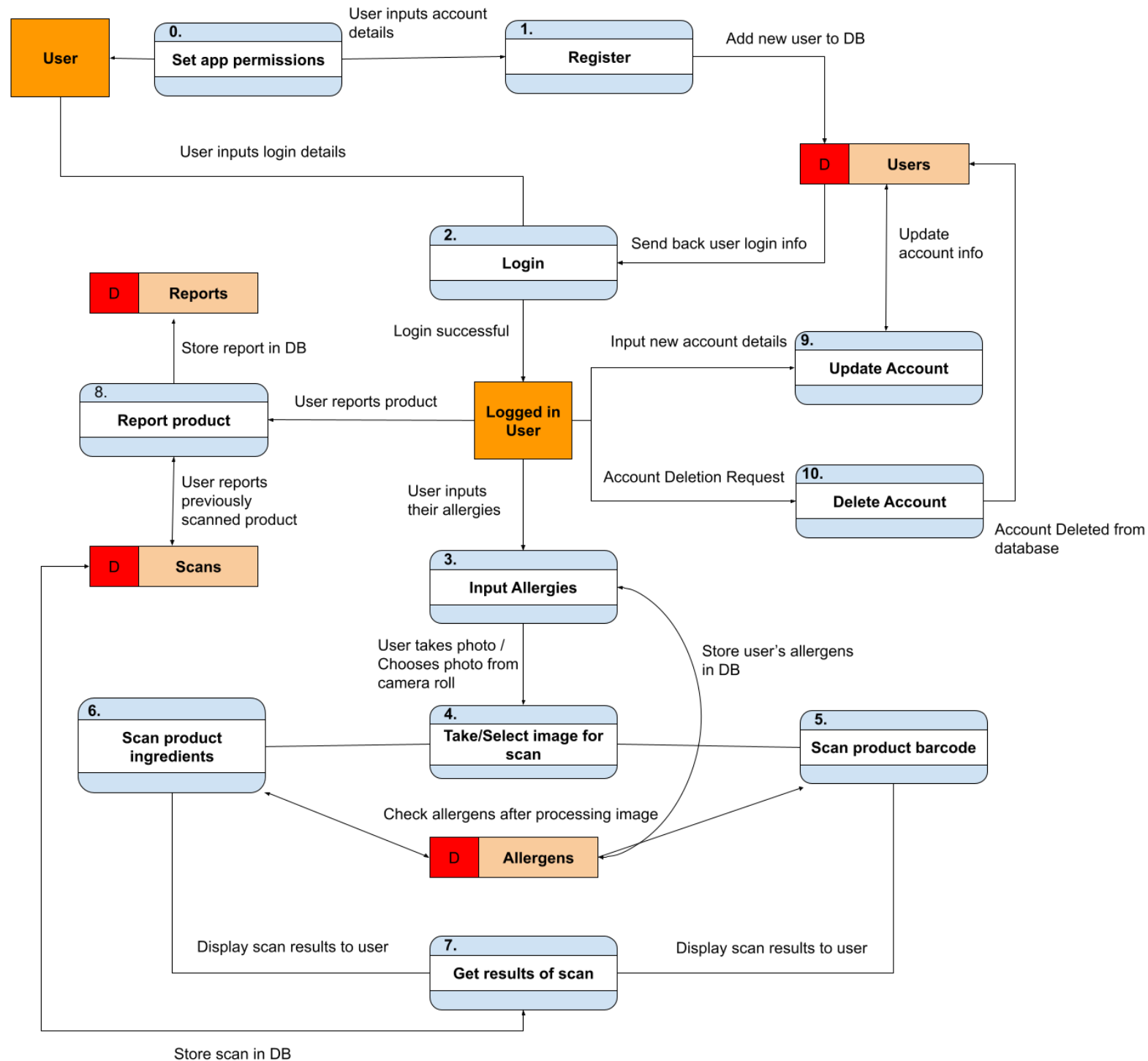
3rd Party Components
We plan to make use of the following 3rd party components:

- Open Food Facts API - to identify a product from the barcode.
- Google Cloud Vision API - potentially for OCR.
- Google Translate API - to translate ingredients text from a foreign language to English.
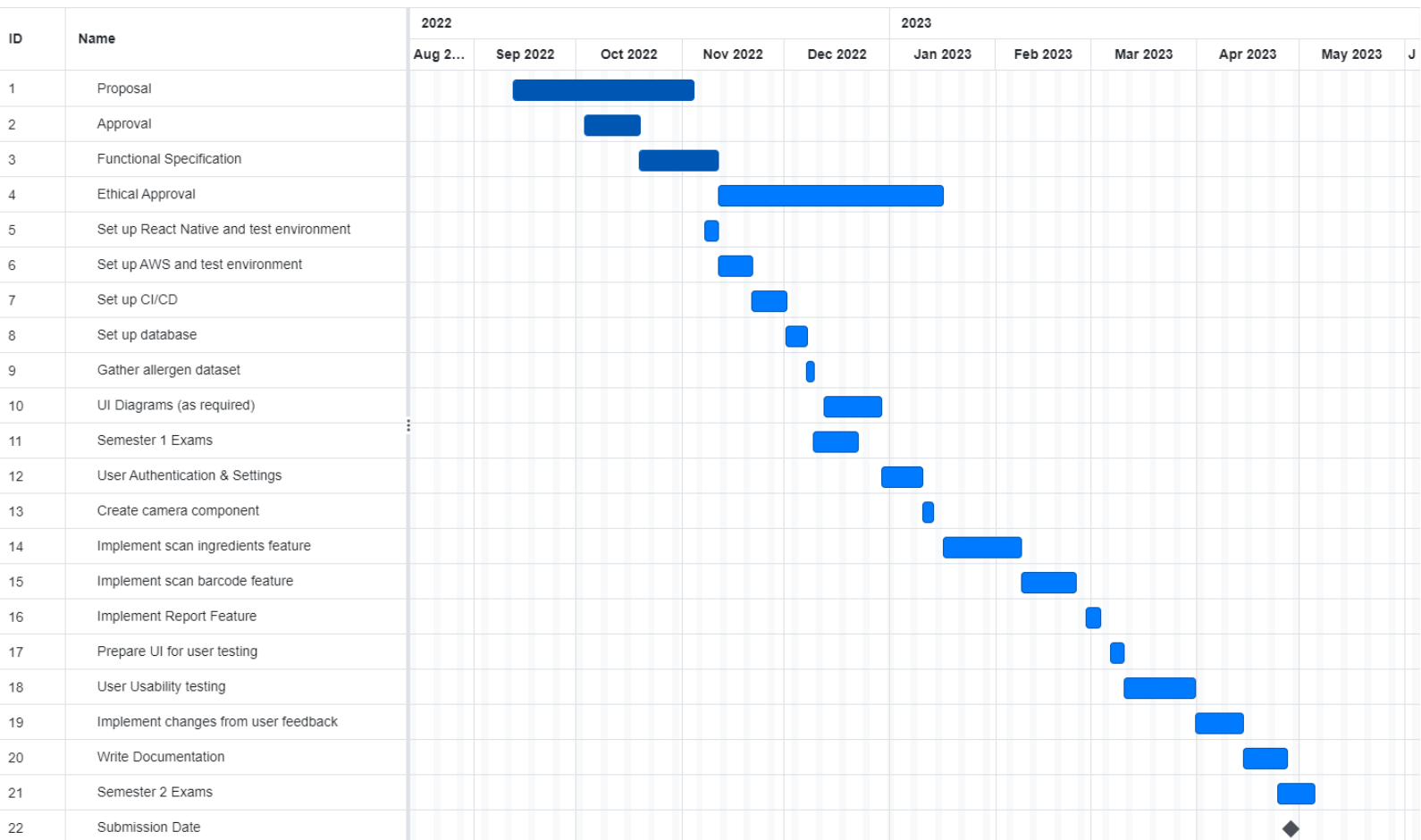
5. High-Level Design

Below is a data flow diagram which displays how the system will work.

6. Preliminary Schedule

Below is a GANTT chart that displays our preliminary schedule for this project.

ID	Name	2022					2023					
		Aug 2...	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	J
1	Proposal											
2	Approval											
3	Functional Specification											
4	Ethical Approval											
5	Set up React Native and test environment											
6	Set up AWS and test environment											
7	Set up CI/CD											
8	Set up database											
9	Gather allergen dataset											
10	UI Diagrams (as required)											
11	Semester 1 Exams											
12	User Authentication & Settings											
13	Create camera component											
14	Implement scan ingredients feature											
15	Implement scan barcode feature											
16	Implement Report Feature											
17	Prepare UI for user testing											
18	User Usability testing											
19	Implement changes from user feedback											
20	Write Documentation											
21	Semester 2 Exams											
22	Submission Date											

7. Appendices

Below are links to the documentation of some of the tools that we plan to use for this project.

[1] [Open Food Facts](#)
[2] [Google Translate API](#)
[3] [Google Vision API](#)
[4] [VisionCamera](#)
[5] [React Native](#)
[6] [AWS Lambda](#)
[7] [JetBrains Code With Me](#)
[8] [Visual Studio Code's LiveShare](#)
[9] [DynamoDB](#)
[10] [FSAI](#)
[11] [InformAll](#)
[12] [FARE](#)