Qassim University جامعة القصيم

2024

CS383 Group Project

SOFTWARE DESIGN DOCUMENT (SDD)

for AllerGuard app

version 1.0

Prepared by Group G2

Contents

1. Introduction 3-5
1.1. Purpose 3
1.2. Scope 3
1.3. References 4
1.4. Structure 5
2. System Overview 6
3. System Architecture and Components Design 7-12
3.1. Architecture Description. 7-8
3.2. Component Decomposition Description 8
3.3. Detail Component Description 9-10
3.4. Design Rationale 10-12
4. Data Design 13-16
4.1. Database Description 13-14
4.2. Data Structure 14
4.3. Data-flow Diagram (DFD) 14-16
5. Design Details 17-21
5.1. Class Diagram 17
5.2. State Diagram 18
5.3. Activity Diagram 19
5.4. Sequence Diagram 20-21
6. Human Interface Design 22-26
6.1. Overview of the User Interface 22
6.2. Detail Design of User Interface 22-26
7. Work Section 27

1. Introduction

This document serves as a Software Design Document (SDD) for our AllerGuard app, which focuses on detecting allergens. Its purpose is to provide a detailed and comprehensive reference for the design and architecture of the software. The SDD outlines the system's components, modules, and their interactions, as well as the design principles and guidelines for implementation. It serves as a guide for developers, designers, and other stakeholders involved in the software's design and development process.

1.1. Purpose

The SDD aims to offer a thorough and complete overview of the design aspects of the software system. It covers various dimensions of the design to ensure understanding, the document ensures alignment with the requirements specified in the SRS. It acts as a bridge between the high-level requirements and the actual implementation details, providing a clear path for developers to follow.

1.2. Scope

The SDD serves as a guide for the development team, providing them with a clear understanding of how to translate the requirements outlined in the SRS into a fully functional software system. It establishes a blueprint for the development process, ensuring that the design aligns with the specified goals and objectives of the software project. The scope is broad, aiming to cover all relevant dimensions of the software design to facilitate successful implementation.

1.3. References

To enhance the comprehension of this SDD document, it is advisable to refer to the following sources:

[1] "Flutter Documentation." Flutter, https://docs.flutter.dev

[2] "Why a Multi-function iPaaS is the Future of APIs." Software AG, www.softwareag.com/en_corporate/resources/api/wp/multi-function-ipaas.html?utm_source=google&utm_medium=cpc&utm_campaign=aim_api-intg&utm_region=hq&utm_subcampaign=stg-1&utm_content=stg.

[3] "ER Diagrams." Lucidchart, www.lucidchart.com/pages/er-diagrams#:~:text=Make%20an%20ERD-,What%20is%20an%20ER%20diagram%3F,each%20other%20within%20a%20system.

[4] "رسومات تحليل النظم-4 | | Data flow diagram DFD and context." YouTube, uploaded by حياة عظيم, 25 May 2022, https://www.youtube.com/kZspaeZ3o7Y&t=1s.

[5] "How to create a Context-level Data Flow Diagram (DFD)." YouTube, uploaded by Degan Kettles, 30 June 2020, youtu.be/ZB2CcVXzWgk.

[6] "What is Data Flow Diagram?" Visual Paradigm, www.visual-paradigm.com/guide/data-flow-diagram/what-is-data-flow-diagram/.

[7] "Modeling Basics - Creating UML Class Models." YouTube, uploaded by Sparx Systems, 04 October 2017, youtu.be/Iw3FjQ-qxt8.

[8] "Class Diagram - Step by Step Guide with Example." YouTube, uploaded by Master2Teach, 24 April 2020, youtu.be/iLsJ0Ix_dho.

[9] "UML Class Diagrams." YouTube, uploaded by Lucid Software, 11 August 2023, youtu.be/6XrL5jXmTwM.

[10] "1.3.7 – UML State Diagram - Object-Oriented Design." YouTube, uploaded by Le Hoang Ha, 12 November 2020, youtu.be/qICdYjJA-Ps.

[11] "Software Engineering | C5 - L13 | State machine models." YouTube, uploaded by Open Courses-المقررات الحرة,
25 April 2016, youtu.be/w6pRlFeXSzs.

[12] "How to Make a UML Sequence Diagram." YouTube, uploaded by Lucid Software, 27 August 2018, youtu.be/pCK6prSq8aw.

[13] "Sequence Diagram." Visual Paradigm, www.visual-paradigm.com/learning/handbooks/software-design-handbook/sequence-diagram.jsp.

1.4. Structure

The SDD document is organized into distinct chapters and sections, each serving a specific purpose and contributing to the overall understanding of the software desgin.
In the next section, the System Overview, we will describe the software process activity model with reasons.

Following the System Overview, the System Architecture and Components Design which provids architecture description ,component decomposition description, detail component description and design rationale.

The Data Design section It encompasses a detailed exploration of the database, elucidating its structure, the intricacies of data representation, and the flow of information within the system.

The Design Details section, we employ various UML diagrams to provide a comprehensive view of the software system's, they are state diagrams, class diagrams, activity diagrams and sequence diagrams to describe the design of a software system, reflecting the main requirements .

Finally,the human interface design encompasses the visual, interactive, and informational aspects that collectively contribute to a user-friendly and efficient system.

2. System Overview

The AllerGuard app is designed to assist individuals with food allergies or intolerance in quickly identifying allergen-free products, promoting well-being and saving time. People with food allergies often spend significant time searching for products that are safe for consumption and provide detailed ingredient information. The app addresses this challenge by offering a user-friendly interface that simplifies the process of finding allergen-free options.

For the development of the AllerGuard app, we have chosen to adopt the Waterfall methodology. This approach ensures a systematic and well-documented process, enabling accurate identification of allergen-free products and meeting the needs of individuals with food allergies. The methodology's emphasis on documentation and traceability promotes reliability and issue resolution. Clear milestones and planning facilitate timely delivery, benefiting users' time-saving and well-being. Additionally, the Waterfall methodology ensures compliance with regulations or standards if required.

Overall, the Waterfall methodology is a suitable choice for the development of the AllerGuard app. Its systematic process, emphasis on documentation, milestone-driven planning, and potential for regulatory compliance align well with the goals and requirements of the project.

3. System Architecture and Components Design

3.1. Architecture Description

The AllerGuard app follows a modern and scalable architecture to provide a seamless user experience. The app consists of three main components: the mobile application, a server-side component, and external services integration.

1. Mobile Application:

The mobile application is developed using the Flutter framework, which allows for a single codebase to be used for both iOS and Android platforms. This approach ensures compatibility across a wide range of devices, providing convenience for our users. The app offers a user-friendly interface that allows users to scan product barcodes using their device's camera or manually search for specific products. The scanned barcode or product search query is then sent to the server-side component for processing.

2. Server-Side Component:

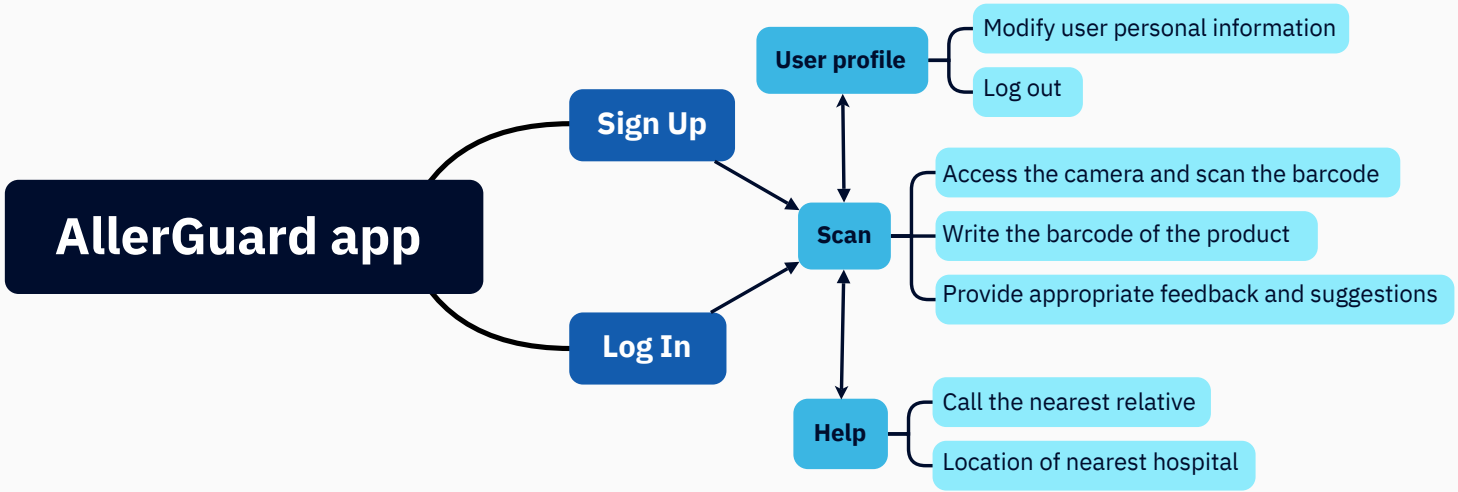
The server-side component acts as the backbone of the AllerGuard app. It handles the business logic and data management tasks related to allergen detection and recommendation.

Key functionalities of the server-side component include processing the scanned barcode or product search query received from the mobile application, retrieving product information from a database or external sources, and performing allergen detection on the retrieved product data. The server-side component utilizes a database to store product information, including allergen data, for efficient retrieval and processing.

3. External Services Integration:
To enhance the allergen detection capabilities and improve the accuracy of recommendations, the AllerGuard app integrates with external services and APIs. This integration includes accessing allergen databases or APIs that provide comprehensive information about allergens present in various food products. The server-side component utilizes these external services to cross-reference the retrieved product information and allergen data, enabling accurate allergen detection and recommendation generation. Additionally, the app may integrate with barcode scanning libraries or APIs to facilitate barcode scanning functionality.

The system architecture of the AllerGuard app ensures a seamless and reliable user experience. Users can easily scan product barcodes or search for specific products, and the app provides real-time information about allergen presence in those products, along with alternative recommendations. The server-side component handles the processing and data management tasks, while external services integration enhances the accuracy and completeness of allergen information.

3.2. Component Decomposition Description



3.3. Detail Component Description

Product Scan Component:

Users can effortlessly scan product barcodes to inspect ingredients and identify potential allergens. If allergens are detected, safe alternatives are presented. If no allergens are found, users are informed that the product is safe for consumption.

Allergy Assessment Component:

This component empowers users to update and review their allergy information. Featuring checkboxes for selecting specific allergens and capturing the time of the last allergy attack, it enhances the accuracy of subsequent product scans.

User Profile Component:

Allowing users to manage and customize their personal information, the User Profile component facilitates updates to passwords and other settings, ensuring a personalized experience.

LogIn Component:

For returning users, the Login Component streamlines the entry process. Users can log in by entering their email/phone number and password on the Login Page. The "Remember Me" feature provides a convenient option for saving login credentials for subsequent sessions.

Registration Component:

The Registration Component serves as the gateway for new users, providing a smooth onboarding experience. Users navigate from the Start Page (featuring the app's logo) to the Login/Sign Up page.

From there, they seamlessly transition to the Create Account page, where they input their full name, valid email, phone number, and a strong password. After successful submission, users proceed to the Enter Code page for phone number activation. The onboarding journey includes adding emergency contacts and answering allergy assessment questions, creating a comprehensive user profile.

3.4. Design Rationale

The AllerGuard app is meticulously crafted with a user-centric focus, aiming to provide a seamless, secure, and supportive experience for individuals navigating food allergies or intolerances. Every aspect of the application is thoughtfully designed to empower users in detecting and managing potential allergens in products while ensuring swift access to emergency support.

The app is tailored for iOS and Android devices, acknowledging the prevalence of smartphones and tablets in users' daily lives.

The emphasis on hardware specifications, including RAM, storage capacity, and processing power, ensures optimal performance. Given its dependency on internet connectivity for accessing allergen information and external communication, the app prioritizes a stable internet connection. Furthermore, the integration of the device's camera for barcode scanning underscores the need for an environment that supports camera functionality.

Active user engagement is pivotal to the app's functionality. Users are encouraged to input and update their allergy information, fostering a dynamic and accurate allergen detection system. The app synchronizes seamlessly with users' geospatial and temporal data, enhancing the accuracy of information. User feedback holds significant weight, driving continuous improvements to the app's effectiveness.

The commitment to accessibility is evident in compatibility efforts across various devices and operating environments. The user interface is meticulously designed for clarity, simplicity, and ease of use. Custom input fields and a search function enhance the user experience, facilitating effortless input of product barcodes.

User authentication is a key focus, with the sign-up and login functions prioritizing secure access. Verification codes add an extra layer of security during account creation. The user profile page enables personal information modification, ensuring the app delivers accurate results. The scanning function utilizes the device's camera to capture product barcodes, providing real-time feedback based on the user's allergen information.

Additionally, the app incorporates features for emergency assistance, including accessing location information, finding nearby hospitals, and making emergency calls.

The user interface is designed to offer a seamless and user-friendly experience, presenting information in a clear and easily understandable manner. Compatibility with major operating systems, integration with SQLite database, and chatbot functionality contribute to a robust and reliable interface. Secure data transmission is ensured through HTTPS, while email support and push notifications facilitate effective communication.

Performance requirements dictate a rapid app launch and quick interactions within the app, aligning with user expectations for a responsive experience. Safety requirements prioritize accurate scanning for allergen information, crucial for users with severe allergies. Stringent security measures, including strict data authorization, are implemented to safeguard user data and maintain trust.

Essential hardware components, such as camera functionality, adequate RAM, stable internet, GPS capabilities, and emergency call features, ensure the app's reliability. A decent battery life is considered essential to provide users with uninterrupted usage.

In conclusion, the AllerGuard app is more than a technological tool; it's a companion for individuals managing food allergies, offering a robust, user-friendly, and secure platform that empowers users to navigate their unique dietary needs with confidence and convenience.

4. Data Design

4.1. Database Description

In the AllerGuard database, it has three tables (User, Hospital, Product) that contains attributes and the relationships between them.

The first table contains user information (User_id, Name, Password, Email, Phone_number, Relative_number, Region, Allergy Assessment) and the Allergy Assessment it has three quistions to ask the user. Also, the table contains USERID which is the Primary key.

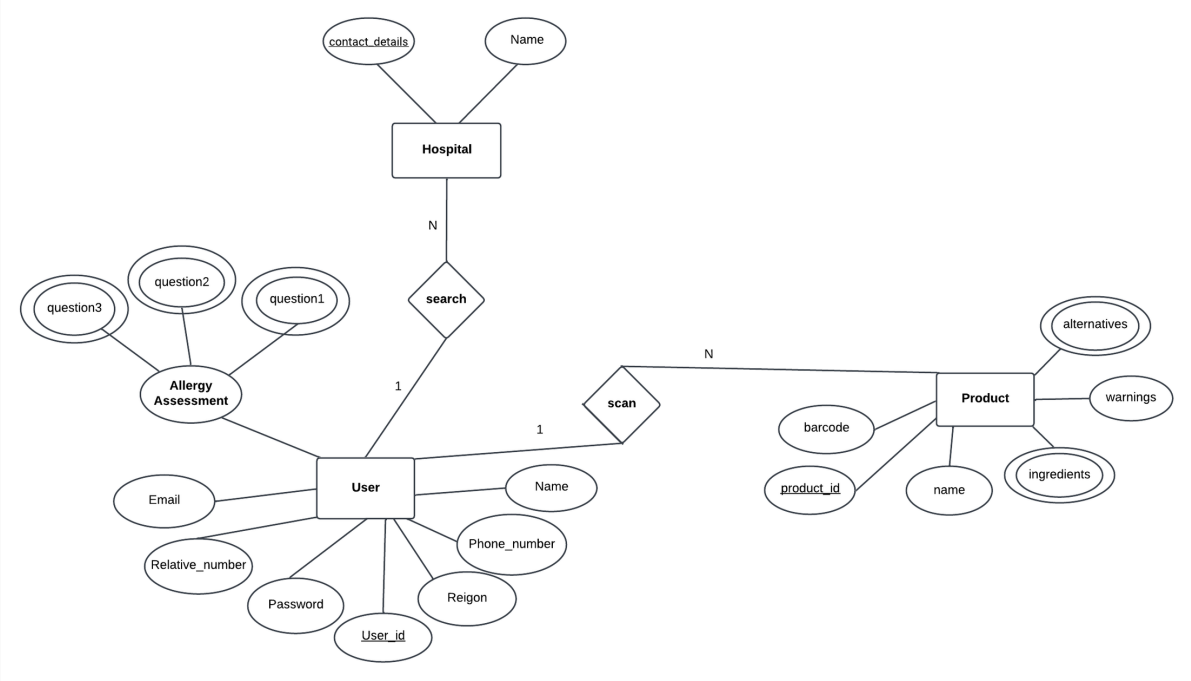
The Hospital table will contain (contact_details, Name)
contact_details which is also a Primary key for The Hospital table and a foreign key for
Name.

the third table is Product contains (Product_id, barcode, name, ingredients, warnings, alternatives) the Product_id contains the Product number and it's also the Primary key for the Product table and the foreign key for UserID, the attributes ingredients, and alternatives it has a double circle that maining multi-valued attribute.

The method of operations is in the following sequence. First, the user enters his personal data, the most important of which is his allergen, so that when he takes a scan of the product, the program and the system can identify it. This is in the first table. The second step is that the user scans the product's barcode or the list of ingredients, and the system will recognize it and give warnings. For the user then, this step is in the second table and the final step.

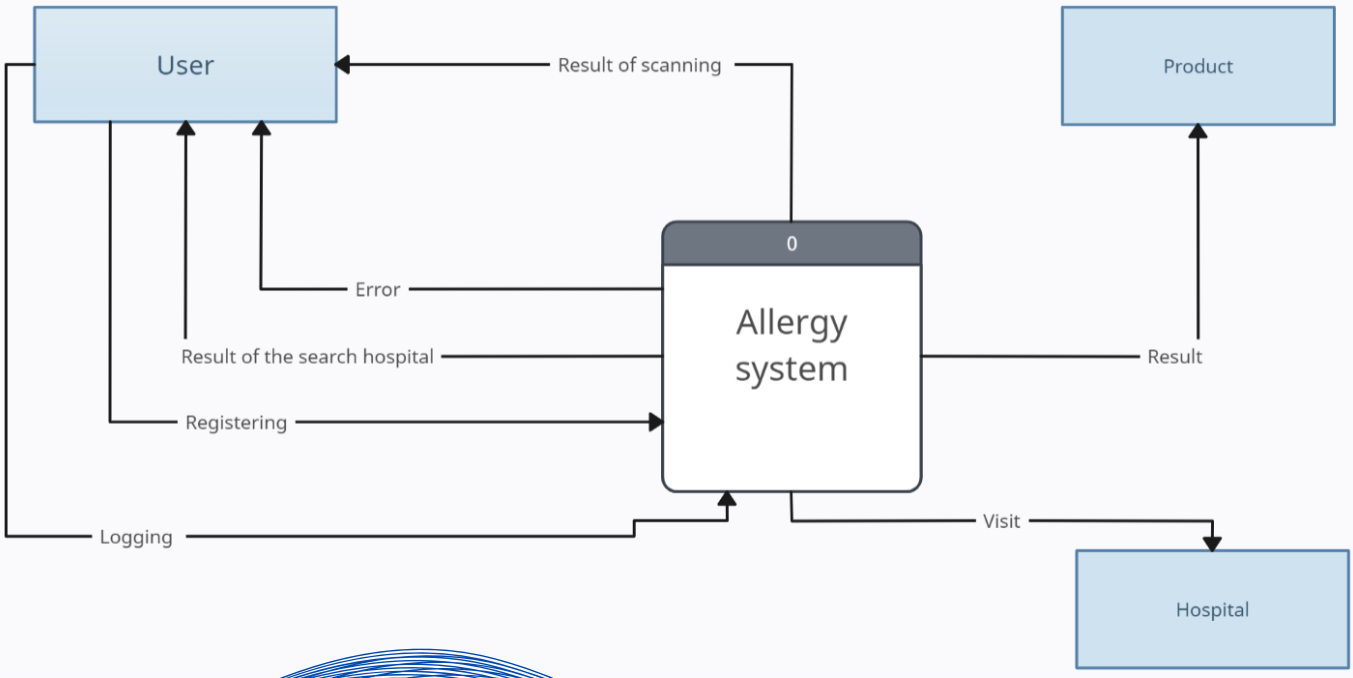
The program allows the user to search for the nearest hospital in the event that he is exposed to allergy symptoms in order to treat them.

4.2. Data Structure

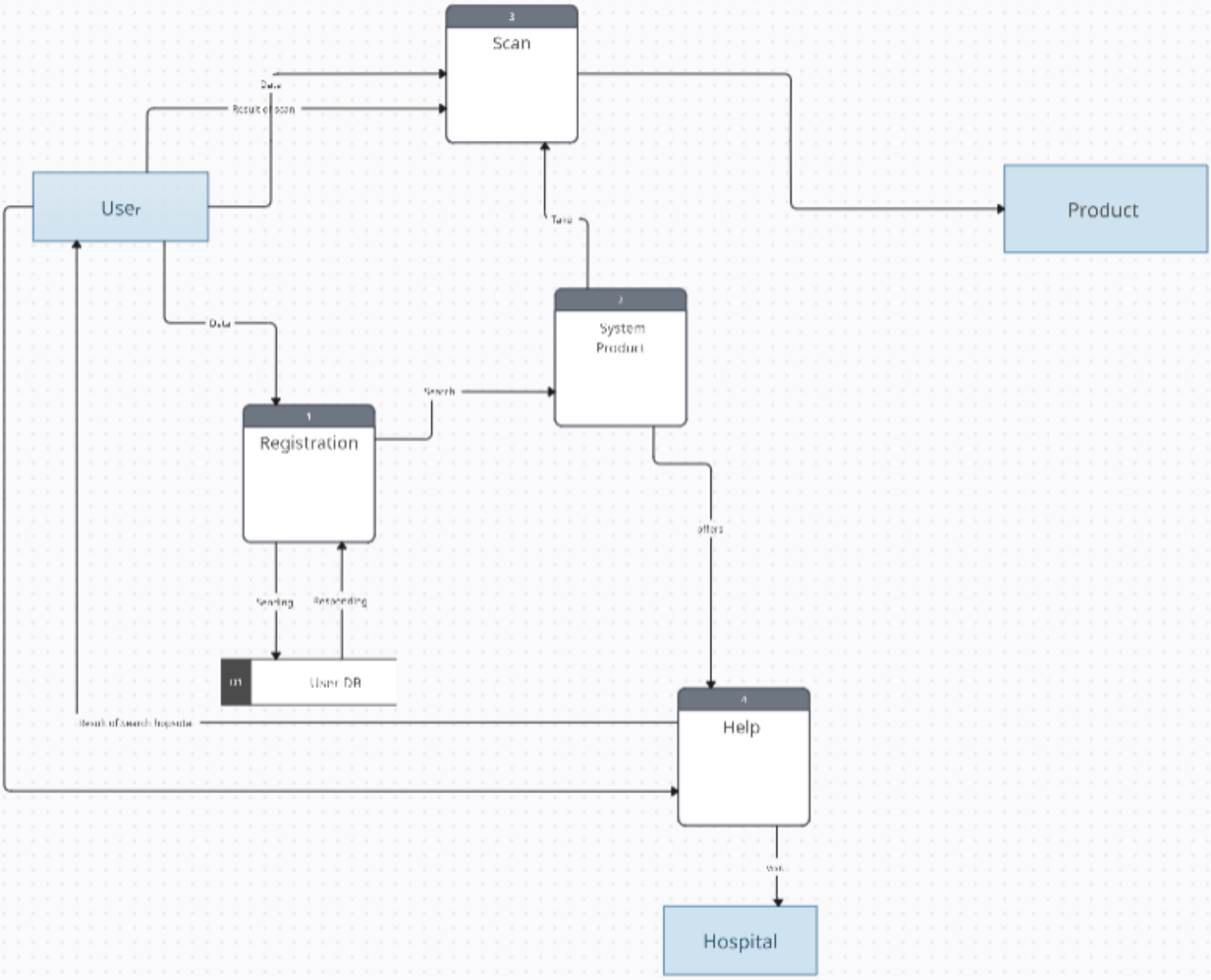


4.3. Data-flow Diagram (DFD)

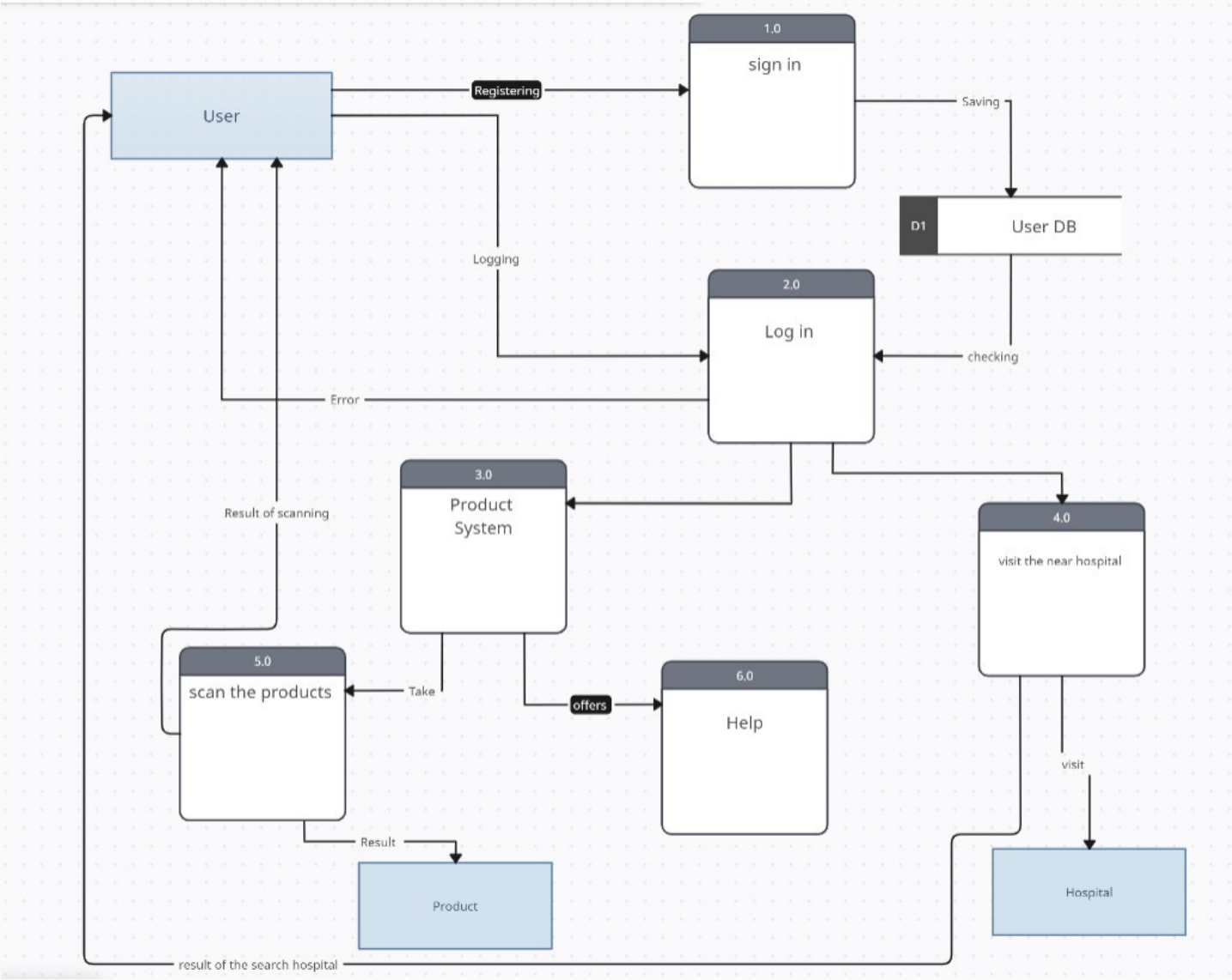
Level 0:



Level 1:

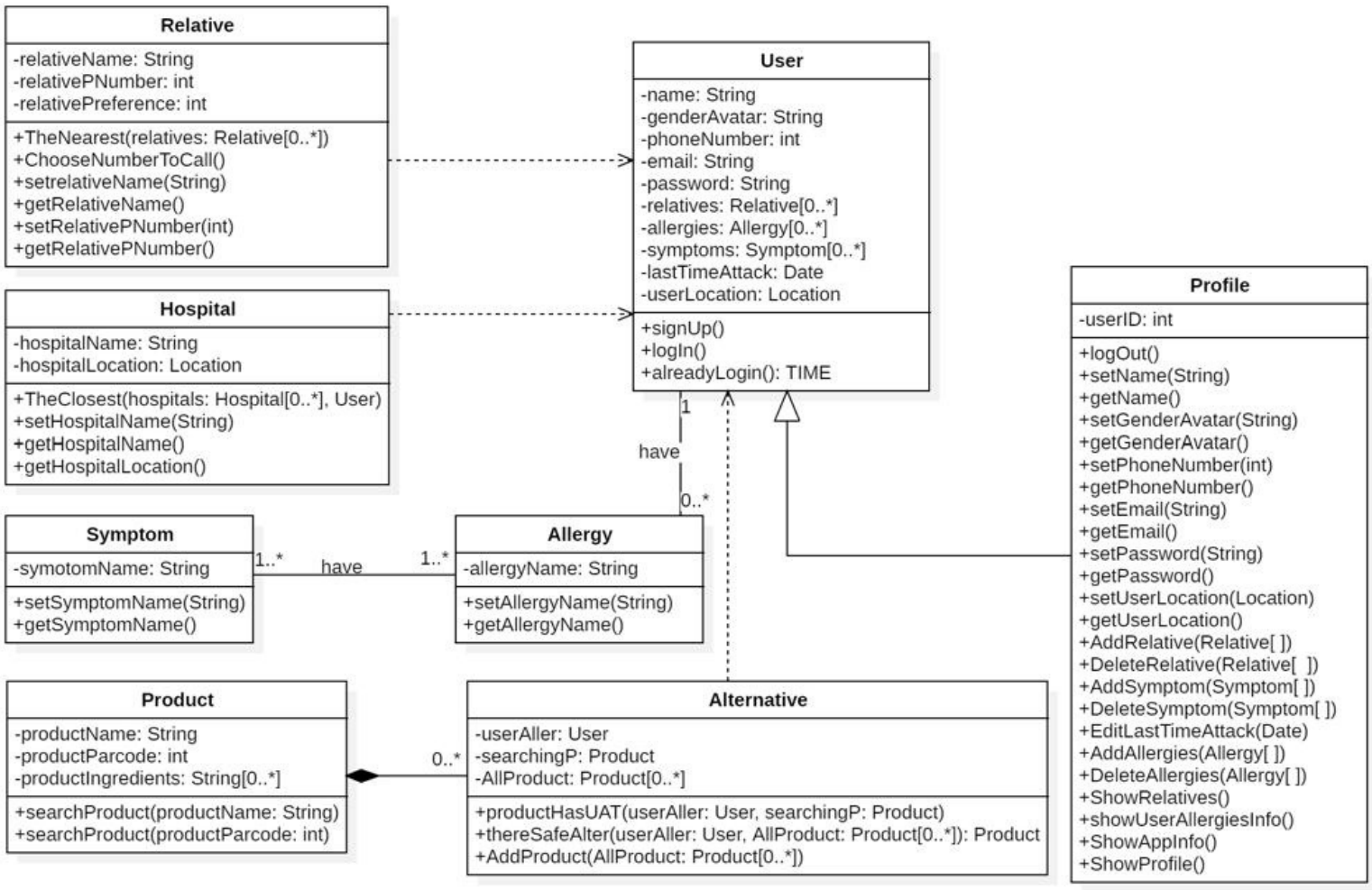

3
Scan
Data
Result of scan
User
Product
Data
2
System
Product
Search
1
Registration
offers
Sending
Responding
D1
User DB
Result of search hospitals
4
Help
Visit
Hospital

Level 2:

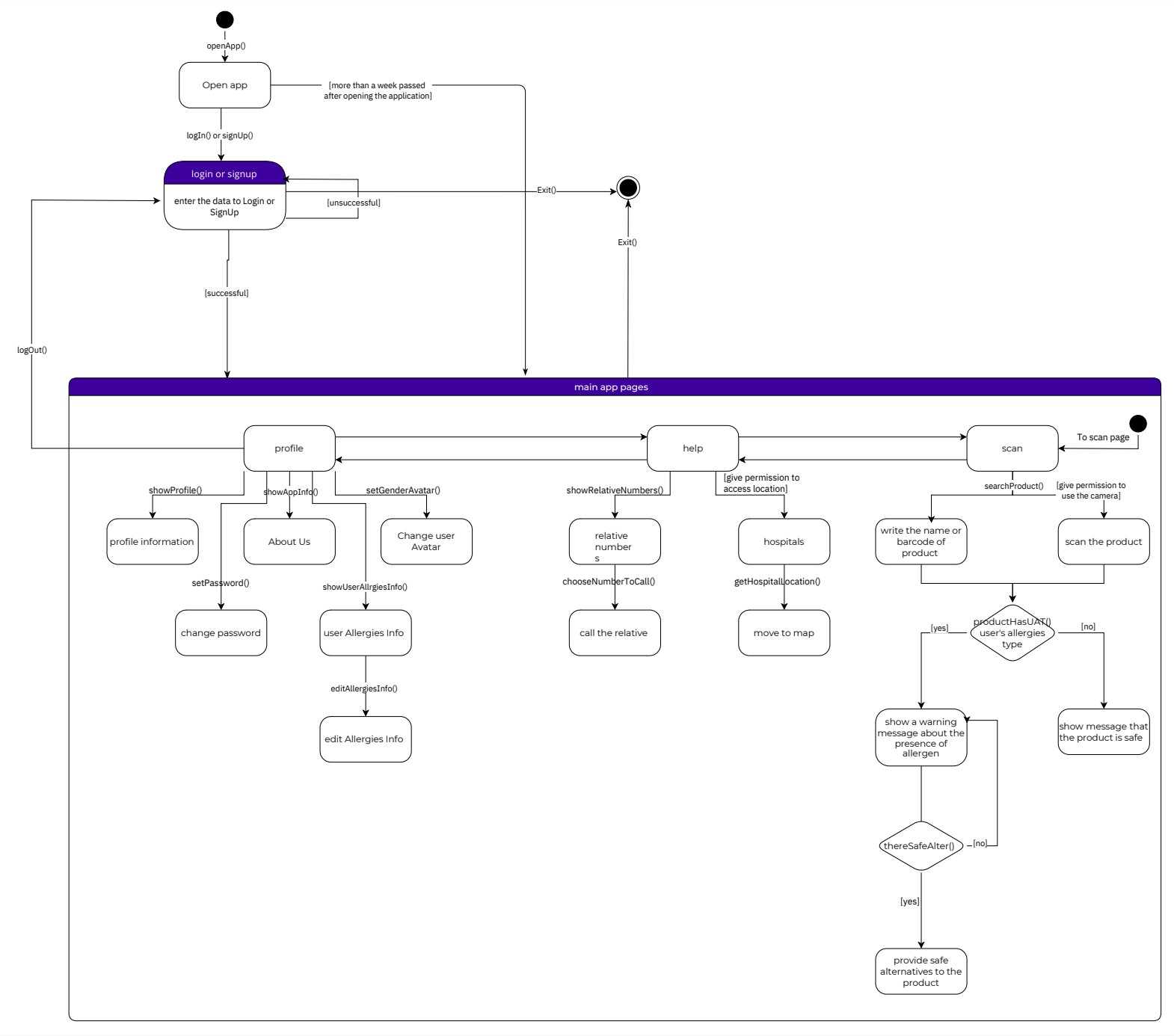

User
Registering
1.0
sign in
Saving
D1
User DB
Logging
2.0
Log in
checking
Error
3.0
Product System
Result of scanning
4.0
visit the near hospital
5.0
scan the products
Take
offers
6.0
Help
visit
Result
Product
Hospital
result of the search hospital

5. Design Details

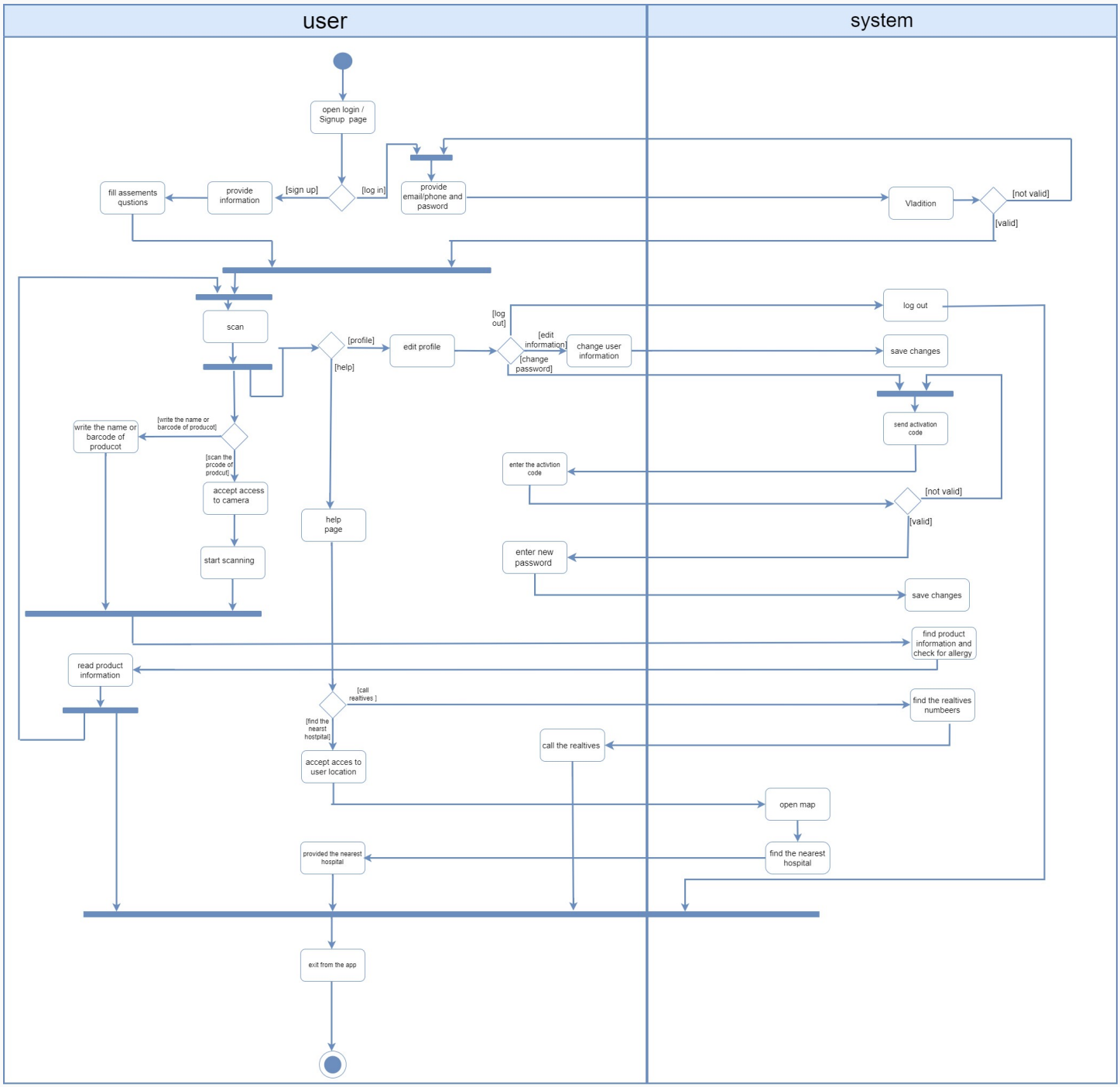
5.1. Class Diagram



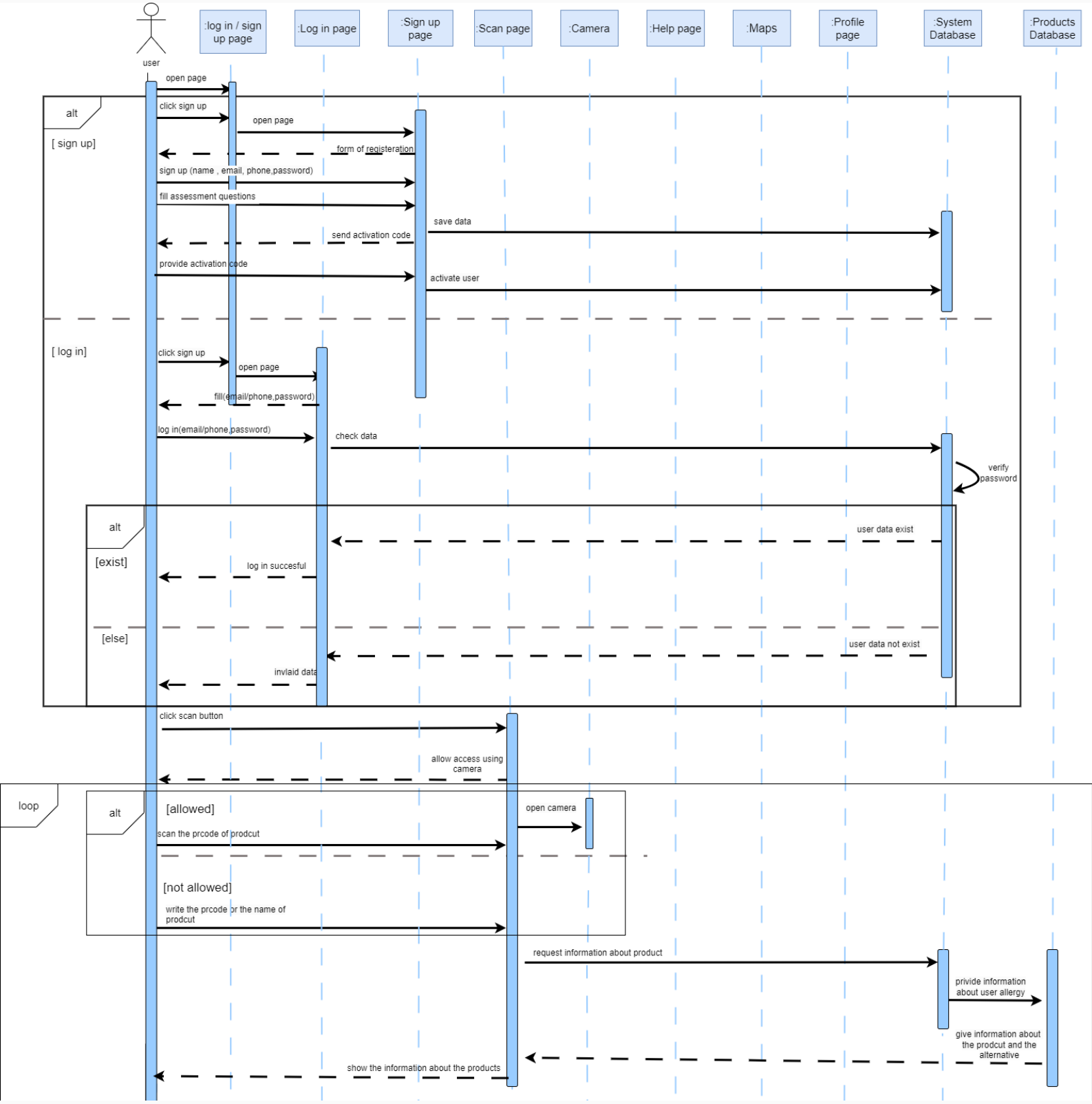
5.2. State Diagram

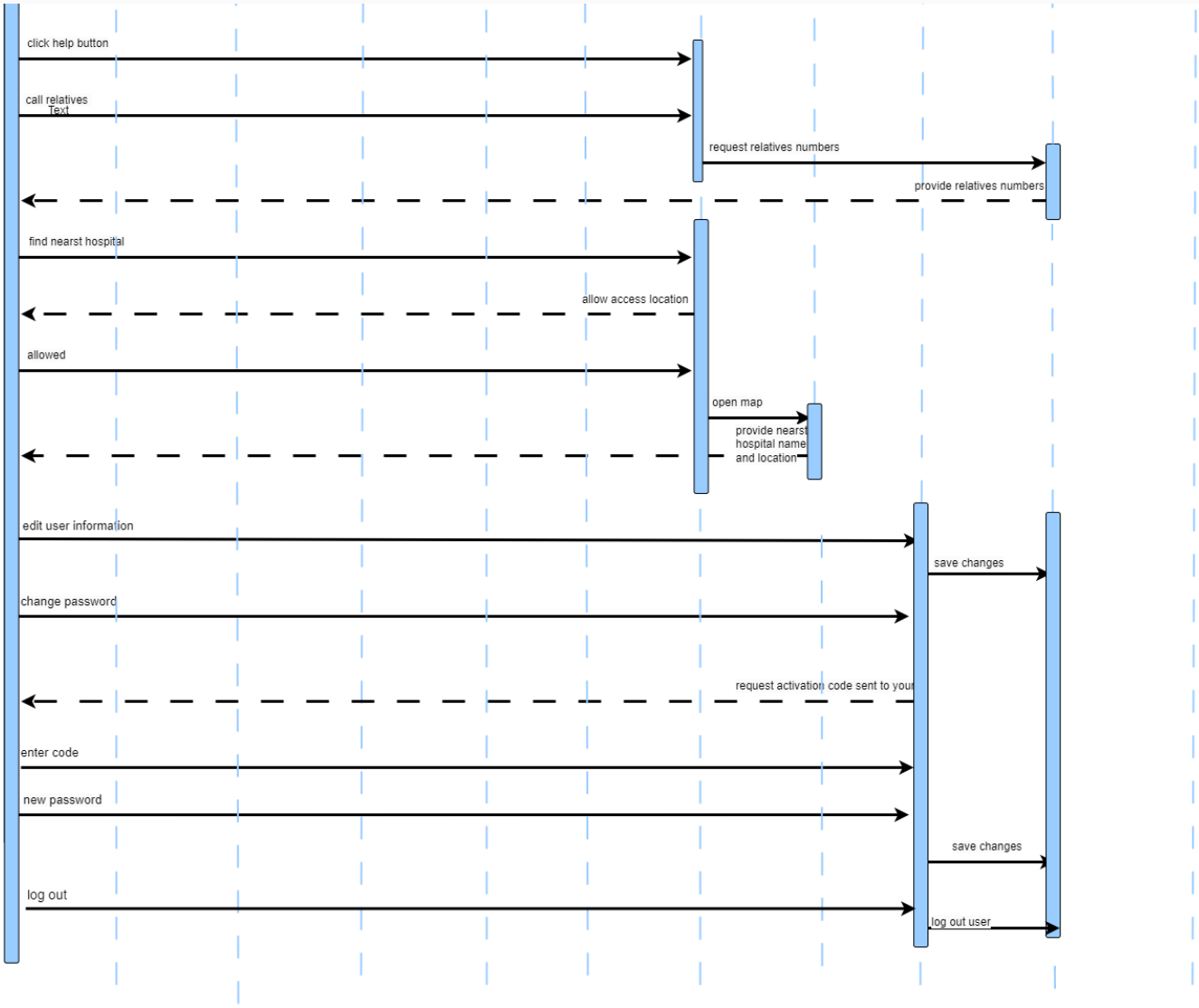


5.3. Activity Diagram



5.4. Sequence Diagram




click help button
call relatives
Text
request relatives numbers
provide relatives numbers
find nearst hospital
allow access location
allowed
open map
provide nearst
hospital name
and location
edit user information
save changes
change password
request activation code sent to your
enter code
new password
save changes
log out
log out user

6. Human Interface Design

6.1. Overview of the User Interface

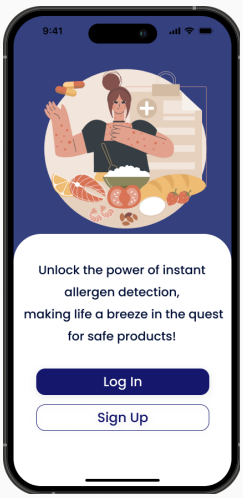
The user interface of the AllerGuard app provides a clear and intuitive design, allowing users to navigate through different pages and utilize various features like scanning, profile management, and accessing help options. Users can log in or sign up when they launch the app. The main feature is the scanning functionality, where users can scan a product's barcode to check for allergens. The app provides information about the product's allergen content and suggests alternative products if allergens are found. Users can manage their profile, including personal and allergy information, change passwords, and access additional app details. Help options include calling a relative or finding the nearest hospital. The app's interface prioritizes simplicity and ease of use for efficient allergen detection and user management.

6.2. Detail Design of User Interface

App's start page

This is the first page that appears to the users when they launch the app.

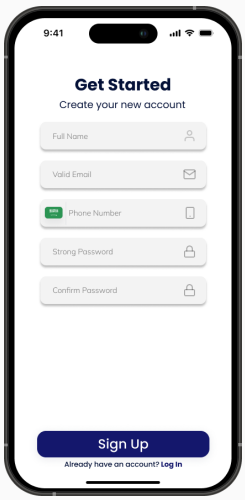
Registration page



Users can choose between the Log In option if they already have an account or the Sign Up option if they are new to the app.

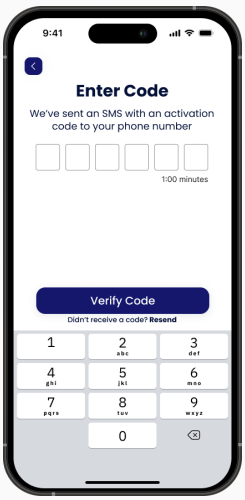
Sign Up pages

User Information



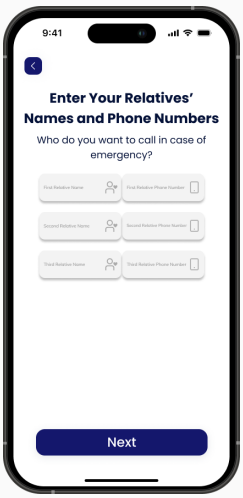
The first page of the Sign Up process has a fill-in form for the needed information (UserFullName, Email, PhoneNumber, Password, ConfirmPassword).

Activation Code



The second page of the Sign Up process prompts users to enter the activation code sent to their phoneNumber, and it has a number field.

Relatives Information

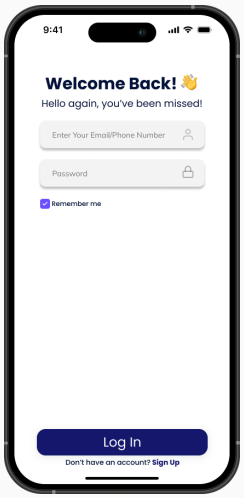


The third page of the Sign Up process asks for the names and phone numbers of the user's relatives.

Allergy Assessment

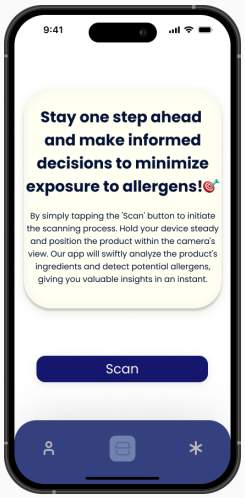
The fourth page collects answers to three assessment questions. The questions have different input types such as a drop-down menu, date field, and selection field.

Log In Page



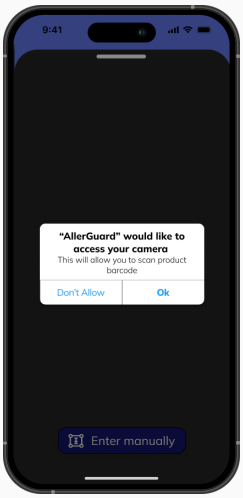
The Log In page features a form where users can enter their Email/PhoneNumber and Password. Users can also choose to remain logged in by tapping a checkbox for future sessions.

Scan Home page



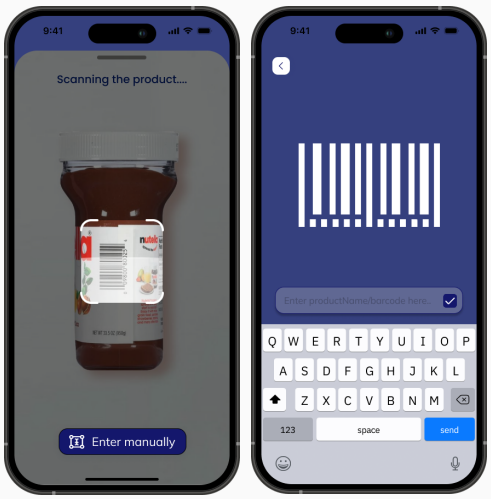
The home page where users can tap the "scan" button that initiates the scanning process.

Requesting camera acsess permission



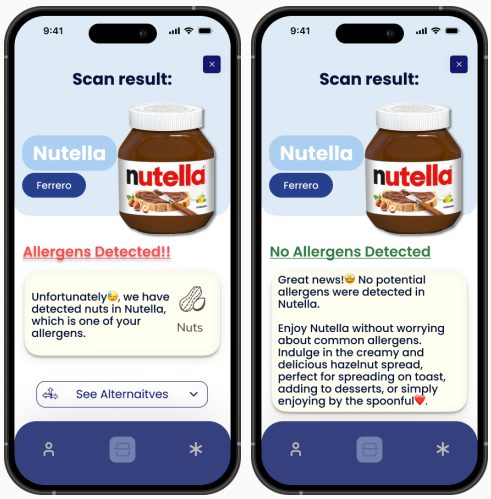
If users are new to the app, permission to access the camera is required.

Barcode Scanning



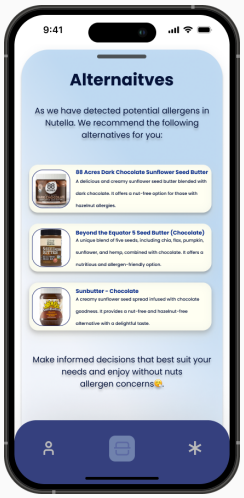
Users can scan the product's barcode either using the device's camera or by entering it manually. If users choose to enter the barcode manually, a page will appear with a text field.

Scan Result



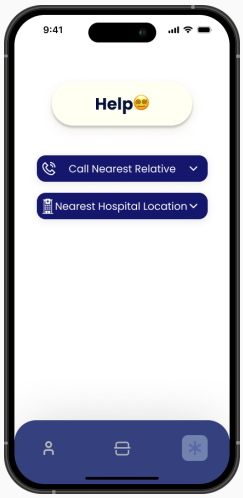
When users finish scanning the product's barcode, a "scan result" page will appear containing the product information and a message indicating whether it contains allergens or not. These are the two possible results.

Alternative Products



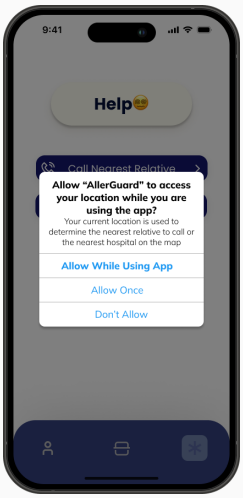
If the product does contain potential allergens, users can tap the "see alternatives" button to view alternative products without the specified allergens.

Help Page



The help page includes two options: calling the nearest relative or finding the nearest hospital location.

Requesting location permission

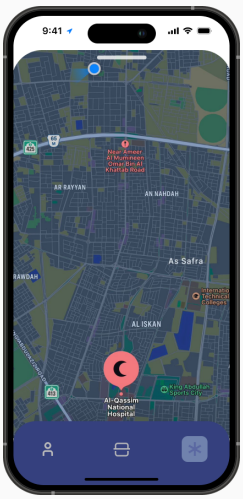


If users are new members and try to tap on either of the buttons, permission to access their location is required.

Call Nearest Relative

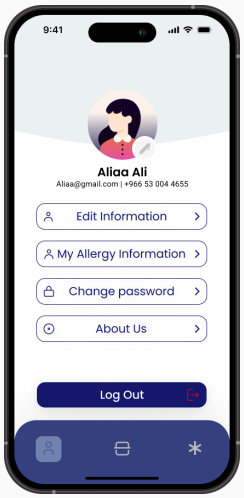
If users choose to call the nearest relative, a page will be displayed containing a list of relatives arranged according to their closeness to the user's location. And this message is displayed if users try to call one of the relatives.

Nearest Hospital



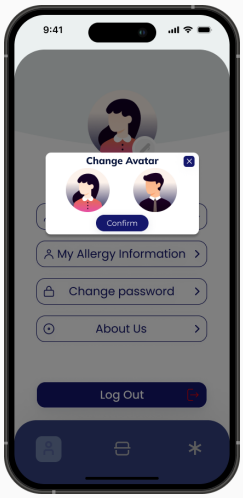
When users want to find the nearest hospital location, a map containing their location as well as the nearest location to them will be displayed.

User Profile Page



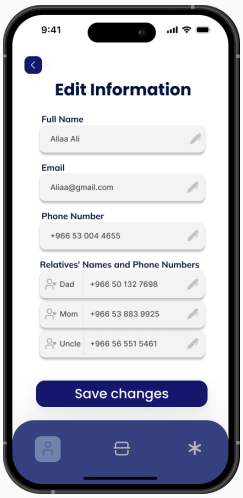
The profile page displays users' information (Name, Email, PhoneNumber) and buttons to edit user information or allergy information, change password, open the About Us page, or log out of the account.

Edit Avatar



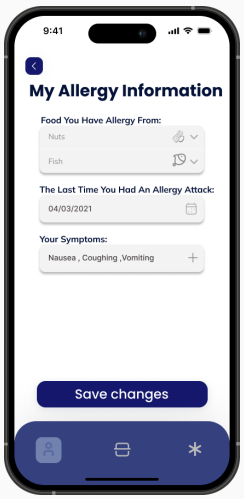
Users can change their avatar by tapping on it, which triggers a pop-up menu.

Edit Information



When users tap on the "Edit information" button, a page with editable text fields for the user's FullName, Email, PhoneNumber, Relatives' Names, and PhoneNumbers will appear.

Allergy Information

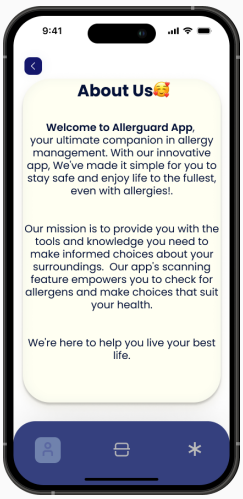


This page will be displayed if users tap on "My Allergy Information" button, and they will be able to edit their answers for the allergy assessment questions.

Change Password

The "Change Password" button initiates a process that requires a verification code sent to the user's phone number. Upon entering the correct code, users can change their password.

About Us



Tapping the "About Us" button displays a page with a welcoming message and an explanation of the app's purpose.

7 Work Section

Chapter	Student name and section they work on
Introduction	Raghad AlSuhaibani
System Overview	Aliaa AlRishan
System Architecture and Components Design	Lama AlShmali (3.1. + 3.2.) & Rafeef AlSuhaibani (3.3. + 3.4.)
Data Design	Sumayh AlHarbi (4.1. + 4.3. "context level and level2") & Rafeef AlSuhaibani (4.2.) & Amani AlHarbi (4.3. "level1")
Design Details	Raghad AlYaeesh (5.1. + 5.2.) & Raghad AlSuhaibani (5.3. + 5.4.)
Human Interface Design	Aliaa AlRishan (6.1. + 6.2.) & Raghad AlSuhaibani (6.2.)
Report design	Aliaa AlRishan