

University
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Master of Applied Computing

Internship/Project - II (COMP-8977)

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Monitoring App for Type I Diabetic Patient Record

User Manual

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Table of Contents

Overview	1
Getting Started.....	1
Login Page	3
Registration Page	4
User Onboarding Page.....	5
Homepage Screen.....	7
Navigation Menu	8
My Food Page.....	9
Food Search Page	11
Food Details Page	11
Food Cart Page.....	12
Edit Meal Page	12
Questionnaire Page	13
History Page.....	14
Trends Page	15
Profile Page.....	16

List of Figures

Figure 1 Login Page.....	3
Figure 2 Registration Page.....	4
Figure 3 Verification Alert Message.....	4
Figure 4 Email Verification Mail.....	5
Figure 5 Firebase Verification Prompt.....	5
Figure 6 User Onboarding Page - Part 1.....	6
Figure 7 User Onboarding Page - Part 2.....	6
Figure 8 Homepage.....	7
Figure 9 Navigation Menu.....	8
Figure 10 My Food Page.....	9
Figure 11 Pre-meal Glucose Reading Modal.....	9
Figure 12 Food Summary Page.....	10
Figure 13 Post-meal Blood Glucose Entry Modal.....	10
Figure 14 Food Search Page.....	11
Figure 15 Food Details Page.....	11
Figure 16 Food Cart Page.....	12
Figure 17 Edit Meal Page.....	13
Figure 18 Questionnaire after post-meal glucose entry.....	13
Figure 19 Questionnaire Page.....	14
Figure 20 Questionnaire Feedback.....	14
Figure 21 History Page.....	15
Figure 22 Trends Page.....	15
Figure 23 Profile Page - Part 1.....	16
Figure 24 Profile Page - Part 2.....	16

Overview

The Monitoring App for Type I Diabetic Patient Record tackles the challenges of Type I diabetes management through an integrated platform. It combines comprehensive meal logging, personalized insulin dosage calculations, and adaptive user interactions. The app aims to enhance accuracy and ease of diabetes management by automating food intake recording and recommending insulin dosages based on individualized carbohydrate-to-insulin ratios. Utilizing advanced algorithms and real-time feedback, the app improves user experience and reduces the cognitive burden of daily diabetes care. The project focuses on creating a user-friendly tool to empower patients and improve their quality of life.

The app is designed to support individuals managing Type I diabetes by automating food intake recording and insulin dosage estimation using precise carbohydrate calculations. It features an intuitive user interface that streamlines meal logging, facilitates real-time carbohydrate monitoring, and provides personalized insulin dosage recommendations. Enhanced features include the ability to add multiple entries per food intake session for detailed tracking and interactive questionnaires for immediate user feedback. The primary objective is to empower patients with a reliable tool for independent diabetes management, improving their quality of life. Additionally, the app offers comprehensive data analysis and reporting capabilities for sharing insights with healthcare providers for informed medical decisions.

Getting Started

To start the Type I Diabetes App project, follow these steps:

1. Install the following tools:
 - a. MongoDB Community Server
 - b. Any IDE of preference for Web Development (VSCode/WebStorm preferred)
 - c. NodeJS
2. Obtain an API Key from USDA by navigating to the following URL:
<https://fdc.nal.usda.gov/api-key-signup.html>
3. Create a new application in your Firebase Console and add the following projects to your Firebase Console:
 - a. **Firestore Database:** Create a default database with 2 collections –
 - i. userProfile
 - ii. users
 - b. **Firebase Authentication:** Enable Email/Password based login
4. Clone the project repository from GitHub: [GitHub Repository](#)

5. Navigate to the backend directory and install the necessary dependencies:

```
cd DiabeticApp-backend-master  
npm install
```

6. Create a .env file in the “DiabeticApp-backend-master” directory and populate it with the following content:

```
PORT = 8082  
URI = mongodb://localhost:27017
```

7. Navigate to the frontend directory and install the necessary dependencies:

```
cd Frontend  
yarn install
```

8. Create a .env file in the Frontend directory and populate it with the following content:

```
API_KEY = <API_Key_from_USDA>  
FIREBASE_API_KEY = <Firebase_API_Key>  
BASE_URL = http://localhost:8082
```

9. Navigate to Project Settings of the Firebase Console in your created application and obtain the NPM Firebase SDK setup code.

10. Navigate to the config.js file in the “Frontend” directory and paste the SDK code. The code should look similar to the below code snippet:

```
// Import the functions you need from the SDKs you need  
import firebase from "firebase/compat/app";  
import "firebase/compat/auth";  
import "firebase/compat/firestore";  
import { FIREBASE_API_KEY } from "@env"  
  
const firebaseConfig = {  
  apiKey: FIREBASE_API_KEY,  
  authDomain: "",  
  databaseURL: "",  
  projectId: "",  
  storageBucket: "",  
  messagingSenderId: "",  
  appId: "",  
  measurementId: ""  
};
```

```
// Initialize Firebase
if (!firebase.apps.length) {
  firebase.initializeApp(firebaseConfig);
}

export { firebase };
```

11. Start the backend server:

```
npm run dev
```

12. Start the frontend Application:

```
npx expo start
```

13. Access the application by navigating to <http://localhost:8081>

Login Page

The login page is the first page that you see upon loading the application:

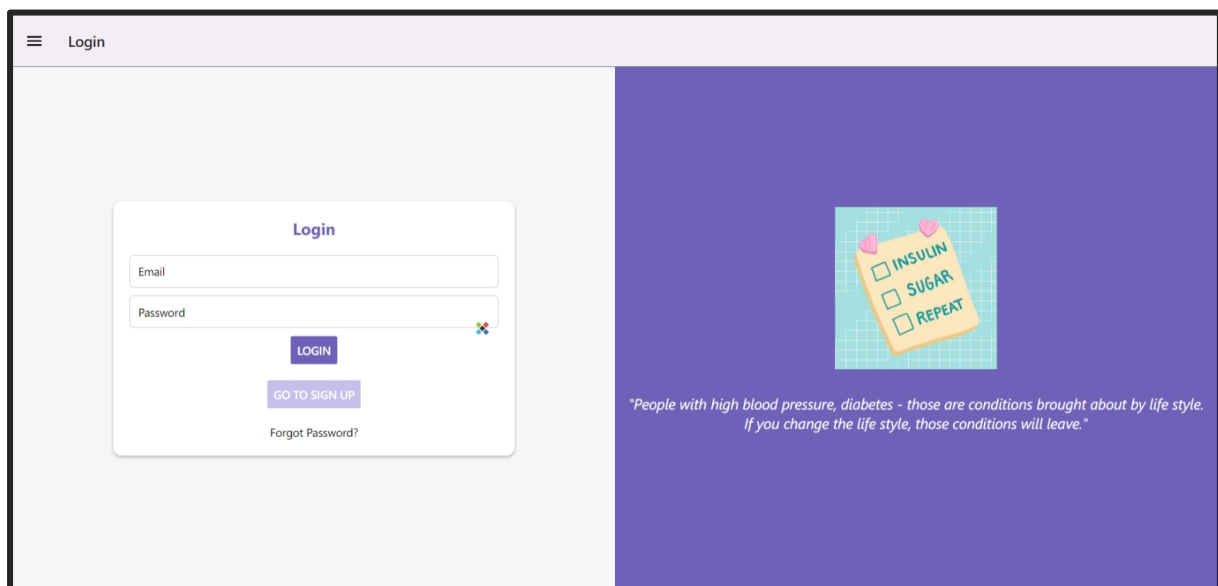


Figure 1 Login Page

If you already have an account registered on the application, enter in the registered email and password to log into the application by clicking on the “LOGIN” button. Otherwise, you can click on the “GO TO SIGN UP” button to register a new account.

If you forget the password to your account, you can reset your password by clicking on the “Forgot Password?” link.



Registration Page

Enter in the following details to create an account on the application and click on the “SIGN UP” button:

- i. First Name
- ii. Last Name
- iii. Email
- iv. Password

Figure 2 Registration Page

Upon signing up you receive an alert to check your email to verify your account.

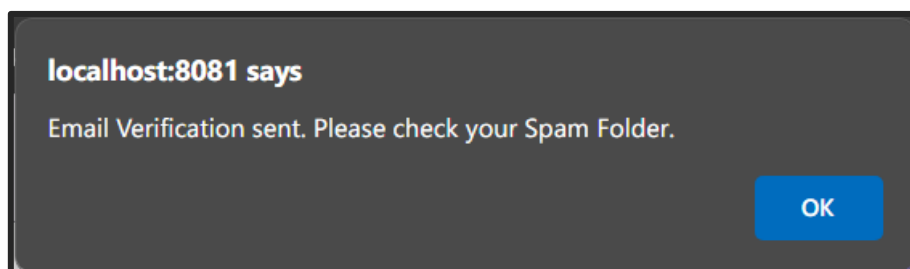


Figure 3 Verification Alert Message

Verify your email by heading over to your email app or website and verifying your account by clicking on the verification link in the sent mail.

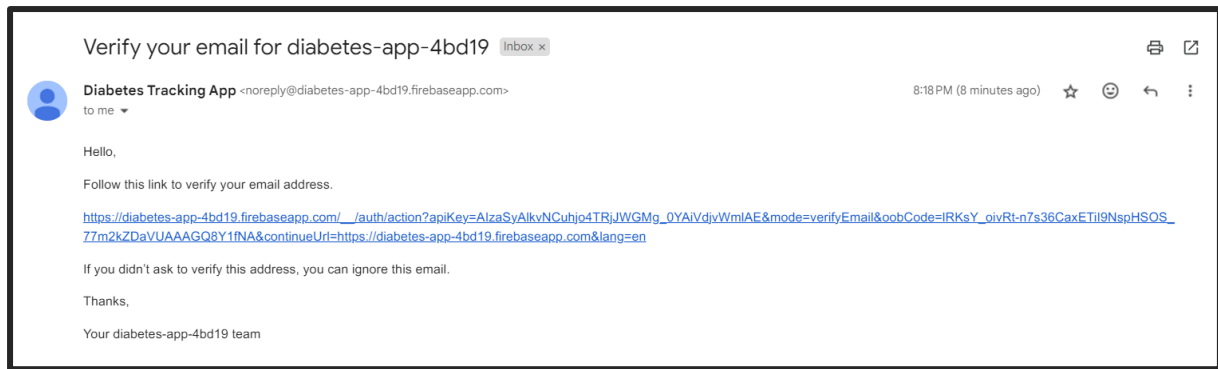


Figure 4 Email Verification Mail

Upon clicking on the verification link, click on the “CONTINUE” button to complete the verification.

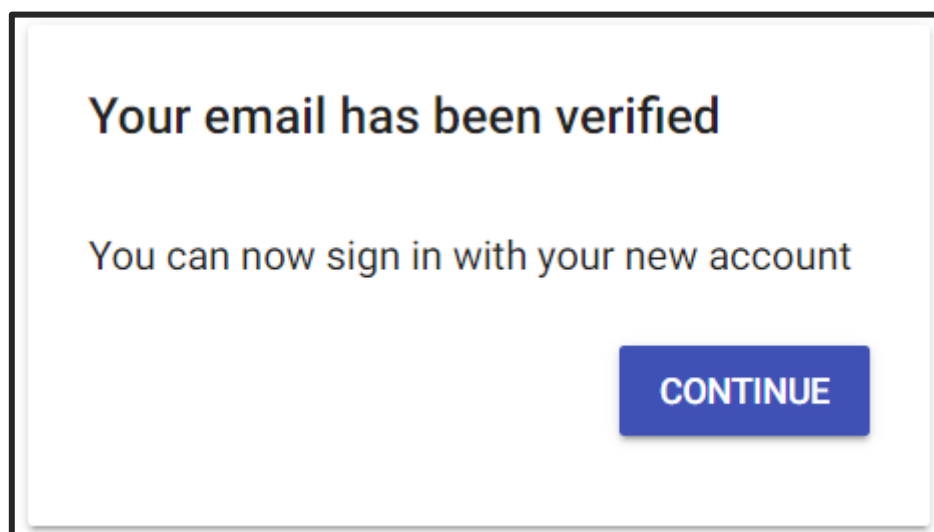


Figure 5 Firebase Verification Prompt

Go back to the application and click on the “GO TO LOGIN” button to go back to the login page to log into the application with your verified account credentials.

User Onboarding Page

New users upon logging into the application go to the onboarding page to fill their profile details. The following details are to be filled by the user:

- i. Weight (in lbs)
- ii. Height (in feet and inches)
- iii. Age
- iv. Blood Glucose Range
- v. Target Blood Glucose
- vi. Start and End hours for Breakfast, Lunch and Dinner
- vii. User's Insulin-to-Carbohydrate Ratio for Breakfast, Lunch and Dinner
- viii. Correction Ratio



The screenshot shows a web application interface for user onboarding. At the top, there is a header bar with a hamburger menu icon and the text "userInfo". Below the header, a light blue box contains the instruction "Please Fill Out Below Information First". The form consists of several input fields: "Enter Weight (lbs)" (a wide text box), "Enter Height" (two separate boxes for "Feet" with the value "5" and "Inches" with the value "10"), "Enter Age" (a text box), "Enter your blood glucose range (a-b) (in mmol/l)" (a text box), and "Enter your target blood glucose (in mmol/l)" (a text box). Below these are six rounded rectangular buttons arranged in three rows: "Breakfast Start Hour", "Breakfast End Hour", "Lunch Start Hour", "Lunch End Hour", "Dinner Start Hour", and "Dinner End Hour". At the bottom of the form is a grey button labeled "Next". A vertical scrollbar is visible on the right side of the form area.

Figure 6 User Onboarding Page - Part 1

The screenshot shows the second part of the user onboarding page. It features a light blue box with four horizontal bars, each containing a number: "6", "7", "8", and "5". Below these bars is a dark blue button labeled "Back". At the bottom of the page is a wide, dark blue button labeled "Submit".

Figure 7 User Onboarding Page - Part 2

After submitting this information. You get redirected to the Homepage.

Homepage Screen

The user is presented with a dashboard in this page after logging into the application or after onboarding the user into the application in the homepage.



Figure 8 Homepage

The user then has the option to add the food the user had for the day. You are shown the current date, the carbohydrate intake and the breakdown of carbs consumed for each meal.

You also can see the graphs for Carbs consumption history and Insulin Dosage history for the week on the right-hand side of the page.

For accessing the page to enter the food items for a meal you can click any of the buttons for Breakfast, Lunch and Dinner to be presented with the “My Food” page for the respective meal.

Navigation Menu

Clicking on the menu button shows the navigation menu to access other pages in the application:

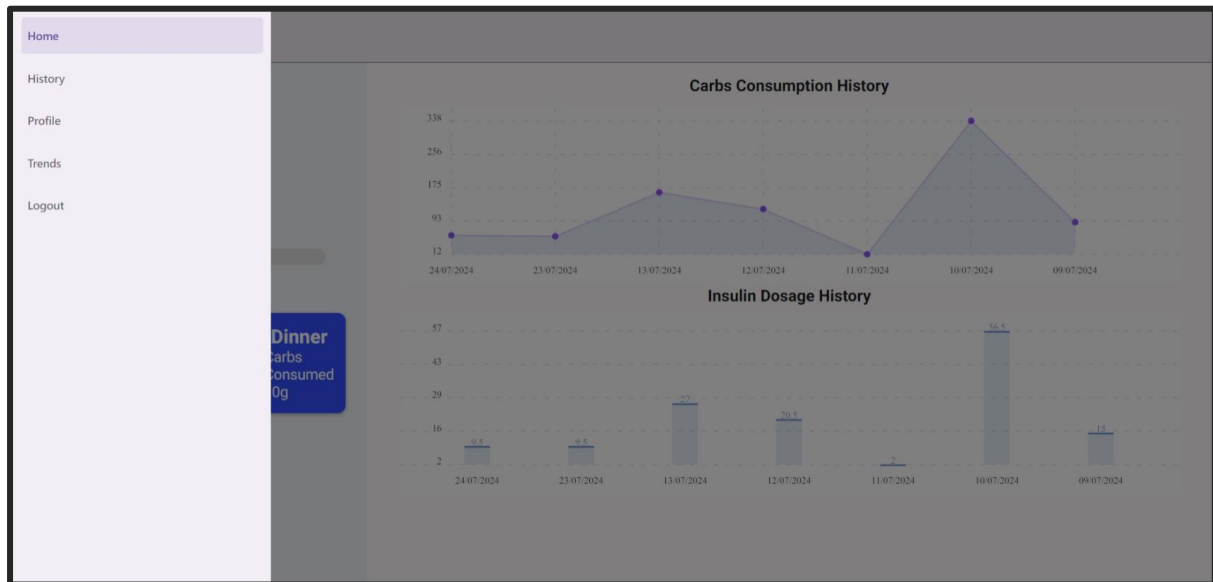


Figure 9 Navigation Menu

You can access the following pages of the application, from this menu:

- Homepage
- History Page
- Profile Page
- Trends Page

Clicking on the Logout menu items logs you out of the application.

My Food Page



Figure 10 My Food Page

You get the following options in the “My Food” page:

- Add Blood Glucose before Meal
- Add food items for the meal
- Summary of the Meal
- Edit the Meal

You also get to see the user entered information on the right-hand side of the page.

Clicking on the “Add Blood Glucose Reading Before Meal” button will present a modal to enter the glucose reading before having your meal.

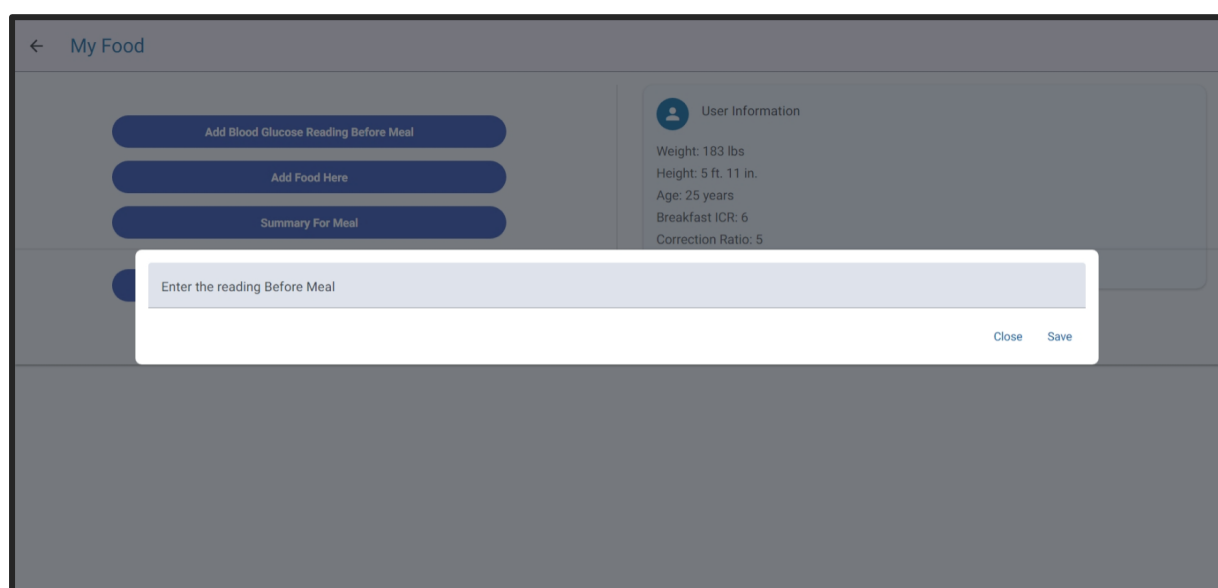


Figure 11 Pre-meal Glucose Reading Modal

Enter the glucose reading and click on “Save” to save the data.

You can then click on the “Add Food” button to add food items for your meal.

After you have saved the food items for the meal, you can click the “Summary for Meal” button to display the food items you have submitted for the meal, add the blood glucose after your meal and view your correction dose.

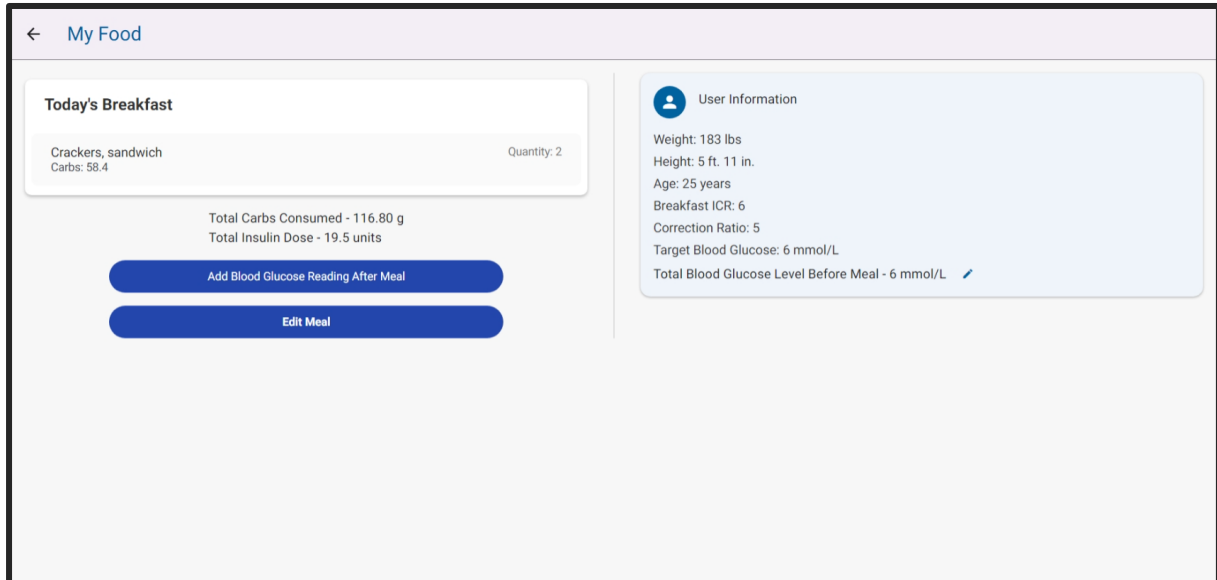


Figure 12 Food Summary Page

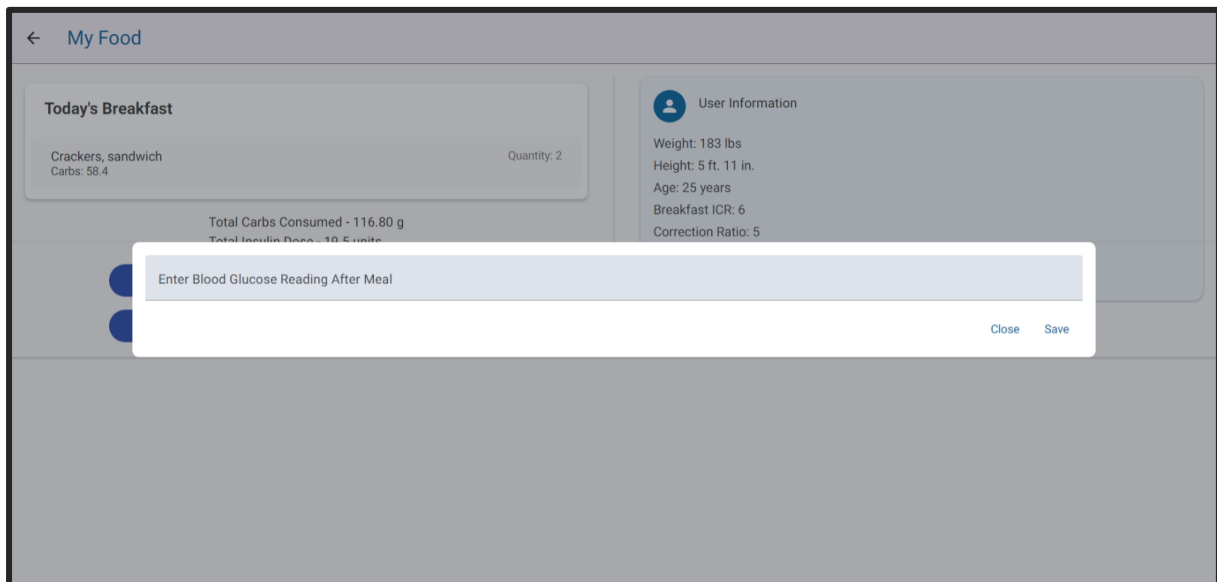


Figure 13 Post-meal Blood Glucose Entry Modal

The “Edit Meal” button allows you to edit the saved food items.



Food Search Page



Figure 14 Food Search Page

Enter the name of the food item for the you wish to add to your meal and hit the Return key to search for the food item. You can then select the food item in the results that show up.

Once adding a food item, you can access the food cart with all the items you have added. The icon for it is in the bottom right corner of the page.

Food Details Page

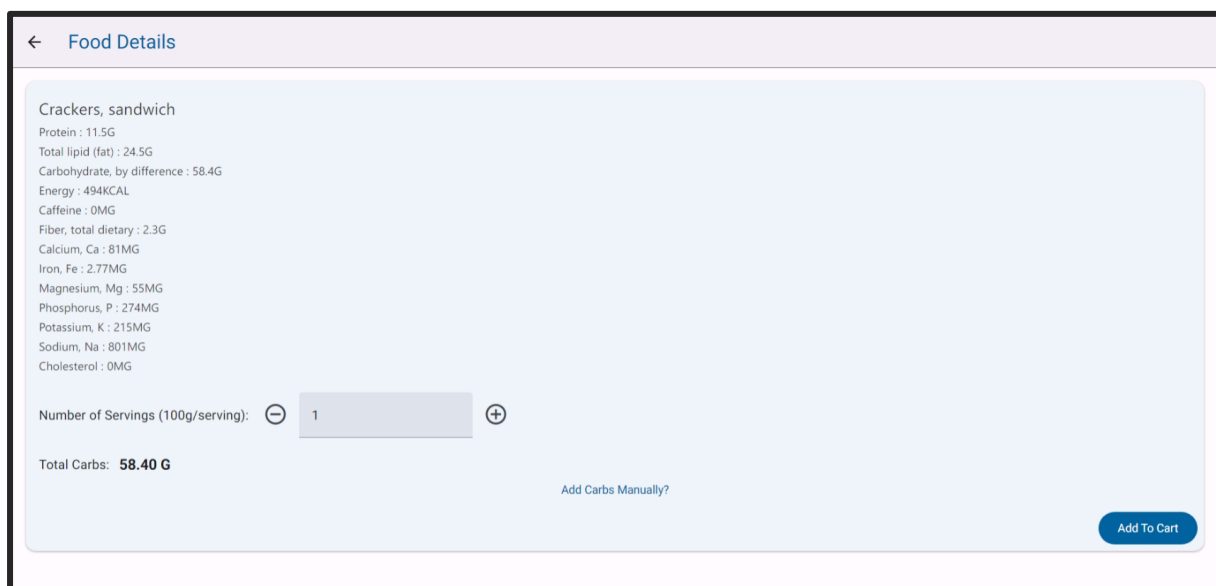


Figure 15 Food Details Page

All nutrients for the meal are shown in this page. You can add the number of servings of the food item show the total carbohydrates you receive after having the food item.

You also have the option to add the carbohydrates for the food item manually if you already are aware of the amount of carbohydrates you had with the food item.

Once you have provided the required servings or entered the carbs manually, you can click the “Add To Cart” button to add it to your cart.

Food Cart Page

The list of the food items you have added to your cart are shown in this page.

You can then edit the servings for the meal by clicking the pencil icon. Which then shows the “Food Details” page where you can edit the servings accordingly.

You can also delete the food item by clicking on the bin icon.

Once you are satisfied with the food items you have in your meal click on the “Save” button to save the meal.

If you have more items to add to the meal, click on the “Add More Food” button to load the “Food Search” page. Search for the food item to add, enter the number of servings and add to your cart.

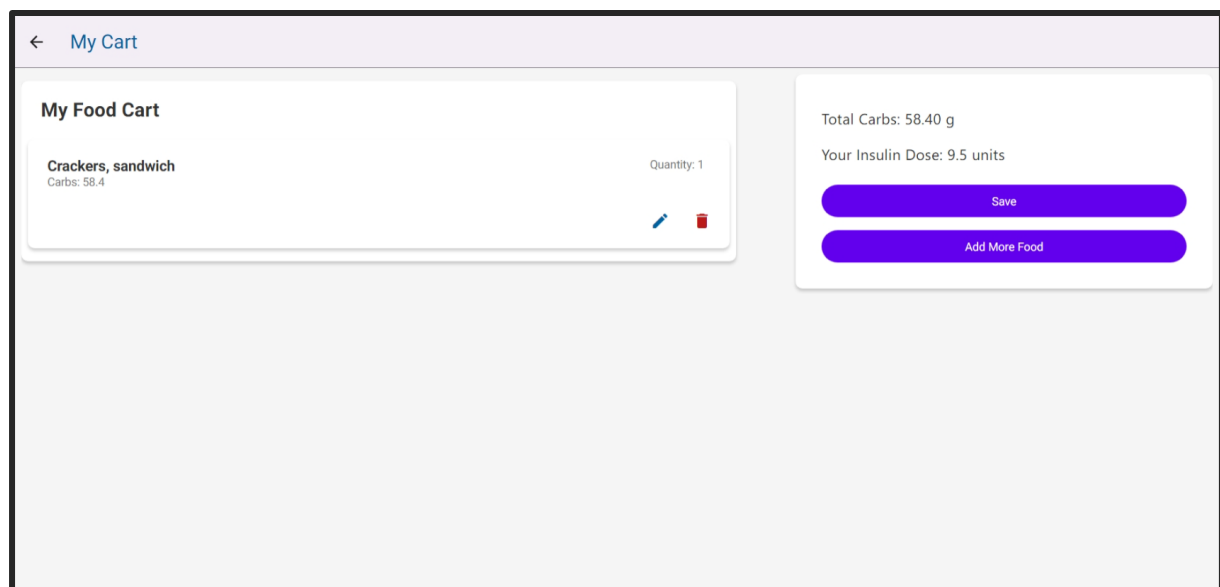


Figure 16 Food Cart Page

You then get redirected back to the homepage. Clicking on the meal again gives the option to view a summary of the meal and edit the meal.

Edit Meal Page

Clicking on the “Edit Meal” button in the “My Food” page brings you to this page:



← Edit Meal

My Food Cart

Crackers, sandwich
Carbs : 58.4
Quantity: 2

Milk, whole
Carbs : 4.63
Quantity: 1

Add Food

Total Carbs: 121.43 g
Your Insulin Dose: 20 units

Save

Figure 17 Edit Meal Page

Here you can add more food items to your existing meal, edit servings and carbohydrate intake for the food item or delete the food item from the meal like the “Food Cart” page of the application.

After making the necessary modifications, you can click the “Save” button to save your changes.

Questionnaire Page

← My Food

Today's Breakfast

Crackers, sandwich
Carbs: 58.4
Quantity: 2

Milk, whole
Carbs: 4.63
Quantity: 1

Total Carbs Consumed - 121.43 g
Total Insulin Dose - 20 units
Your correction dose - 0.5

Consult a Questionnaire

Edit Meal

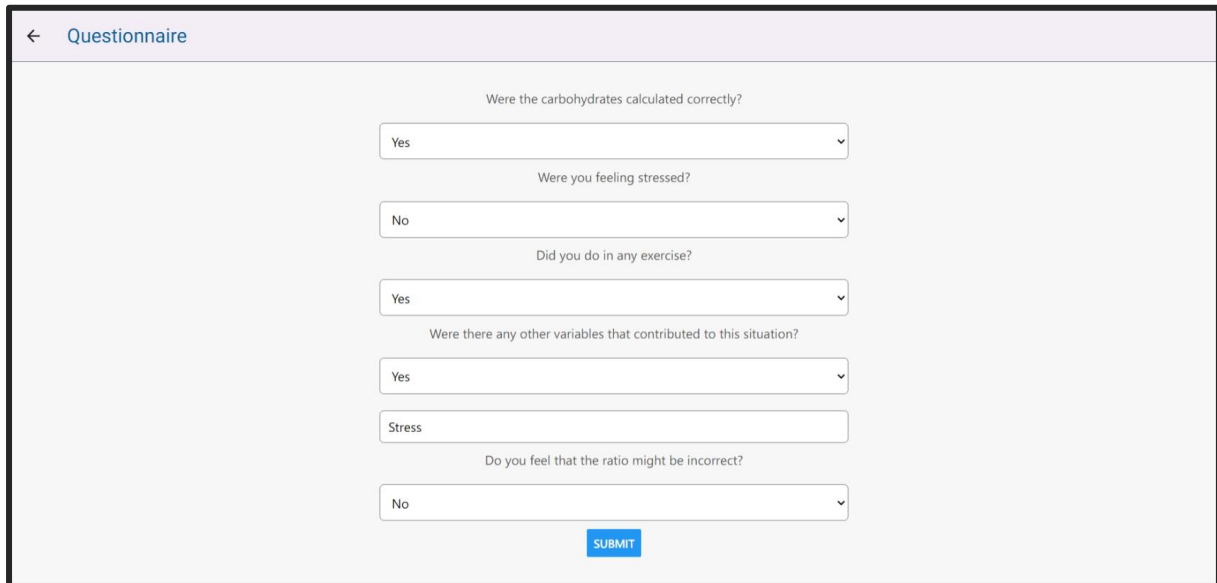
User Information

Weight: 183 lbs
Height: 5 ft. 11 in.
Age: 25 years
Breakfast ICR: 6
Correction Ratio: 5
Target Blood Glucose: 6 mmol/L
Total Blood Glucose Level Before Meal - 6 mmol/L
Total Blood Glucose Level After Meal - 9 mmol/L

Figure 18 Questionnaire after post-meal glucose entry

In the “My Food” page, after you enter the post-meal glucose reading, you get a scenario to consult a questionnaire. This scenario arises if your blood glucose increases or decreases in comparison to your target blood glucose level for the meal.

After clicking the “Consult a Questionnaire” button you will be redirected to the below page where you must answer few questions to reflect on your blood glucose intake.



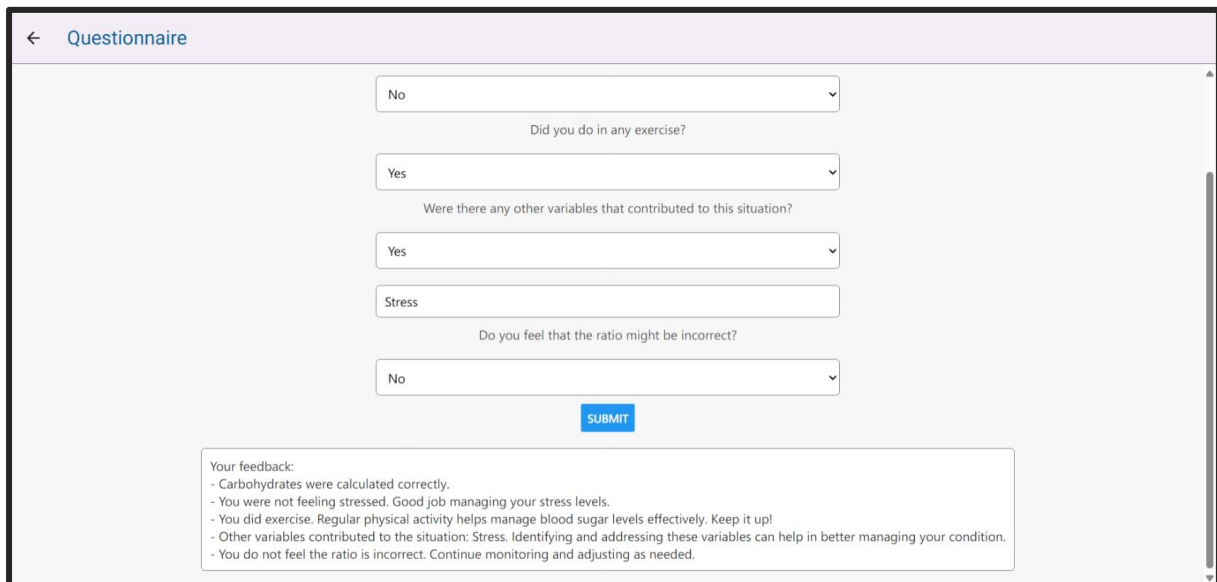
The screenshot shows a web application interface titled "Questionnaire". It contains several questions with dropdown menus for answers:

- Question: "Were the carbohydrates calculated correctly?" with a dropdown menu showing "Yes".
- Question: "Were you feeling stressed?" with a dropdown menu showing "No".
- Question: "Did you do in any exercise?" with a dropdown menu showing "Yes".
- Question: "Were there any other variables that contributed to this situation?" with a dropdown menu showing "Yes".
- Text input field: "Stress".
- Question: "Do you feel that the ratio might be incorrect?" with a dropdown menu showing "No".

A blue "SUBMIT" button is located at the bottom right of the form.

Figure 19 Questionnaire Page

Upon clicking on the “SUBMIT” button you can review the feedback based on the answered questions.



The screenshot shows the same "Questionnaire" page, but with the "SUBMIT" button highlighted. Below the form, there is a feedback section titled "Your feedback:" with the following text:

- Carbohydrates were calculated correctly.
- You were not feeling stressed. Good job managing your stress levels.
- You did exercise. Regular physical activity helps manage blood sugar levels effectively. Keep it up!
- Other variables contributed to the situation: Stress. Identifying and addressing these variables can help in better managing your condition.
- You do not feel the ratio is incorrect. Continue monitoring and adjusting as needed.

Figure 20 Questionnaire Feedback

History Page

You can get the information for the meals that you have added in the application in the “History” page which can be accessed in the navigation menu.

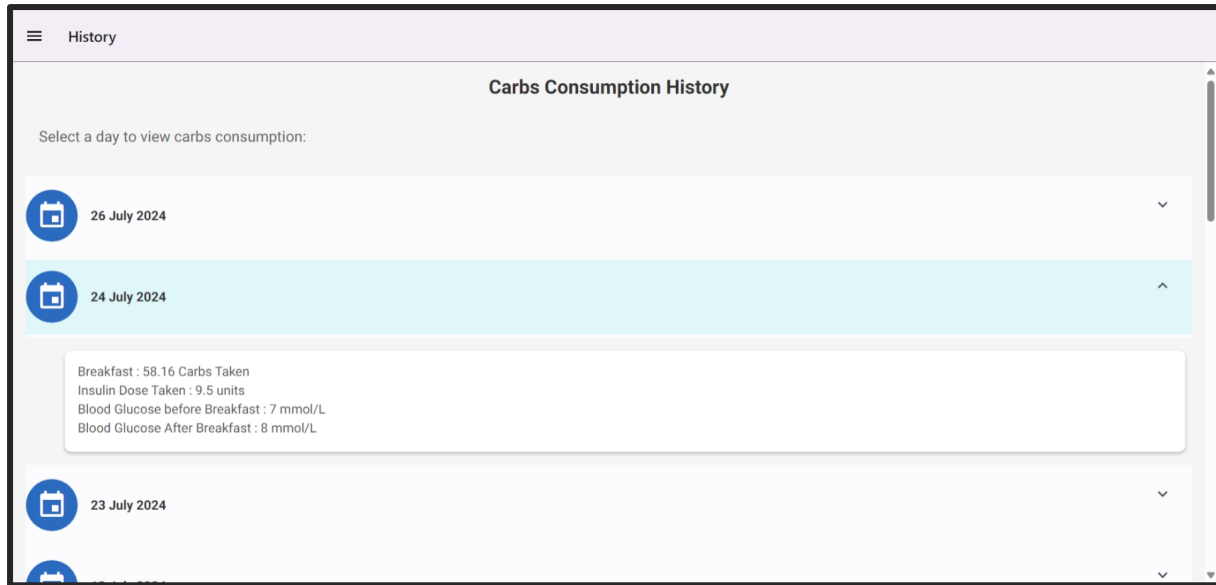


Figure 21 History Page

You select the day you wish to get the information for, and the following data is displayed:

- Carbs consumed for the meal
- The insulin dose needed to take after the meal
- Blood Glucose before Meal
- Blood Glucose after Meal

Trends Page

The trends page displays the graphs for Carbohydrates consumed since the last 7-days and the history of the Insulin dosages within the same timeframe.

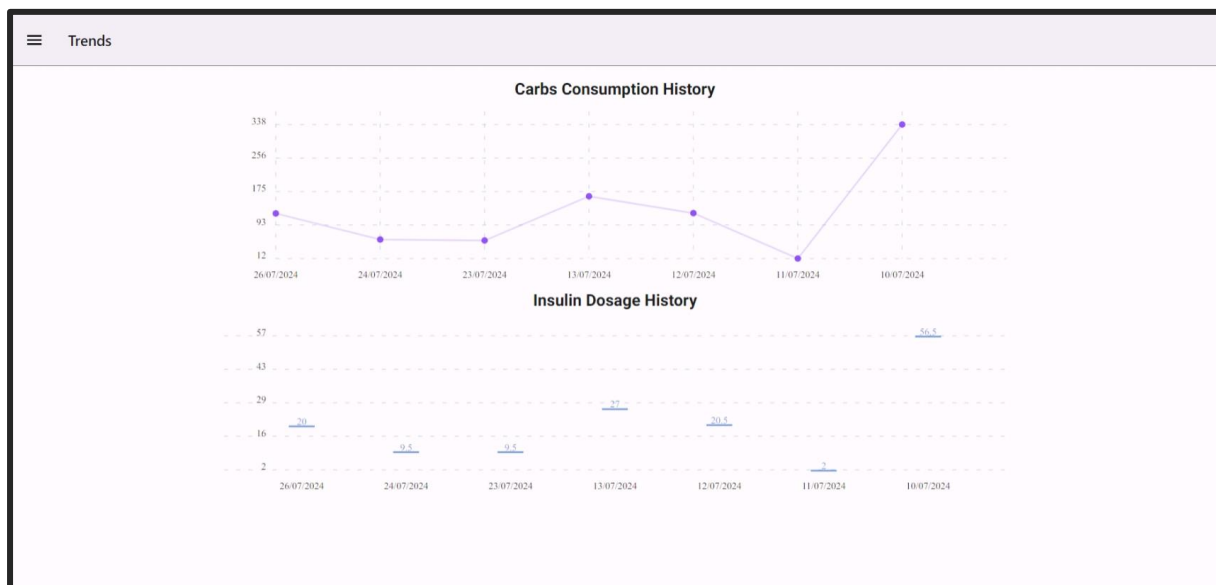
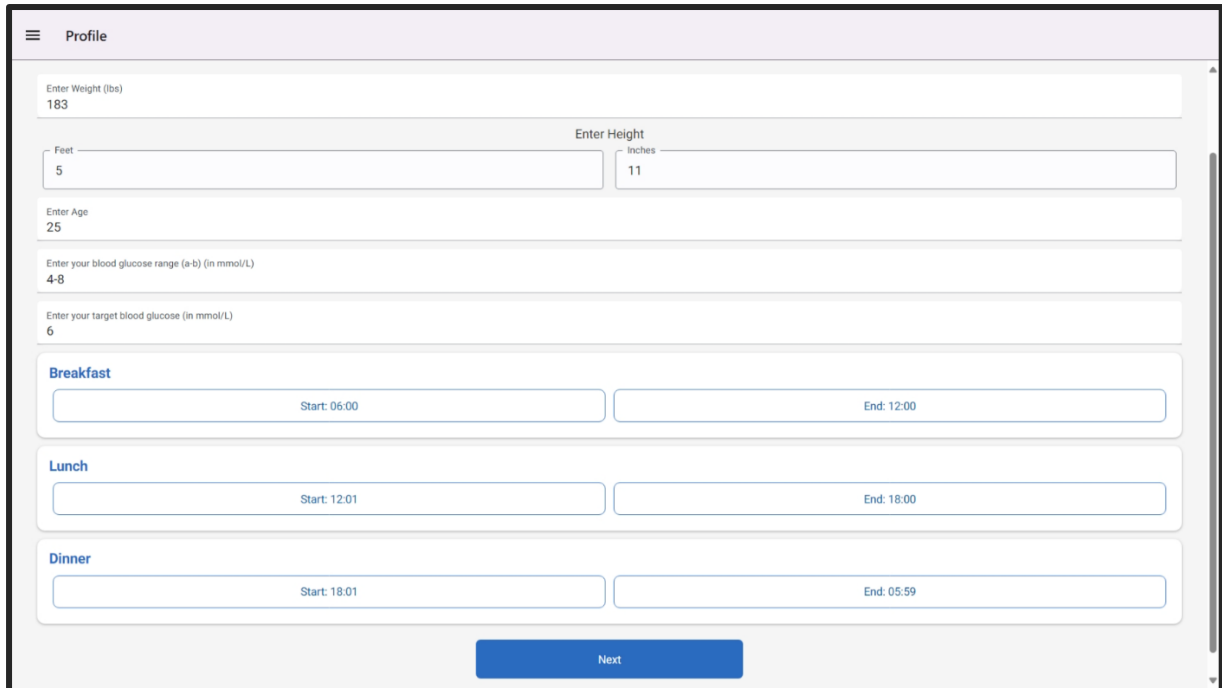


Figure 22 Trends Page

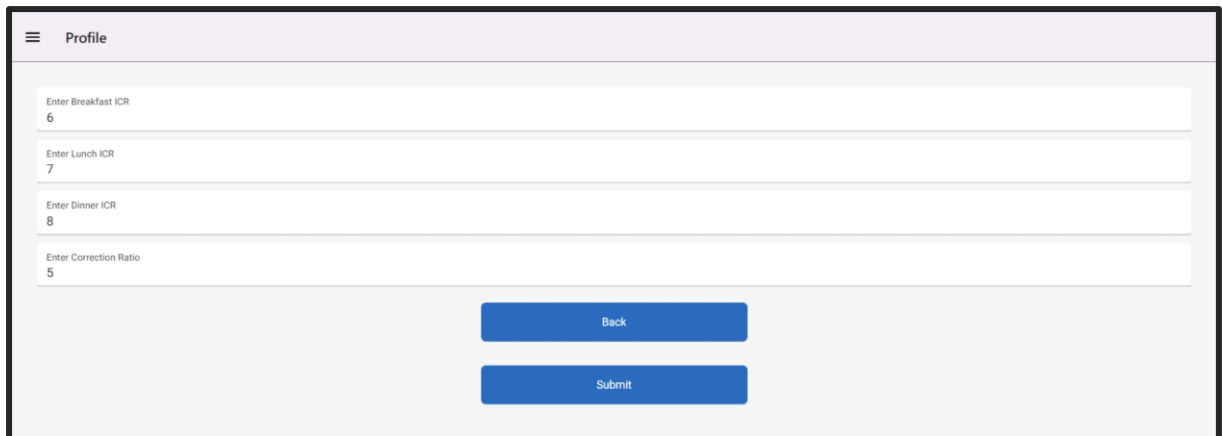
Profile Page



The screenshot shows the 'Profile' page with a light purple header. Below the header, there are several input fields for personal information: 'Enter Weight (lbs)' with the value '183', 'Enter Height' with 'Feet' (5) and 'Inches' (11), 'Enter Age' with the value '25', 'Enter your blood glucose range (a-b) (in mmol/L)' with the value '4-8', and 'Enter your target blood glucose (in mmol/L)' with the value '6'. Below these fields are three meal sections: 'Breakfast' with 'Start: 06:00' and 'End: 12:00', 'Lunch' with 'Start: 12:01' and 'End: 18:00', and 'Dinner' with 'Start: 18:01' and 'End: 05:59'. At the bottom of the form is a blue 'Next' button.

Figure 23 Profile Page - Part 1

The Profile Page allows you edit the information you had provided during the onboarding process of the application allowing you to update the Insulin-to-Carbohydrate Ratio for all meals, set the hours for the meals, etc.



The screenshot shows the 'Profile' page with a light purple header. Below the header, there are four input fields for meal-related information: 'Enter Breakfast ICR' with the value '6', 'Enter Lunch ICR' with the value '7', 'Enter Dinner ICR' with the value '8', and 'Enter Correction Ratio' with the value '5'. At the bottom of the form are two blue buttons: 'Back' and 'Submit'.

Figure 24 Profile Page - Part 2