INTEX 2022

Section 4 - Group 13
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EXECUTIVE SUMMARY

Our client, the National Kidney Foundation of Utah and Idaho has been one of the leading advocates for those suffering with kidney disease since 1988. It is our privilege to join their cause by creating a dynamic web application that helps those with kidney disease increase their quality of life. Kidney 2 is designed to assist the dietary needs of those in different stages of renal disease by tracking their nutrition. Similar to food journals, the application is intended to track daily food and drink intake while monitoring nutrient levels in regard to kidney health. This report summarizes the analysis of the proposed system, outlines its features in response to requirements, and identifies how this project will bring value to the National Kidney Foundation of Utah and Idaho and its users.

BACKGROUND

The National Kidney Foundation (NKF) of Utah and Idaho's mission is to prevent kidney and urinary tract diseases, improve the health and well-being of individuals and families affected by these diseases, and increase the availability of all organs for transplantation. We were tasked with designing a website that helps them further their mission. According to NKF, 33 percent of all Americans are at high risk of kidney disease. This means that resources to help those facing Chronic Kidney Disease (CKD) are strained and inadequate for many Americans. The danger for most lies in the fact that 90 percent of kidney function can be lost before any symptoms appear. This leads to many Americans seeking medical attention with extremely limited kidney function. Therefore, people diagnosed with Stage 4 Chronic Kidney Disease and those facing a Dialysis treatment plan are in desperate need of diet and lifestyle recommendations tailored to their situation. Most face months of waiting to see a healthcare professional that can assist them with these recommendations which could lead to worsening symptoms and declining kidney functionality. The National Kidney Foundation reports that 50 percent of people could prevent End Stage Renal Disease (ESRD), where the kidneys permanently cease functioning, through diet and lifestyle changes. Our website provides tools that can help people at risk of kidney disease track the foods they eat, the micronutrients and macronutrients they contain, set diet goals and help them keep track of their progress daily according to their nutrient intake. We propose that this project can be a first step in expanding outreach to patients before and during their battle with Chronic Kidney Disease.

USER STORIES

To create the best product for the end user, we needed the opinion of the community. After seeking feedback on the Nation Kidney Foundation's blog titled "Kidney Disease" on healthunlocked.com, we were thrilled to see an outburst of interest from those impacted by renal disease. One user shared her story, "My hubby is a diabetic and keeping track of sugars and carbs along with blood pressure is such a difficult thing to do. His transplant center makes him laboriously jot all of that down in a notebook and then brings in the notebook to his doctors so they can review it." We heavily based our system requirements on community requests in order to answer their call for a user-friendly program.

SYSTEM REQUIREMENTS

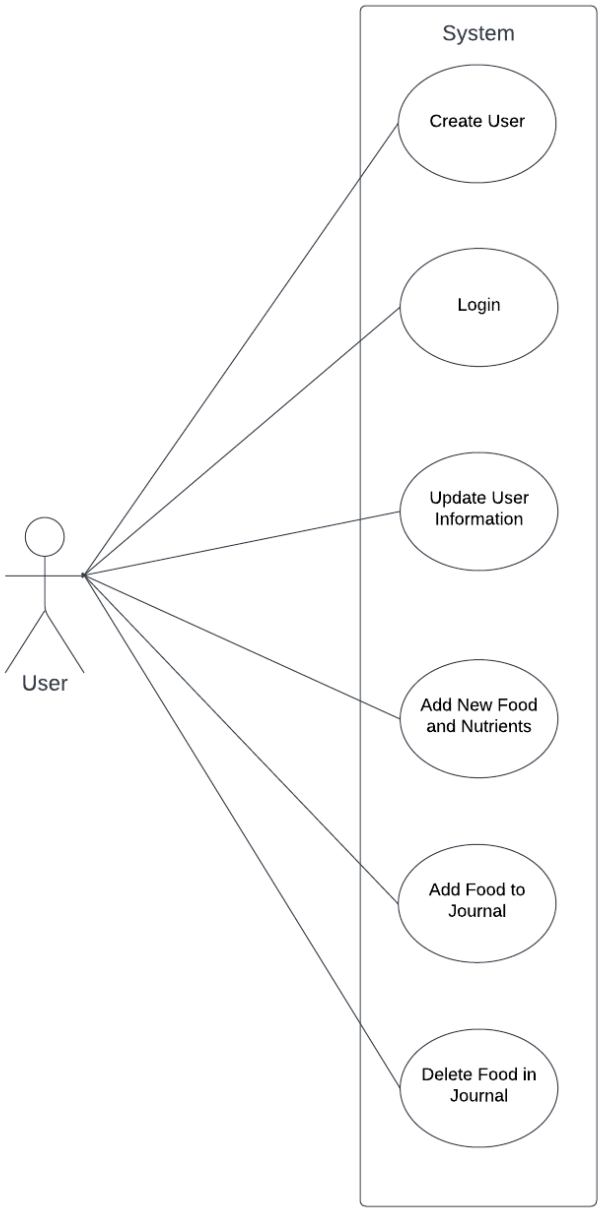
Our system provides a user with a uniquely tailored experience. Kidney 2 is designed to be a diet and lifestyle coach specifically to those with Stage 4 Kidney Disease and those facing a Dialysis treatment plan. It does so by allowing the user to search the foods they eat daily to see their specific macronutrient and micronutrient levels. Additionally, it allows the user to have limits related to their nutrient levels and see how their daily intake affects their set limits and warn them when a food could violate their daily limit. Kidney 2 also allows the user to keep a detailed daily journal of the food they eat. Each of these website functionalities is enhanced by dynamic visualizations that allow the user to see their progress. Lastly, the website allows the user to create an authenticated user profile that keeps track of their weight and their current kidney disease stage. The user can update their personal details and in return Kidney 2 will update to give them recommendations tailored to their body.

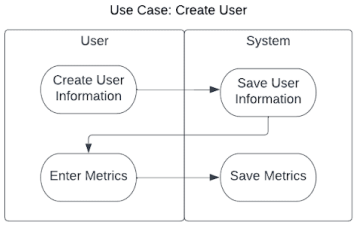
Requirements:

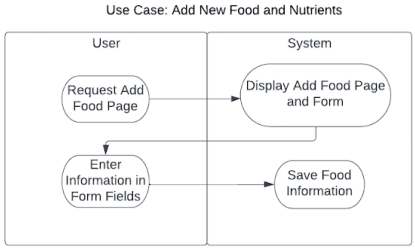
1. An appropriate landing page for the web app
2. CRUD
    a. Ability for the user to enter in personal details (age, height, weight, etc.)
    b. Ability for the user to enter in food details
    c. Ability for the user to add food to a daily journal
3. Reports
    a. Graph with micronutrients (similar to the macronutrient features in other food health apps, but applied to kidney health)
    b. Alerts as micronutrients amounts are exceeded
    c. Suggestions for foods to help balance micronutrients

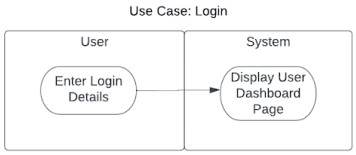
USE CASE DIAGRAMS

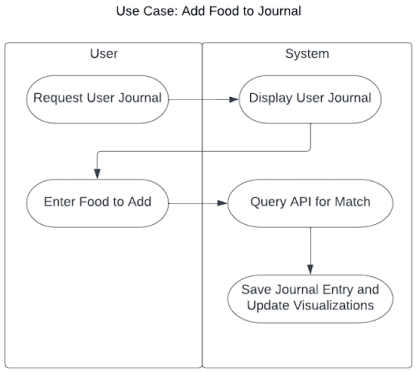
Attached below is the use case diagram along with the individual use cases. The usage scenarios indicate when it will be useful for the user to communicate with the system.

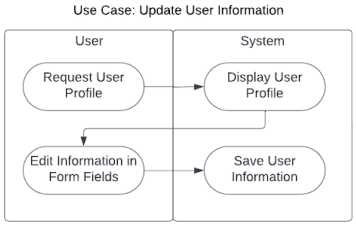


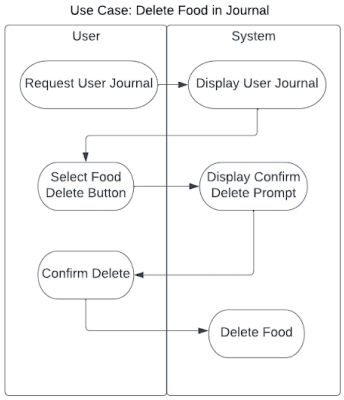






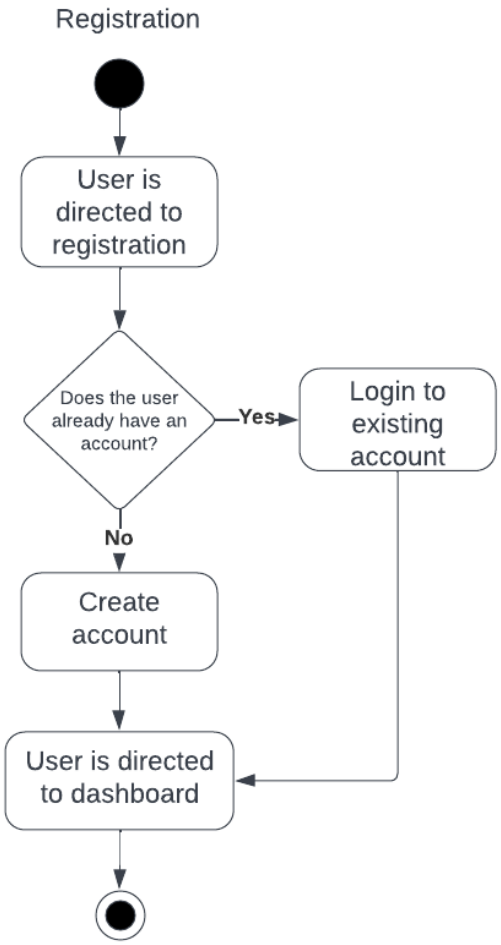


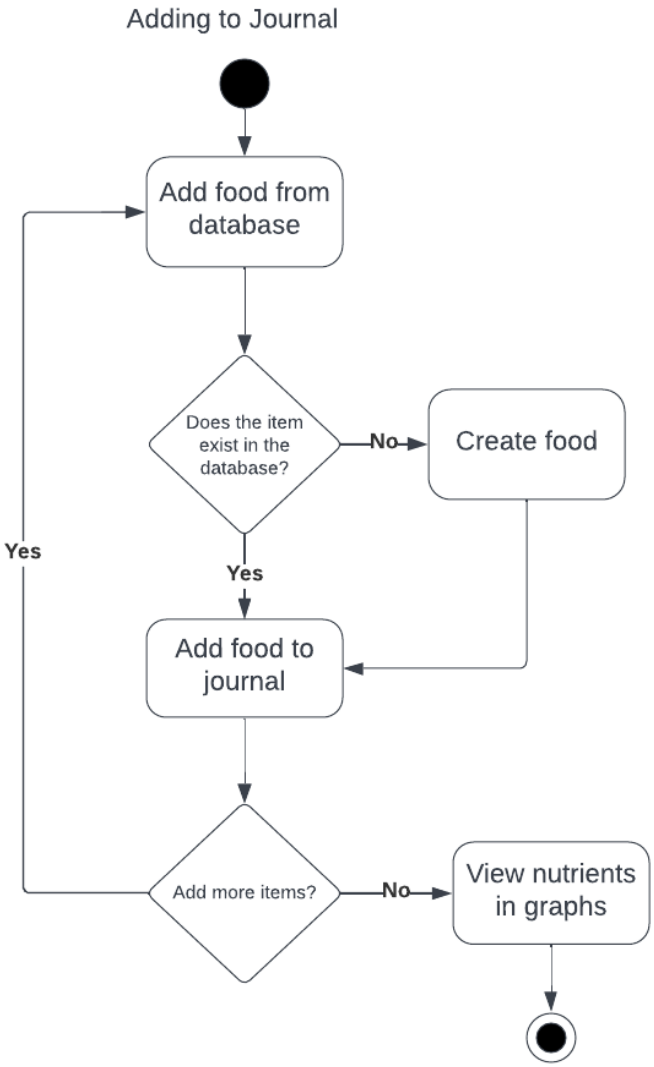




ACTIVITY DIAGRAMS

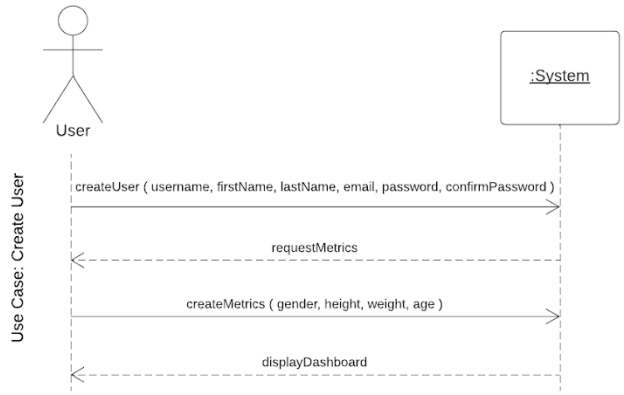
The activity diagrams below illustrate the flow of the ‘Registration’ system and the ‘Adding to Journal’ system according to the system behavior.

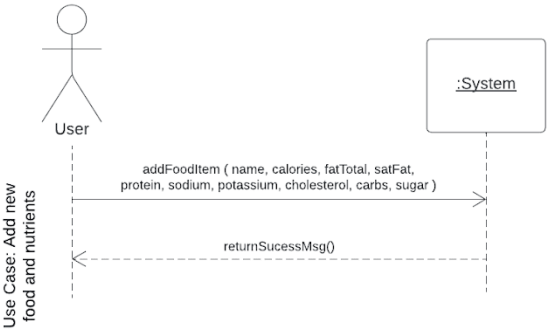


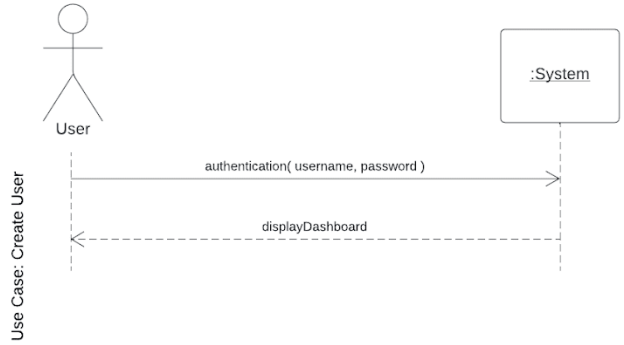


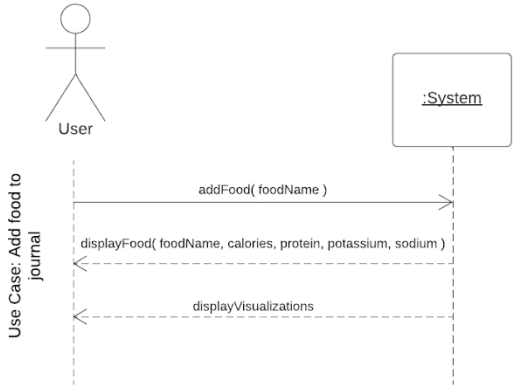
SYSTEM SEQUENCE DIAGRAMS

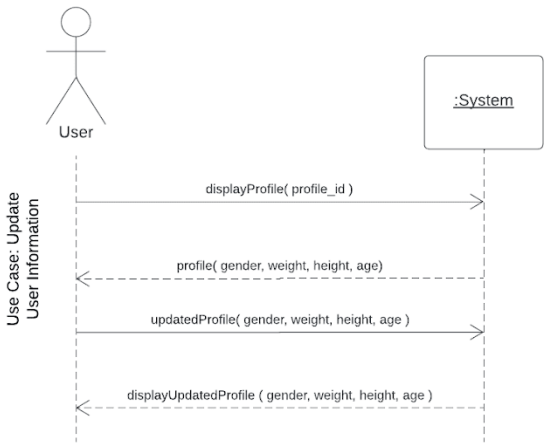
The System Sequence Diagrams (SSD) shows the interaction process between user and system. These are related to the use cases listed above.

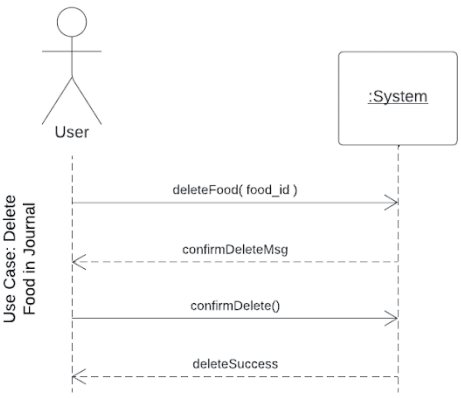






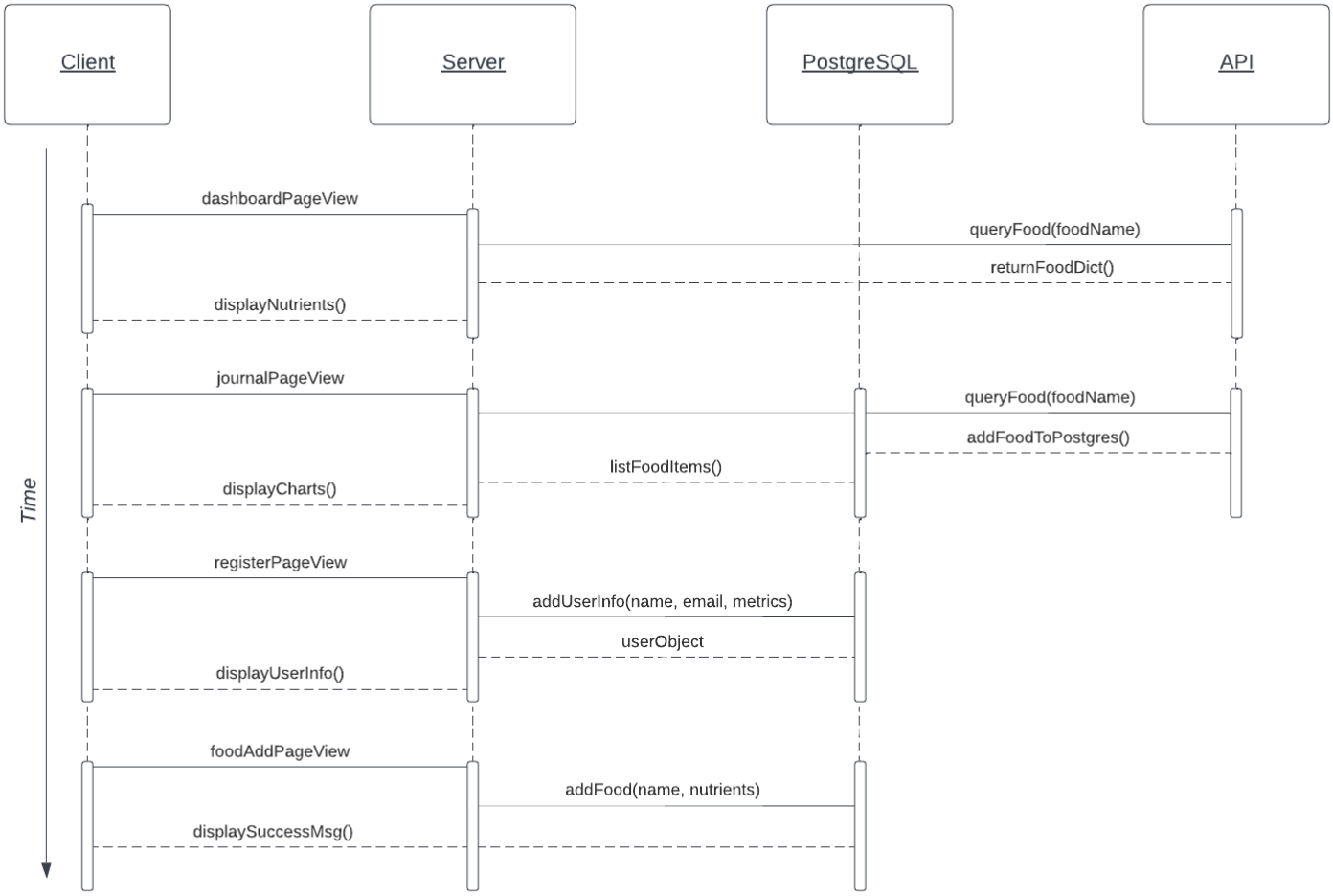






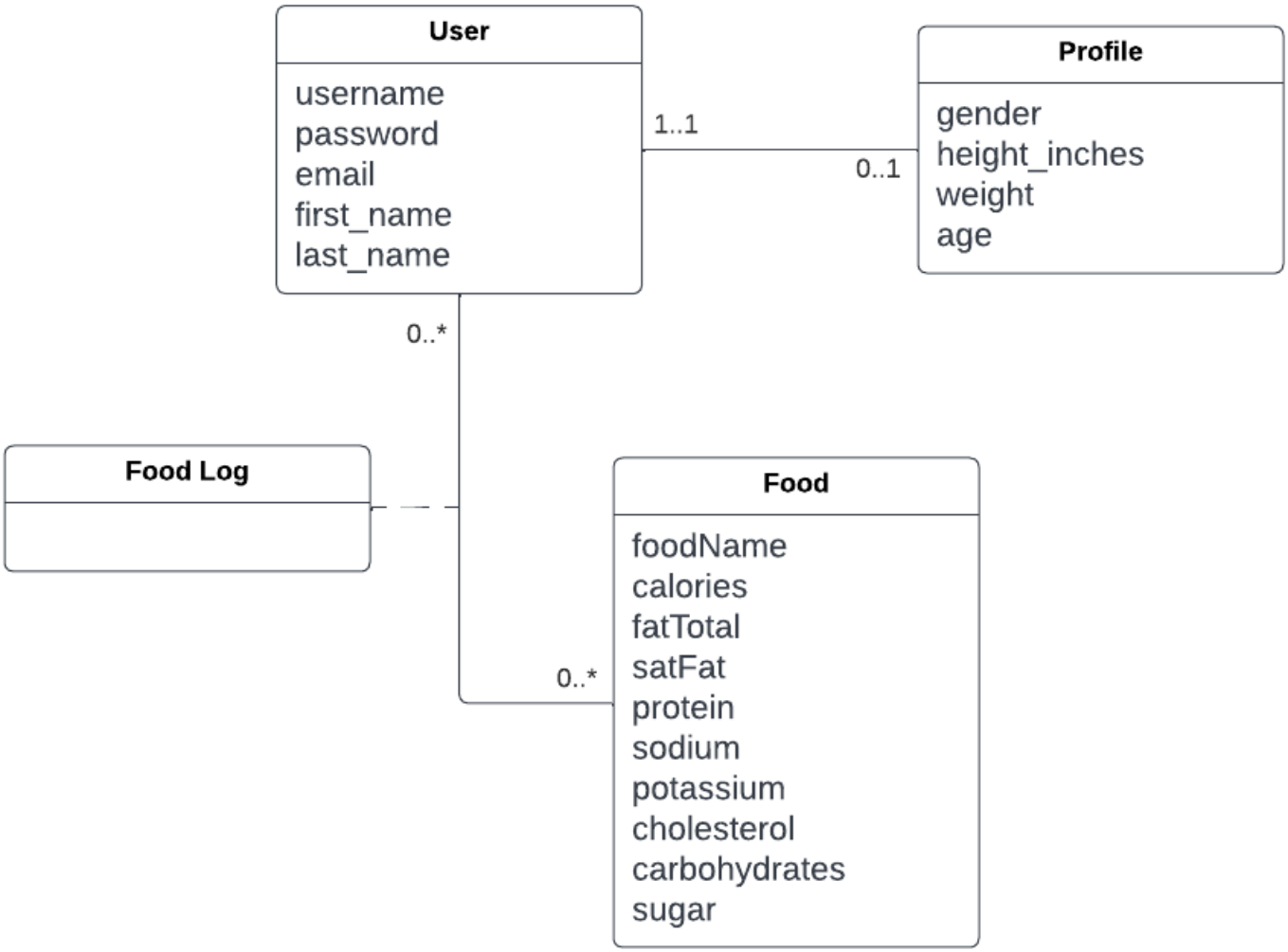
SEQUENCE DIAGRAM

The Sequence Diagram below details how the software will operate between the Client Server and Models.



UML CLASS DIAGRAM

The attached class diagram describes the system domain by showing classes, attributes, and relationships between tables within the database. This is the structure of the models that will be built in the system.



SQL SCRIPT

```
BEGIN;
--
-- Create model Food
--
CREATE TABLE "Food" ("id" bigint NOT NULL PRIMARY KEY GENERATED BY
DEFAULT AS IDENTITY, "foodName" varchar(200) NOT NULL, "calories" integer NOT
NULL, "fatTotal" numeric(7, 2) NOT NULL, "satFat" numeric(7, 2) NOT NULL, "protein"
numeric(7, 2) NOT NULL, "sodium" numeric(7, 2) NOT NULL, "potassium" numeric(7, 2)
NOT NULL, "cholesterol" numeric(7, 2) NOT NULL, "carbohydrates" numeric(7, 2) NOT
NULL, "sugar" numeric(7, 2) NOT NULL);
--
-- Create model Profile
--
CREATE TABLE "Metrics" ("id" bigint NOT NULL PRIMARY KEY GENERATED BY
DEFAULT AS IDENTITY, "gender" varchar(30) NOT NULL, "height_inches" numeric(8,
1) NOT NULL, "weight" integer NOT NULL, "age" integer NOT NULL, "user_id" integer
NOT NULL UNIQUE);
--
-- Create model FoodLog
--
CREATE TABLE "dashboard_foodlog" ("id" bigint NOT NULL PRIMARY KEY
GENERATED BY DEFAULT AS IDENTITY, "food_consumed_id" bigint NOT NULL,
"user_id" integer NOT NULL);
ALTER TABLE "Metrics" ADD CONSTRAINT
"Metrics_user_id_bf16638d_fk_auth_user_id" FOREIGN KEY ("user_id")
REFERENCES "auth_user" ("id") DEFERRABLE INITIALLY DEFERRED;
ALTER TABLE "dashboard_foodlog" ADD CONSTRAINT
"dashboard_foodlog_food_consumed_id_71238e0e_fk_Food_id" FOREIGN KEY
("food_consumed_id") REFERENCES "Food" ("id") DEFERRABLE INITIALLY
DEFERRED;
ALTER TABLE "dashboard_foodlog" ADD CONSTRAINT
"dashboard_foodlog_user_id_3a87e1de_fk_auth_user_id" FOREIGN KEY ("user_id")
REFERENCES "auth_user" ("id") DEFERRABLE INITIALLY DEFERRED;
CREATE INDEX "dashboard_foodlog_food_consumed_id_71238e0e" ON
"dashboard_foodlog" ("food_consumed_id");
CREATE INDEX "dashboard_foodlog_user_id_3a87e1de" ON "dashboard_foodlog"
("user_id");
COMMIT;
```

COST

Although the cost of the resources in the project are relatively small, the biggest factor is time and hassle. It is expected that the consultants working on the project will receive an average wage of $36 ranging from $28 to $38 based on their education, skills, and experience. This economic factor is based on salary.com's report from October 27, 2022. Assuming full-time work and factor of 6.5 productive hours per day (to account for socializing, breaks, etc.) per developer, four developers, and a project duration of 640 hours (a 40 hour work week per person over the course of a month), the project will be able to be completed in 25 work days (rounded to the nearest whole). Multiplying the total work hours (640) by the average wage of a web developer ($36), the total employee cost of the project before taxes and benefits would be $23,040.

Another cost is the cost of the data being supplied. In the current state of our application we used a free API from API Ninjas. This isn't scalable nor offers the most extensive nutritional data however. The alternative would be the U.S. Department of Agriculture's complete database found on FoodData Central. This includes multiple data sets such as "Foundation Foods", "Global Branded Foods", and "SR Legacy". There is one limitation to this however, "FoodData Central currently limits the number of API requests to a default rate of 1,000 requests per hour per IP address, as this is adequate for most applications. Exceeding this limit will cause the API key to be temporarily blocked for 1 hour". There is an obvious tradeoff to using this API. In order to have the most detailed and up-to-date nutritional facts, you risk denial of access to the API if the set limit is exceeded. This could be detrimental to the functionality of the website. The solution to this would be scaling up to accommodate the needs based on traffic inflow. This price can only be determined by speaking with a USDA agent and receiving a quote.

Additional costs will include purchasing the domain for the website. If we deployed to Amazon Web Services (AWS) using a standard EC2 instance with 2 vCPUs and 1 gig memory and a year of estimated use, the estimated cost based on the AWS calculator would be $28.30 per month with no upfront costs, $135.78 upfront and $15.81 per month with partial cost distribution, or $266.30 upfront and $4.50 a month with all upfront fees. Railway provides a free hosting service which will suffice during the development stage, but once the application is ready it is advised to choose a scalable hosting service to adjust to traffic.

	Year 0
Upfront Cost	266.30
Hosting Costs	54.00
API Costs	0
Developer Cost	23,040
Total Costs	23,360

	Year 0
Upfront Cost	135.78
Hosting Costs	189.72
API Costs	0
Developer Cost	23,040
Total Costs	23,366

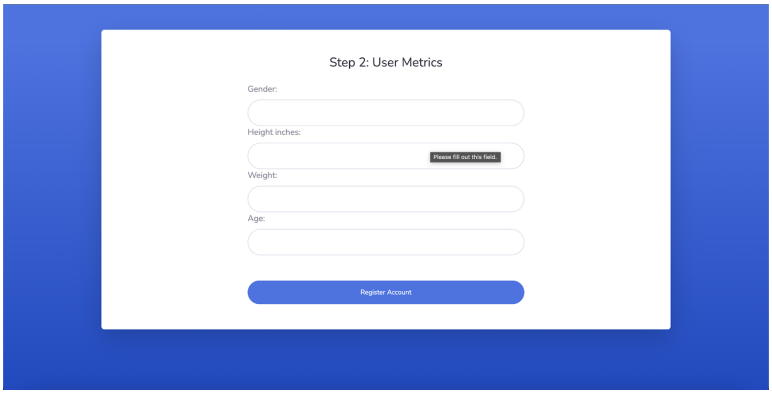
	Year 0
Upfront Cost	0.00
Hosting Costs	339.60
API Costs	0
Developer Cost	23,040
Total Costs	23,380

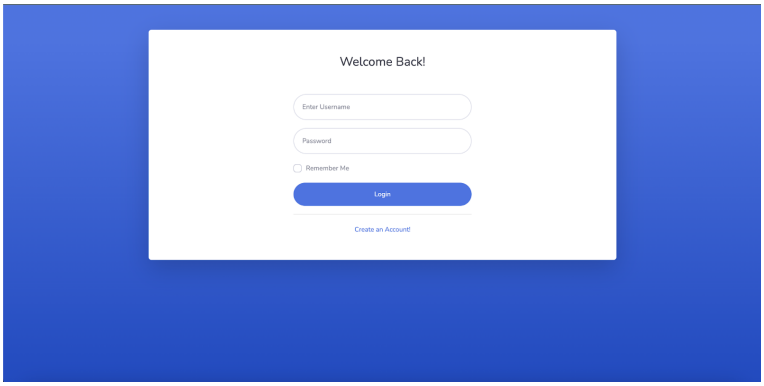
WEBSITE (WIREFRAMES)

*Note: Some of the daily value goals are dynamic such as protein while others are set (This will be changed in a future update)

Landing Page

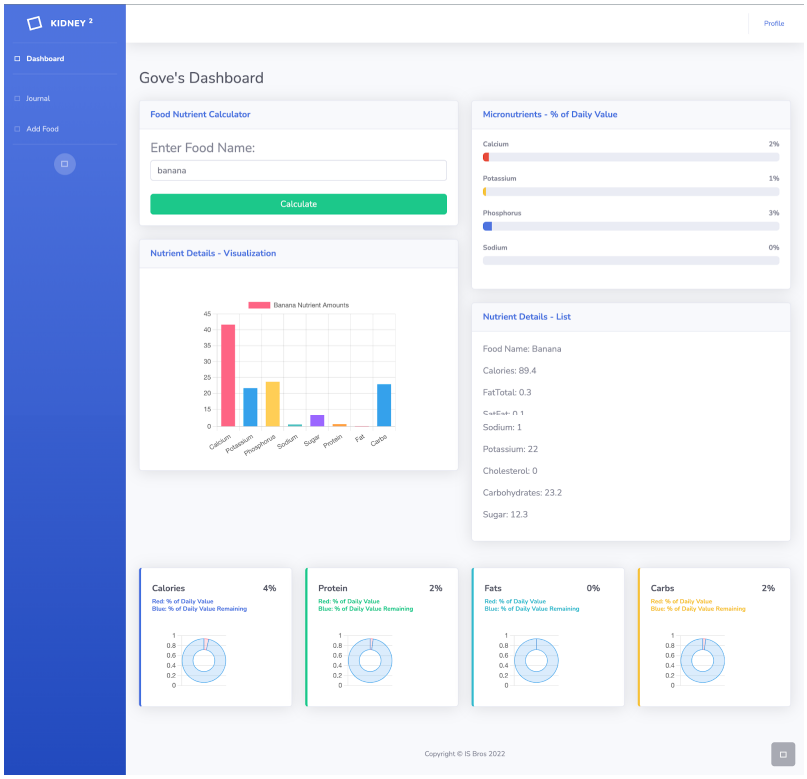
The landing page for Kidney 2 is the registration page. In step 1, the user is prompted to follow the instructions and add personal account information. The user then moves on to step 2 where they will add their metrics such as gender, weight, and age. If the user already has an account, they will select the 'Login' button and enter their credentials for authentication.





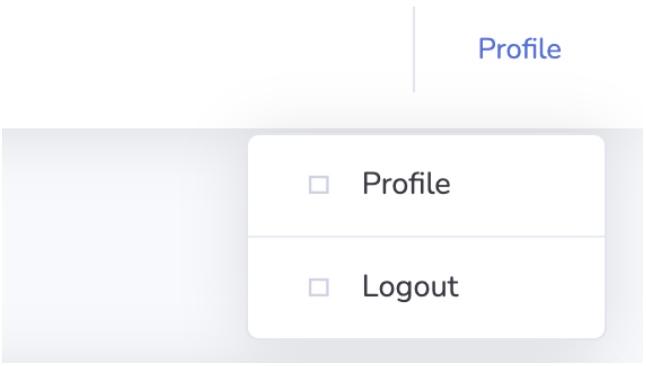
Dashboard

Once the user is authenticated, they are directed to the dashboard. The dashboard is an interactive hub which allows the user to enter food and see the nutritional data. The visualizations dynamically displays the ‘Micronutrients - % of Daily Value’ based on user goals, a list and bar chart of nutrition details, and donut charts visualizing the macronutrients within the food item. The user can then direct themselves to the ‘Journal’ page, ‘Add Food’ page, or they can view their profile in the ‘Profile’ page.



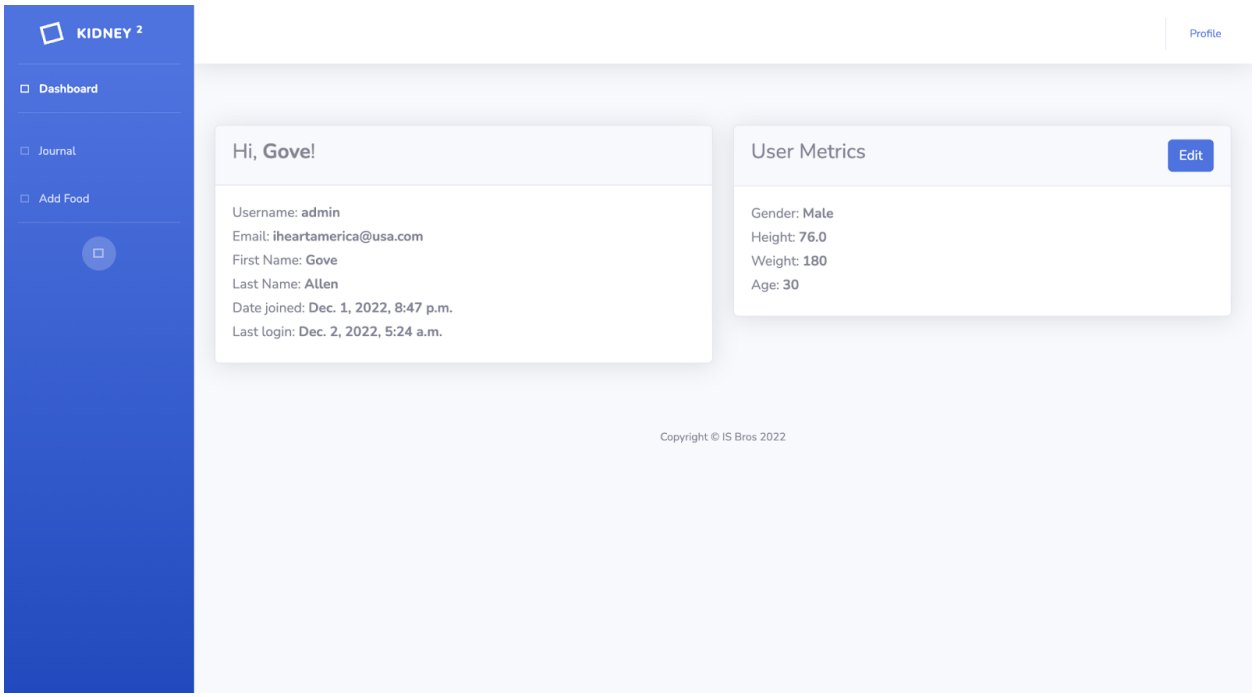
Dropdown Bar

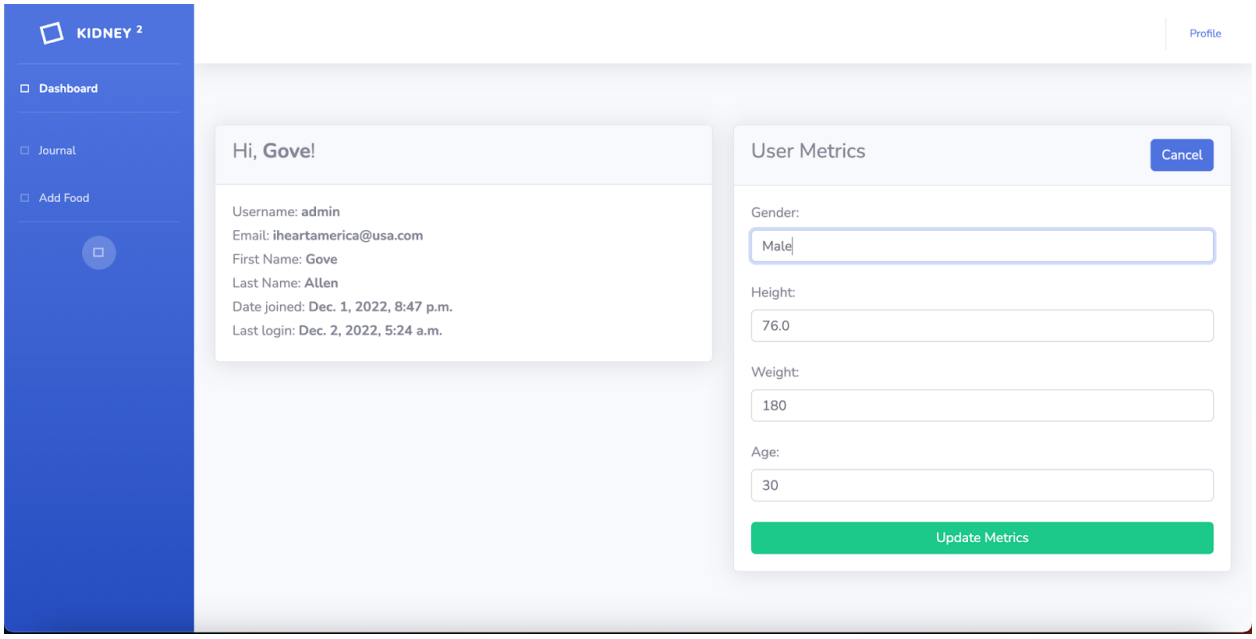
From any page within the application (besides the registration and login page) the user will have the option to view their profile in the ‘Profile’ page or logout of their account which will redirect them to the ‘Login’ page.



Profile

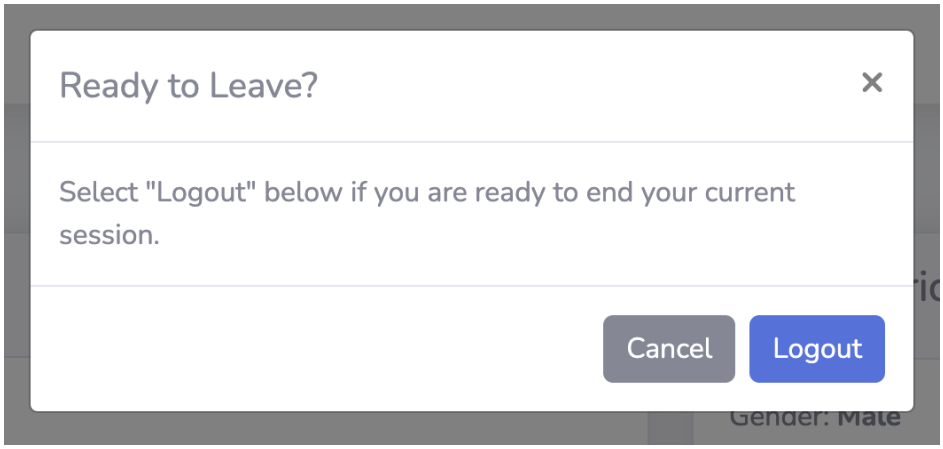
This dynamically welcomes the user that logged in by their first name. It also shows their onboarding information from when they registered and their last login. This page also allows the user to update and save their metric information as it changes.





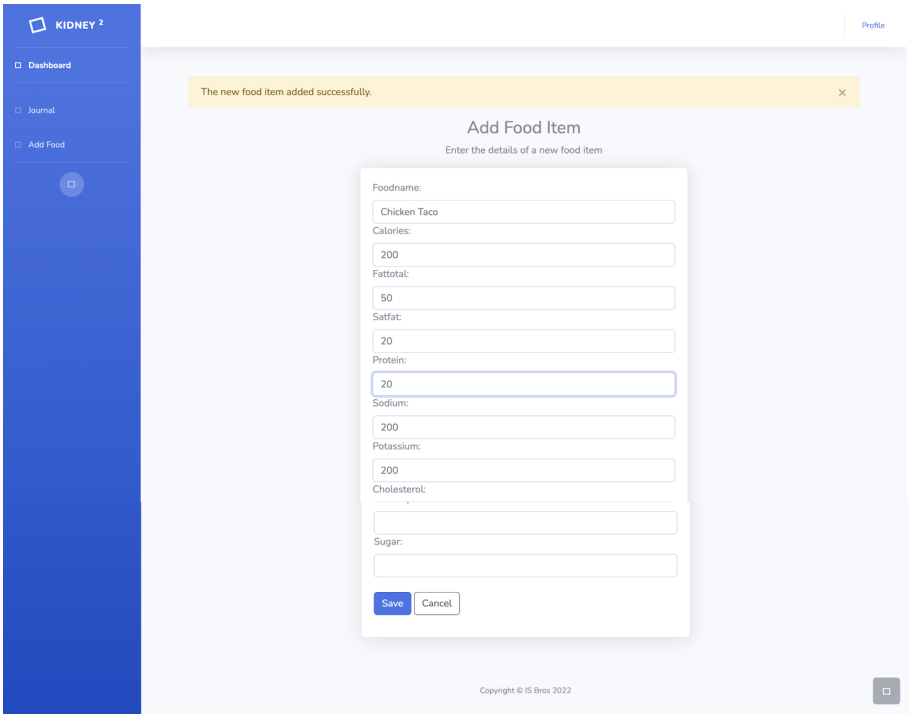
Logout

The logout functionality allows a user to log out of their account. When they select the logout option from the top-right dropdown they are asked to confirm their logout request. After doing so, the user is redirected to the login page.



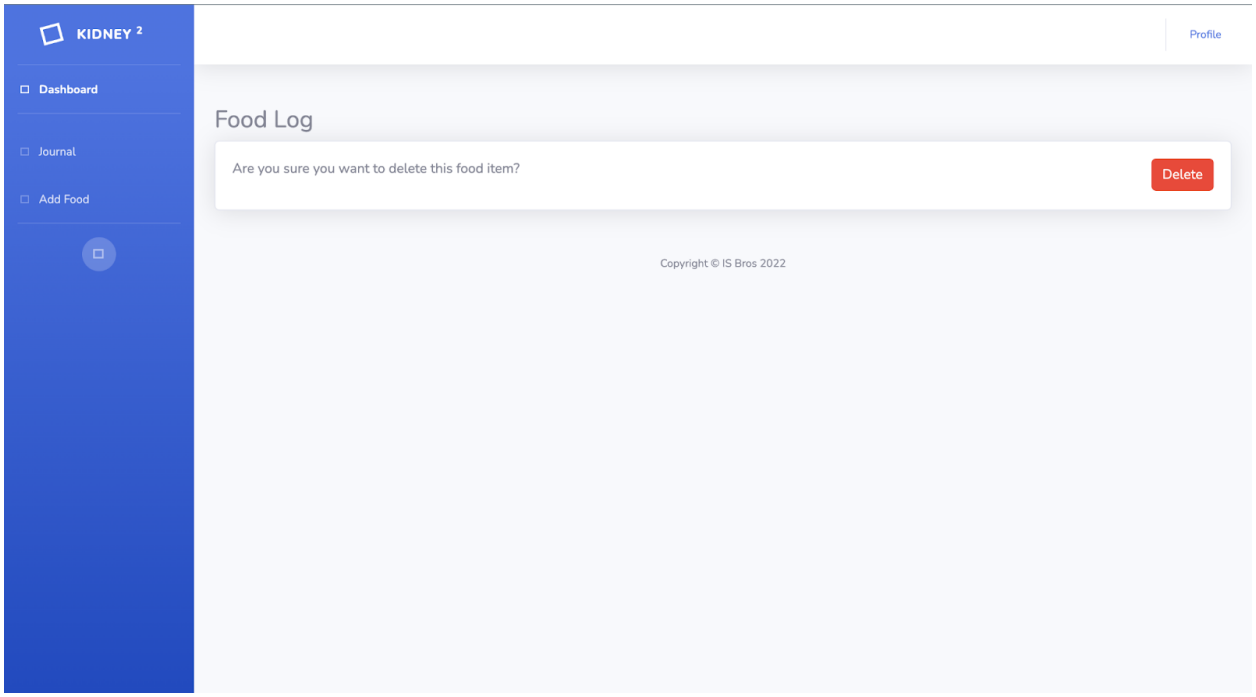
Add Food

The Add Food page gives the user the ability to add a food of their own to the database. The form will ask for the food's name and its micro and macronutrient levels to adequately store it in the database.



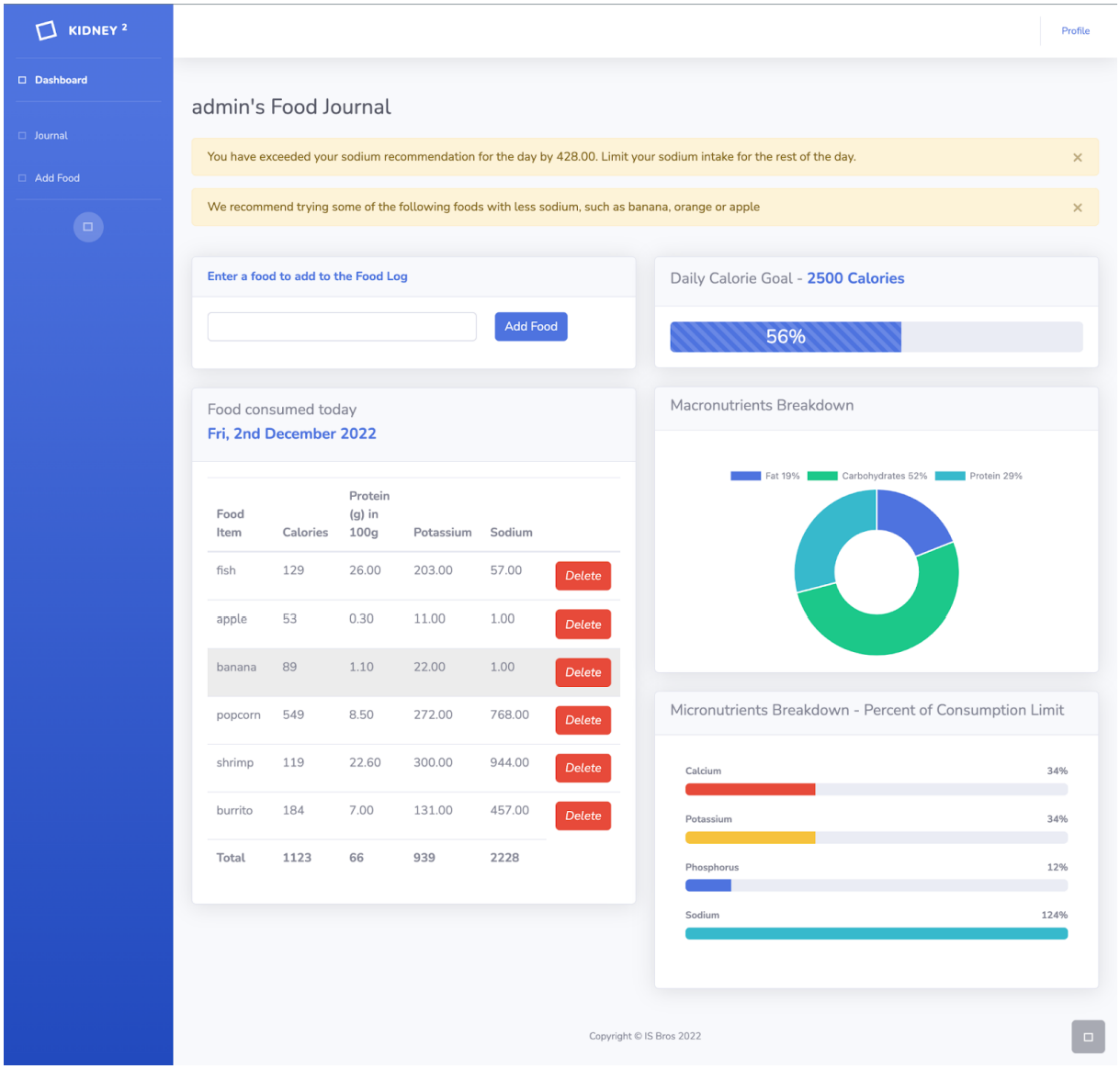
Delete Food from Log

This functionality allows the user to delete an item from their daily food log. By selecting the ‘Delete’ button on the Journal page, they are redirected to the following page which confirms their delete request. By confirming the request the food item is deleted from the log.



Journal

The Journal page provides the user with a summary of their daily food intake for the current day. The user can search for foods to add to their journal everytime they eat throughout the day. It also displays their macronutrient breakdown and Daily Calorie Limit. These visualizations are dynamically updated as the user adds a food item to their journal. This page will also alert the user when they select a food item that will exceed their daily potassium or sodium limit and if a given food has a high amount of a given nutrient. It will also suggest foods that they have already eaten that are lower in either sodium or potassium to help balance the user's diet.



FUTURE USER RECOMMENDATIONS

As shared by members of the HealthUnlocked online community in response to our online post asking for system recommendations and desired features:

- “In my experience, it should start with a Goal. For example, if my potassium is 5.2. How much potassium I can take. Or mg or Na. Make this app more useful for the success than a generic one which already available. A doctor or dietician's advice will be needed.

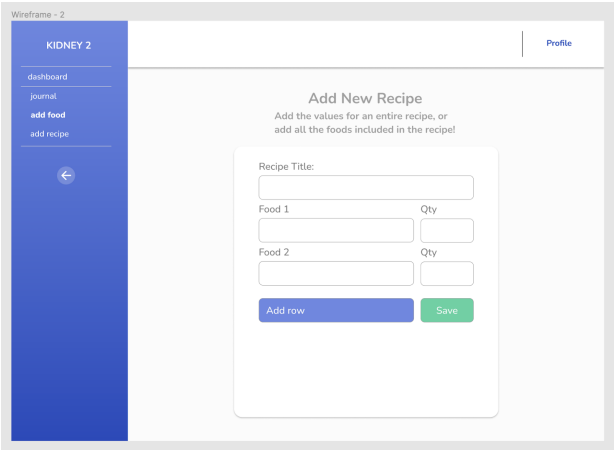
  This app should have Age, weight, current potassium , mg, na, etc level. Based on the level it should advise the daily max consumption of each. For example, based on GFR values one cannot have more than 500 mg of sodium.

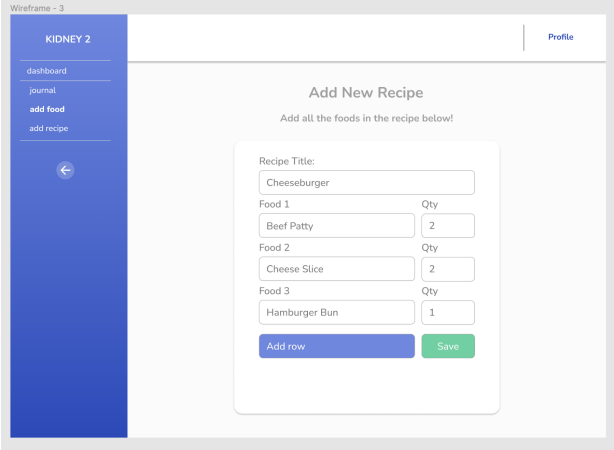
  Add food intake for the day and quantity and it should calculate the total consumption behind it. No app does this today.”
- “Some things that would be nice in an app of this type. Obviously it needs to try all the minerals and salts that we intake and need to watch for ckd. As contributing factors to ckd are diabetes and high blood pressure, it should be able to track blood glucose levels and bp taken at home. The ability to scan barcodes to enter foods. Also for those of us who prefer to cook our meals from scratch, the ability to enter our recipes and have the app calculate the nutritional values.

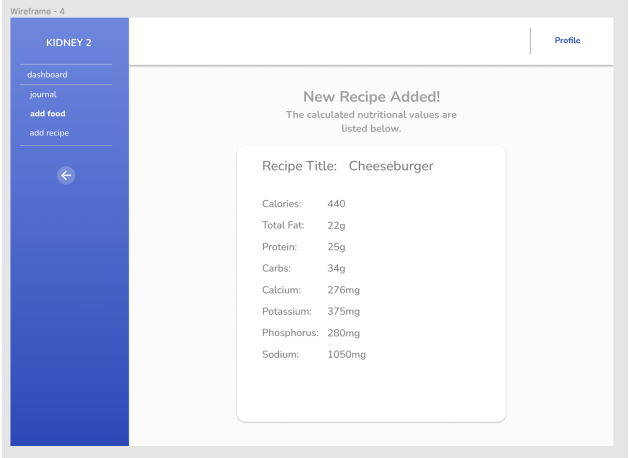
  I have osteoarthritis in just about every joint in my body. The only way I am able to track food is that I can speak my food into the app. It would be wonderful if I could speak in my recipes to be able to better track the food.”
- “I am keeping track of fluids (easy), sodium (relatively easy) and protein (more difficult as you need to weigh things, but particularly difficult with homemade foods, such as pasta dishes, stews, chili, etc).”

LOOKING AHEAD

With the feedback received above, we have big plans moving forward. A major feature that many potential users have expressed interest in is the ability to create custom recipes. The wireframes below demonstrate how we plan to implement this feature. A user would be able to add individual foods that make up a recipe, and the website would calculate the total nutrient values for the recipe and save it to the database.







WORKS CITED

- FoodData Central: https://fdc.nal.usda.gov/
- Bobby: https://github.com/BobsProgrammingAcademy/food-tracker
- Railways: https://dev.to/mr_destructive/django-postgresql-deployment-on-railway-app-d54
- https://www.youtube.com/watch?v=NUqtNglEcCU
- Keys: https://docs.github.com/en/authentication/connecting-to-github-with-ssh/generating-a-new-ssh-key-and-adding-it-to-the-ssh-agent#generating-a-new-ssh-key
- API Ninja: https://api-ninjas.com/
- Wages: https://www.salary.com/research/salary/recruiting/web-developer-hourly-wages#:~:text=The%20average%20hourly%20wage%20for,falls%20between%20%2428%20and%20%2438.
- Forum: https://healthunlocked.com/nkf-ckd/posts/148827779/seeking-feedback-for-a-project?responses=148833358
- Cost Estimations: https://ims-web.com/7-steps-to-help-you-calculate-your-estimated-project-duration/#:~:text=When%20you%20build%20a%20schedule,by%20the%20number%20of%20resources.
- The National Kidney Foundation: https://www.kidney.org/