MYMENU: AN AI-BASED WEEKLY MEAL PLANNER

Matthew Lawrence Christy

Vandana Srinivasan

Drexel University: College of Computing and Informatics

INFO-693-001 / Fall Term 2022-2023

Dr. Timothy Gorichanaz

November 20, 2022

INTRODUCTION

The current market for AI-based diet and meal planners incorporates AI in various ways. However, none are dynamically adaptable based on goals, preferences, and activity. We introduce myMenu, an AI-generated weekly meal planner that considers lifestyle goals, activity, and food preferences. This is achieved by a user-friendly application that resides on standard mobile devices using a supervised learning model-based AI that references pre-labeled data derived from food databases that include ingredient lists, recipes, caloric values, and macro and micronutrients. The AI learns the user's preferences, provides them with user-centric meal plans that offer interest and variety and ensures that users achieve their goals. The supervised AI also considers metabolic changes that may not be addressed with mere consistency and user-based tracking to provide a higher probability of attaining their goals.

The following sections describe the supervised AI prototype, the UI/UX prototype, and a discussion of how testing with user profiles (personas) in both the application and the decision tree led to modifications in the design. Finally, we deliver our final thoughts, considerations, and any pitfalls of our proposed design.

SYSTEM AND AI PROTOTYPE

As mentioned above, myMenu uses a supervised AI model. The machine learning algorithm uses the user's static and dynamic user data along with pre-labeled derived from food databases to deliver a weekly meal plan. Static data includes gender, age, weight (can be automatically updated via Smart Scale), height, specific diet options (such as Keto or Low-Carb), a section to define food allergies or general dislikes, how many times a day the user eats, and the user's weight goal. The system also allows the user to select an initial exercise/activity.

myMenu also utilizes the user's dynamic data. Dynamic data includes calories burned via updated biometrics from a smartwatch or step counter (Apple Watch, Fitbit, etc.) to measure the user's actual activity, along with providing the user a way to tell the AI that they don't like a specific meal recipe.

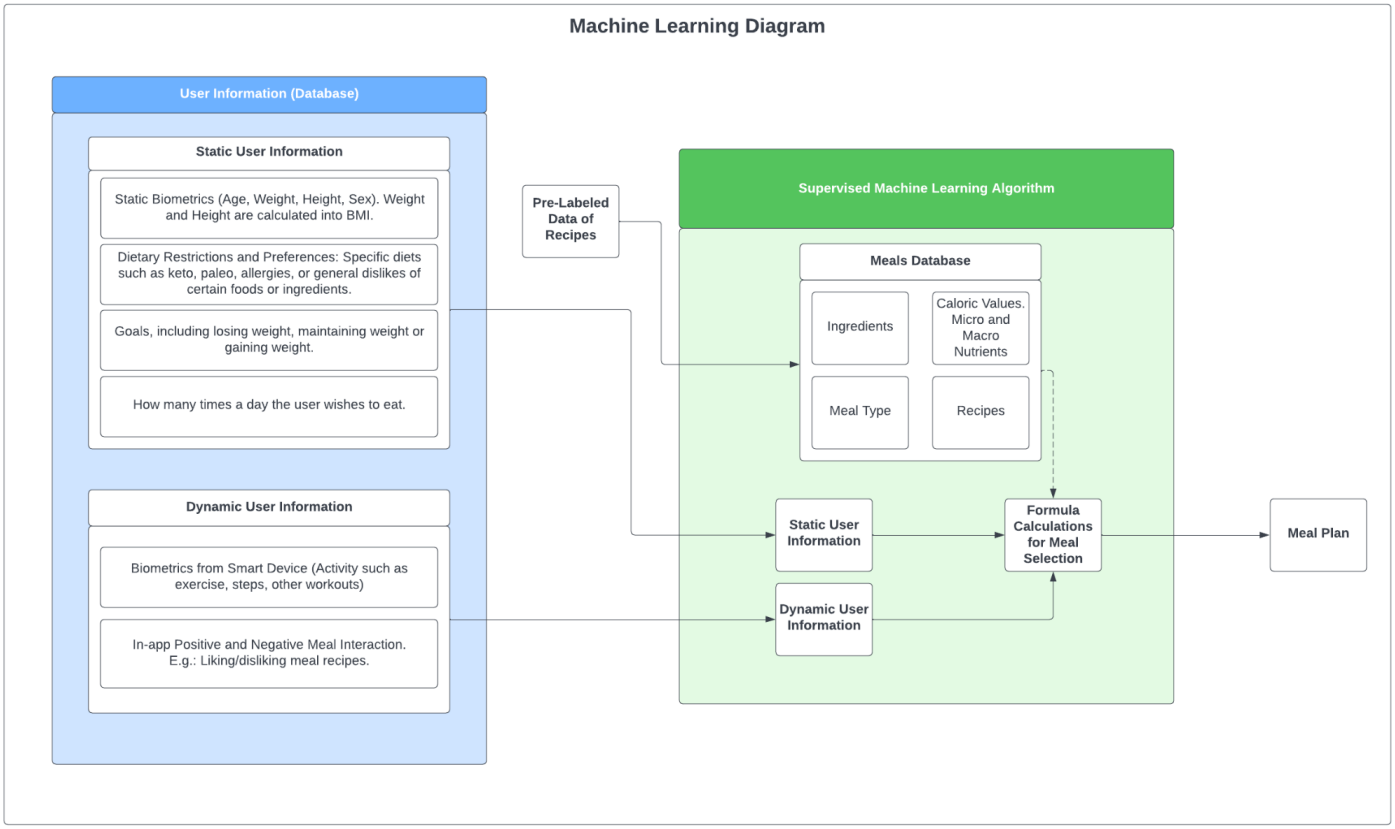

Figure 1: Machine Learning Diagram

Some initial calculations must be considered before the AI can build meal plans. First, the AI needs fundamental values to determine the person's caloric requirements. The standard Basal Metabolic Rate (BMR) equations for men and women are used: (Wright, n.d.)

- **Women:** BMR = 655 + (4.35 X weight in pounds) + (4.7 X height in inches) – (4.7 X age in years)
- **Men:** BMR = 66 + (6.23 X weight in pounds) + (12.7 X height in inches) – (6.8 X age in years)

Next, the system uses the dynamic activity data from the activity tracking biometrics reported by the user's smartwatch. This determines which category below the user should be placed in for their caloric requirements in relation to the user's goals. For instance, the following equations are used for the "Maintain Weight" goal in the user's static data section: (Wright, n.d.)

- **Sedentary (little or no exercise)**: BMR X 1.2 = daily calorie needs

- **Lightly active (light exercise one to three times a week)**: BMR X 1.375 = daily calorie needs
- **Moderately active (moderate exercise three to five times a week)**: BMR X 1.55 = daily calorie needs
- **Very active (hard exercise six to seven times a week)**: BMR X 1.725 = daily calorie needs
- **Extra active (very hard exercise/sports/physical job)**: BMR X 1.9 = daily calorie needs

The values in the equations are adjusted accordingly for weight gain or weight loss goals. Using these calculations and the user-defined meals per day, the AI navigates a decision tree to determine the appropriate meal recipes to recommend for users by referencing the pre-labeled database. The end result is a weekly meal plan specific to the user's biometrics and goals.

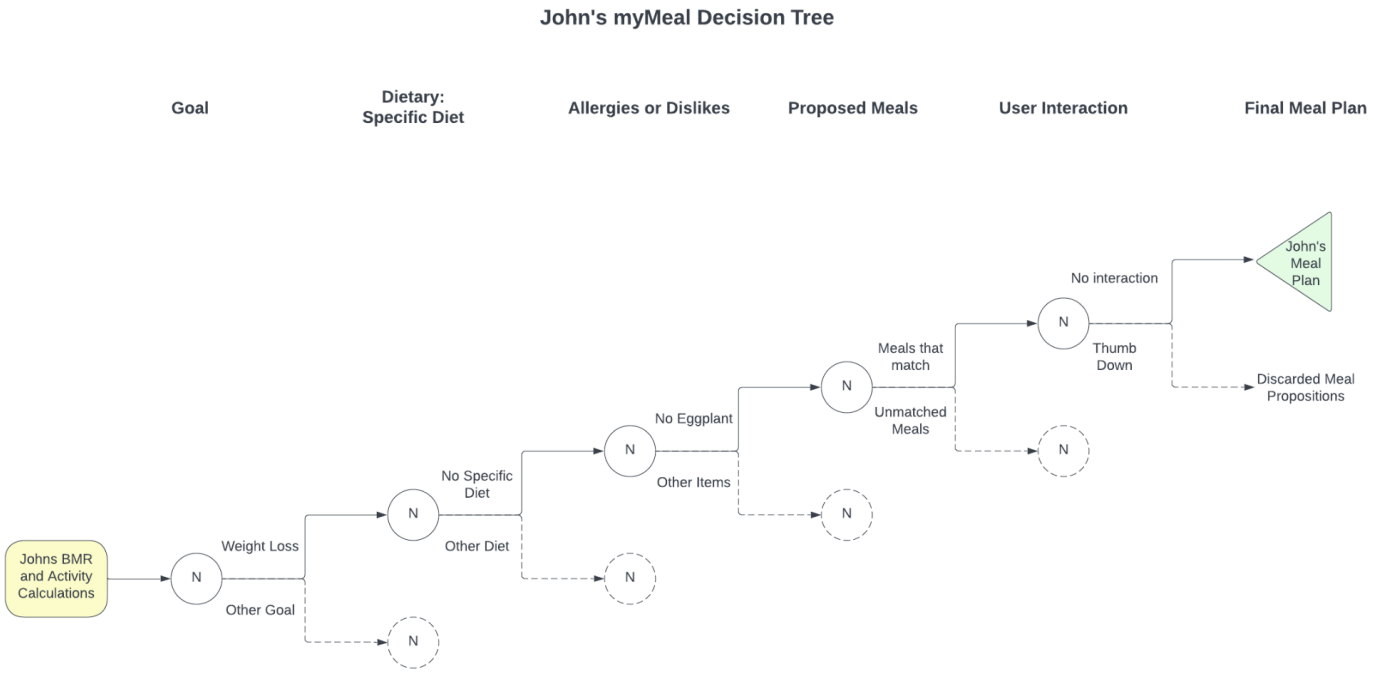

Figure 2: AI Decision Tree

Dynamic data further train the AI in the form of actual activity via dynamic biometrics and user feedback. The user can dislike a meal recipe in the meal plan. Once the user dislikes a recipe, they are presented with a dialogue that asks a few basic questions so the machine can better learn why they disliked it. They can select the meal category the recipe is attached to (e.g., soup) or specific ingredients. The AI will use this data when considering future meal recipes in

the meal plan. Once the user is done, the AI and system pull the disliked meal recipe out of the meal plan and insert a new one based on past and current user preferences (static/dynamic).

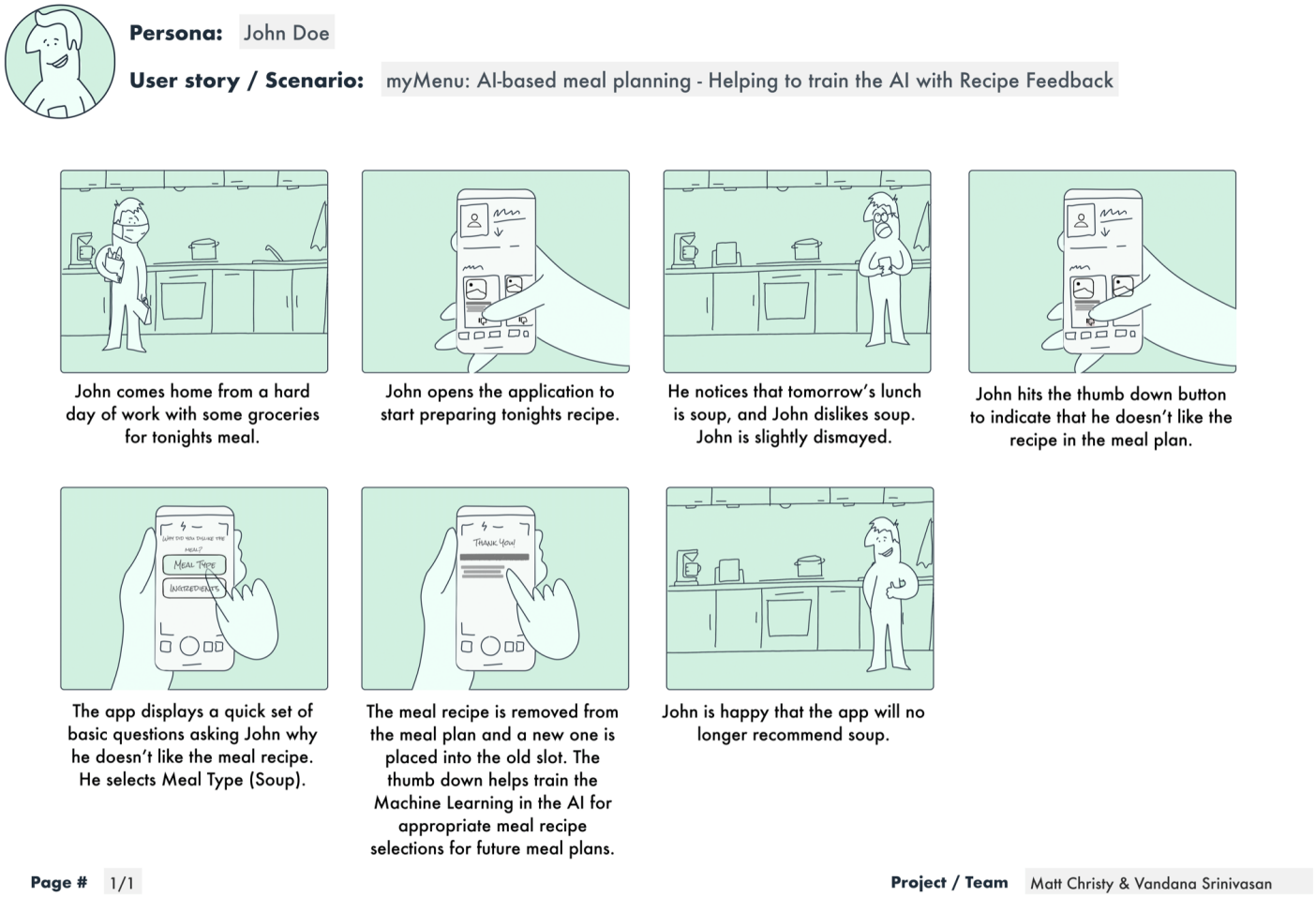

Figure 3: John's Story: Teaching the machine not to recommend soup.

UI PROTOTYPE

For the UI, we prototyped two of the three sections in the myMenu application: myMeals and myProfile. myCommunity wasn't prototyped as it doesn't involve AI or machine learning and is an in-app motivational tool to be considered for the community of users of myMenu. These three sections are accessed by the toolbar at the bottom of the myMenu app. We used our previously mentioned user profile (persona) for the prototype, John.

The app always opens to the home screen, which has a daily motivational quote to help inspire the user and keep them consistent with their goals.

Figure 4: myMenu Home Screen with a motivational quote

MYPROFILE

In myProfile, users enter some initial data: their name, their birthdate (that determines age), gender, height, weight, any allergies or specific dislikes of ingredients or food, their initial activity level, their goal, any particular type of diet (e.g., Keto), and how many meals per day they prefer. Users may edit any of these settings at any time.

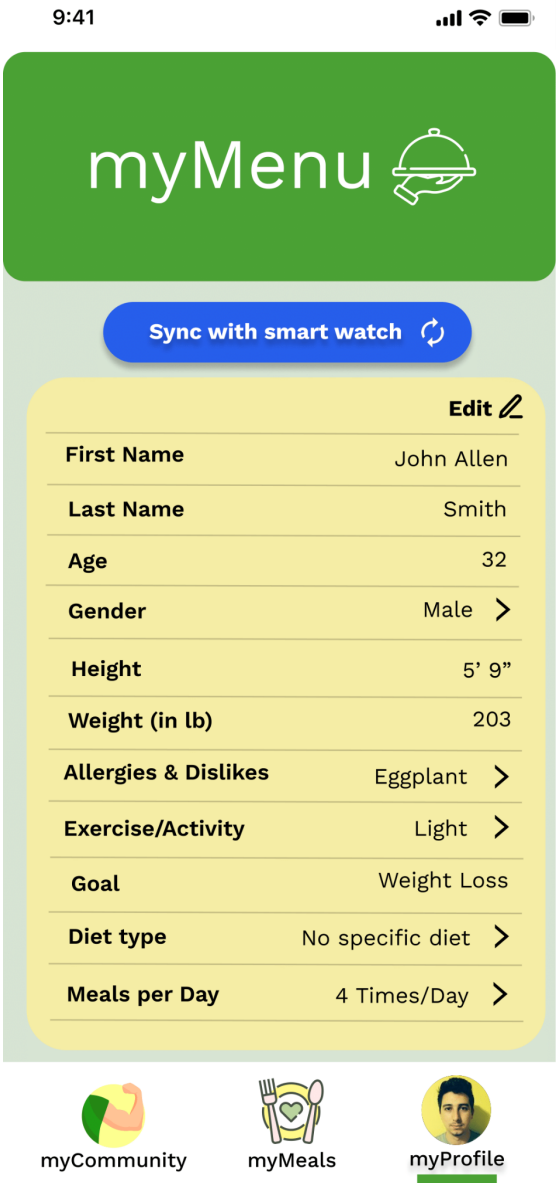

Figure 5: myProfile section of myMenu

MYMEALS

myMeals shows the weekly meal plan generated by the AI. The UI is scrollable, and tapping on a meal will reveal its recipe card. Users can use the thumbs-down button in the weekly meal plan or the recipe card to tell the app they are dissatisfied with the meal selection.

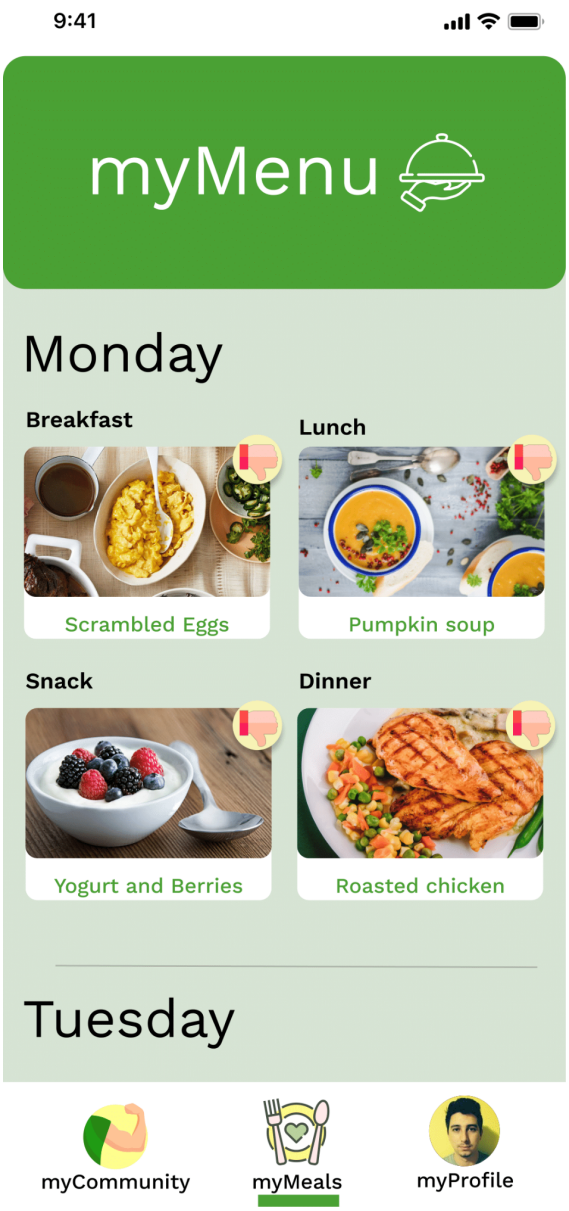

Figure 6: myMeals weekly meal plan view

Figure 7: myMeals Recipe Card for Pumpkin Soup

Once the user marks the meal as disliked, the app displays a series of questions for the user to answer to help the AI learn more about the user's meal preferences. Users can select either the meal category (Soup) or specific ingredients.

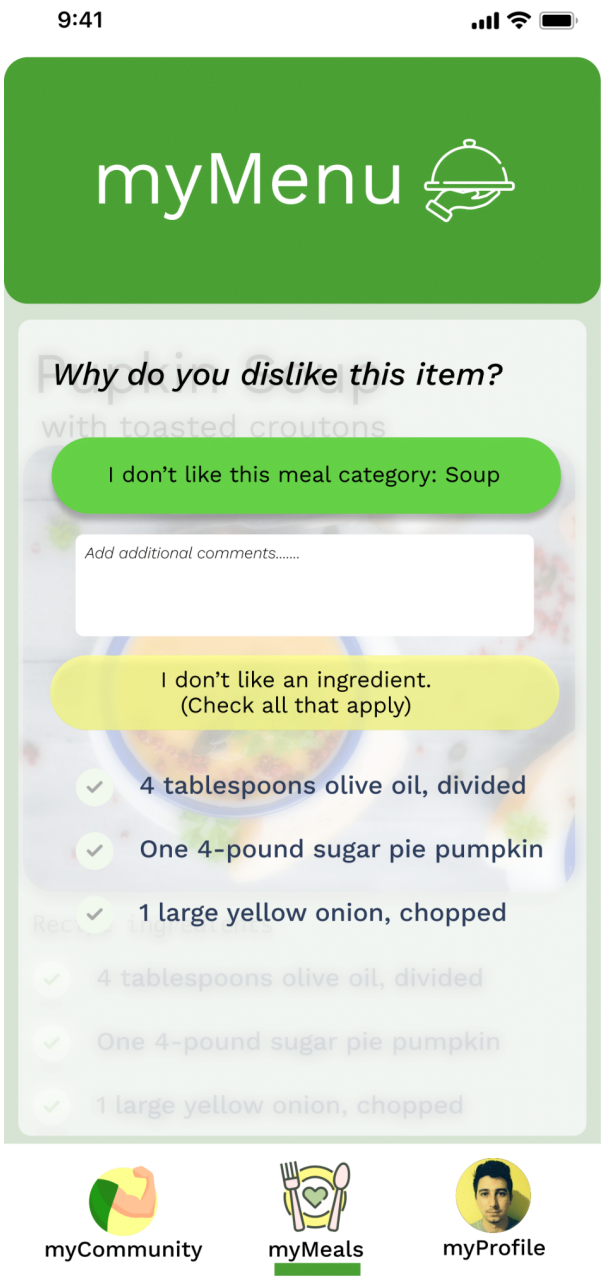

Figure 8: myMeals Dislike Selection: Meal Category (Soup)

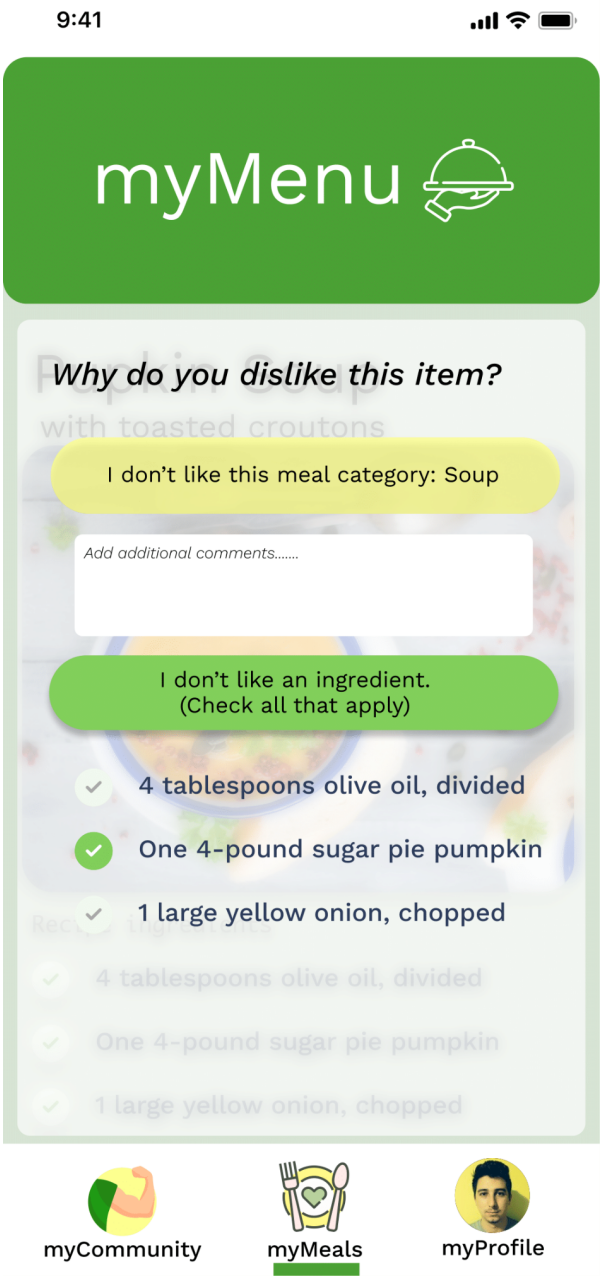

Figure 9: myMeals Dislike Selection: Ingredient (Pumpkin)

The AI then references past and present preferences, queries the pre-labeled database, and generates a new meal in the old slot.

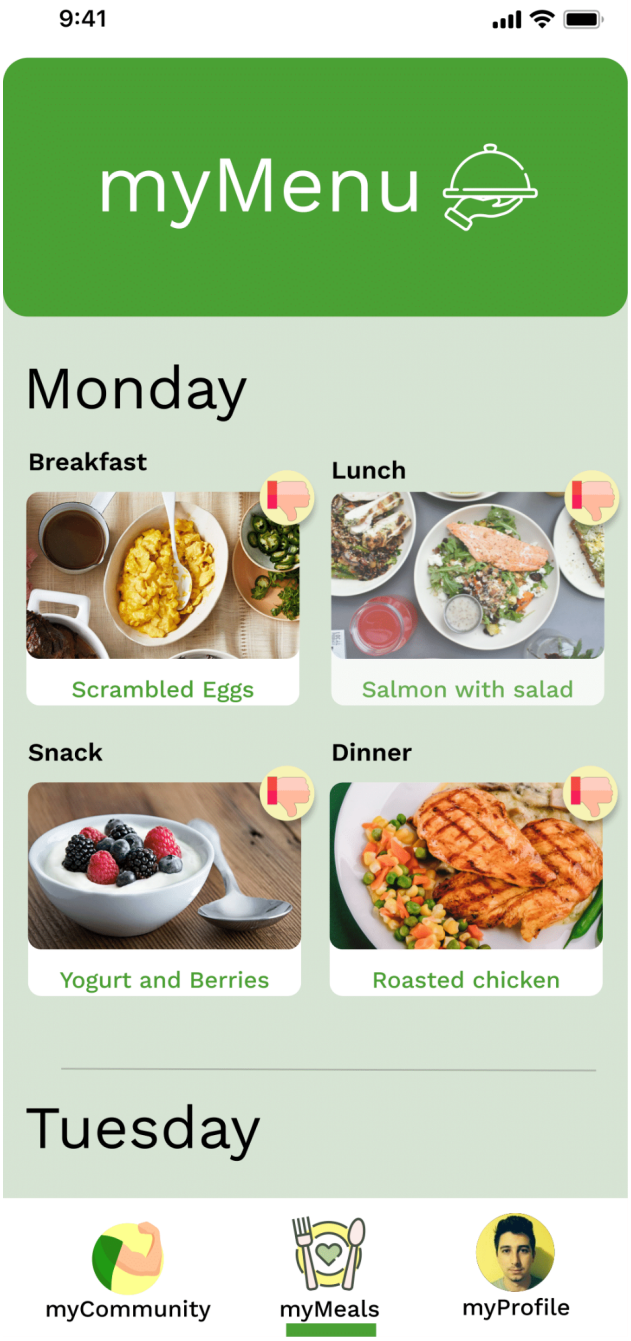

Figure 10: myMeals Updated Weekly Meal Plan: Salmon Salad

EVALUATIONS, FINDINGS, AND DESIGN CHANGES

Evaluations were conducted by developing three user profiles (Tables 1-3). Each user varied in their "static" and "dynamic" data that our AI uses to build their customized weekly meal plans.

John				
Static Data				
Initial Biometrics	**Gender**	**Age**	**Height**	**Weight**
	32	Male	5' 9"	203
Specific Diet	None			
Allergies or Dislikes	Eggplant			
Exercise	Lightly Active			
Goal	Lose Weight			
Times/Day	4			
Dynamic Data				
Calories Burned	*Detected via Smart Watch*			
Dislike Information	*Controlled through thumb down*			

Table 1: John's Data

Suzie				
Static Data				
Initial Biometrics	**Gender**	**Age**	**Height**	**Weight**
	26	Female	5'7"	140lb
Specific Diet	Keto			
Allergies or Dislikes	Peanuts			
Exercise	Moderately Active			
Goal	Maintain Weight			
Times/Day	5			
Dynamic Data				
Calories Burned	*Detected via Smart Watch*			
Dislike Information	*Controlled through thumb down*			

Table 2: Suzie's Data

Jan				
Static Data				
Initial Biometrics	**Gender**	**Age**	**Height**	**Weight**
	42	Female	5'6"	120lb
Specific Diet	Low-Carb			
Allergies or Dislikes	Mushrooms			
Exercise	Sedentary			
Goal	Gain Weight			
Times/Day	3			
Dynamic Data				
Calories Burned	*Detected via Smart Watch*			
Dislike Information	*Controlled through thumb down*			

Table 3: Jan's Data

To start, we used the user data sets in the decision tree to ensure that the flow of the logic and decision-making would theoretically work. We found that the first iteration of our decision tree needed some adjustments.

The first adjustment focused on the actual static and dynamic biometric data. We had an oversimplified idea of how this would work, but as we began to build a tree, we noticed how

we needed to define some data more granularly. At first, we built exercise (activity) and BMI matrices that the AI would reference when navigating the decision tree. As we navigated the tree using the profiles, we realized that the biometrics and activity weren't decisions to be made in the tree but calculations the tree should consider in relation to the user's defined goals and dietary preferences. We shifted to the industry standard equations for calculating BMR and caloric requirements based on user activity levels, as previously outlined in the System and Prototype section.

Second, we initially proposed using "Meal Schedule" as a node; however, it was determined that it should be left up to the user to decide the timings of their meals. Allowing the users to schedule the timings of their meals will enable accommodation for user-specific concerns such as schedules. As we were adjusting this, we also noticed that we hadn't considered how many meals per day a user might want to eat, so we included it as an option in static data for the AI to use when building the meal plan.

The last adjustment was the final three decisions of the tree. We wanted to include a mechanism where a user could dislike a proposed meal in the plan; this would help the AI learn what to recommend to the users. For simplicity, the basic setup of the user profiles asks users for ingredients they may not like or allergies, but it doesn't consider any other preference. Therefore, we implemented a "dislike" button in both the weekly meal plan summary and the individual meal recipe cards. If users dislike the item, they are presented with an option as to why. They can select a specific ingredient or meal category (Pasta, Soup, etc.) The AI will use this data as additional learning information (dynamic data) to prevent future recommendations from including the criterion the user selected.

FINAL THOUGHTS AND IDENTIFIABLE PITFALLS

Determining how the AI would specifically work and developing a decision tree was a little difficult for us. We have a general idea of how AI works, but actually applying it to a design seemed arduous. Having more experience or perhaps taking an AI class before this might have helped with this design aspect. Designing the AI in relation to HCI/UXD wasn't as tricky.

We also acknowledge some user segments that the design excludes, requiring future considerations for those segments. One segment could include people with specific medical conditions, such as diabetes, where the AI would need to consider users' insulin levels in relation to diet and goals. This may be included in the calculations by using modern-day smart insulin monitors. Another segment might be the trans, or transitioning communities, where

identifying as one gender over another would also affect the calculations of calories in relation to their goals.

Overall, we believe the design is a possible start to an actual product. Obviously, the design requires accurate AI and UXD testing, as there are likely variables and considerations we haven't thought of, which would be tackled in iterating the design. However, we are confident that using dynamic biometric data will help ensure users have good meal plans that meet their caloric needs for their specific goals.

REFERENCES

Centers for Disease Control and Prevention. (2022, June 3). *About adult BMI*. Centers for Disease Control and Prevention. Retrieved November 19, 2022, from https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html#Interpreted

Eikey, E. V. (2021, September 24). *Effects of diet and fitness apps on eating disorder behaviours: Qualitative study.* BJPsych Open. Retrieved October 28, 2022, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8485346/

Henderson, R. by E. (2021, February 24). *Low-income families have high awareness of healthy diets but can't afford good quality food*. News Library of Medicine. Retrieved October 28, 2022, from https://www.news-medical.net/news/20210224/Low-income-families-have-high-awareness-of-healthy-diets-but-cant-afford-good-quality-food.aspx

Sadlier, A. (2020, January 13). *Many Americans lie about working out to convince someone they're busy.* New York Post. Retrieved October 17, 2022, from https://nypost.com/2020/01/13/a-lot-of-americans-lie-about-working-out-to-convince-someone-theyre-busy/

Wright, V. (n.d.). *How do I know how many calories I need per day?: Calories*. Sharecare. Retrieved November 19, 2022, from https://www.sharecare.com/health/calories/calories-need-per-day