

INVENTory

Project Report Part 3

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1. Introduction

The grocery inventory tracker for the consumer home helps users plan meals that are cost-effective and nutritionally balanced while it presents opportunities to discover new food combinations through encouraged exploration.

At the application's core is an inventory list that tracks stock levels of various ingredients in the user's refrigerator and pantry. The inventory can be input through multiple channels to maximize the system's flexibility and utility for users unwilling to count items due to limited time, cost or personal motivation.

The application seeks to decrease the time and effort that smart food planning currently requires, and minimize people's aversion to the process. Its fun and usable interface occupies a position that could change behaviors with far-reaching consequences. Such behaviors include decreased agricultural waste, increased culinary literacy, and fulfillment of a more sustainable lifestyle.

To address the overwhelming feeling of uncertainty that novice cooks might feel as a result of low exposure to cooking resources or access to help in the past, the application guides users with prompts to select ingredients they currently own. Self-assured users who are more comfortable planning meals can bypass the option to search by ingredient and search recipes directly. The application delivers a high-value overview of possible combinations sourced from recipe databases. These combinations are filtered by criteria that users already use to narrow the array of recipe options: budget, nutritional value, or dietary restrictions. This information is displayed near the recipe, providing users with more control over their personal diet, and relieving the cognitive load that this granular selection normally requires. Recipe search results are arranged to help users make decisions about what to prepare from pre-owned goods, or reveal new combinations that could be prepared with a few more ingredients.

Beyond inventory tracking, the system maintains configurable dietary profiles so users can compare personal goals with recipes' nutritional value. This information helps users with low nutritional literacy make decisions in support of balanced diets tailored to their tastes.

Requirements Summary

1. Monitor current grocery inventory by quantity.
2. Prepare shopping lists for the next grocery restock
3. Aid with meal planning by suggesting recipes based on users' current inventory.
4. Dynamically filter recipes based on nutritional information, cost, and ingredients.
5. Convey recipes' nutritional value with graphical representations.

2. Final Design Summary

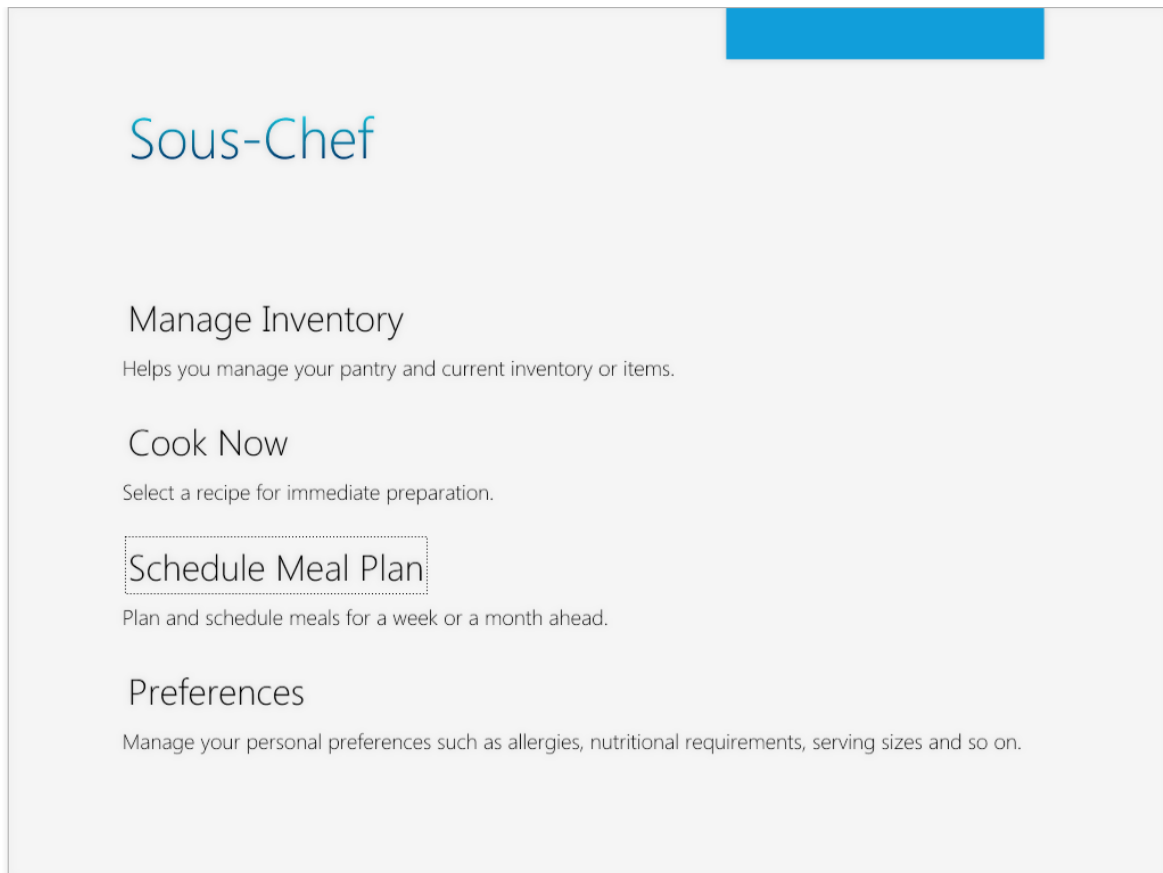


Fig 1: Home Screen

For our final design, we chose a modified version of the Sous-Chef app, which was proposed as one of the alternatives during Part 2 of our project. This design features a step by step, guided approach to meal planning, abstracting complexity by splitting up larger tasks into smaller steps.

The screenshot above, (Fig 1) depicts the Home screen that the user encounters when he starts interaction with the application. All the major use cases of the application are immediately visible to the user, along with instructional text for each link which describe the tasks.

The screen designs are all specifically tailored with a touch screen as the target design. Consequently all the links, buttons and options have sufficiently large hit-boxes. Most screens do not require any kind of text entry, instead relying on alternative input mechanisms such as sliders for numeric values, and large sets of options to reduce free text input. However in the few situations where text input is required (such as filters or creating new profiles), the application will immediately pop up a virtual keyboard to enable text entry.

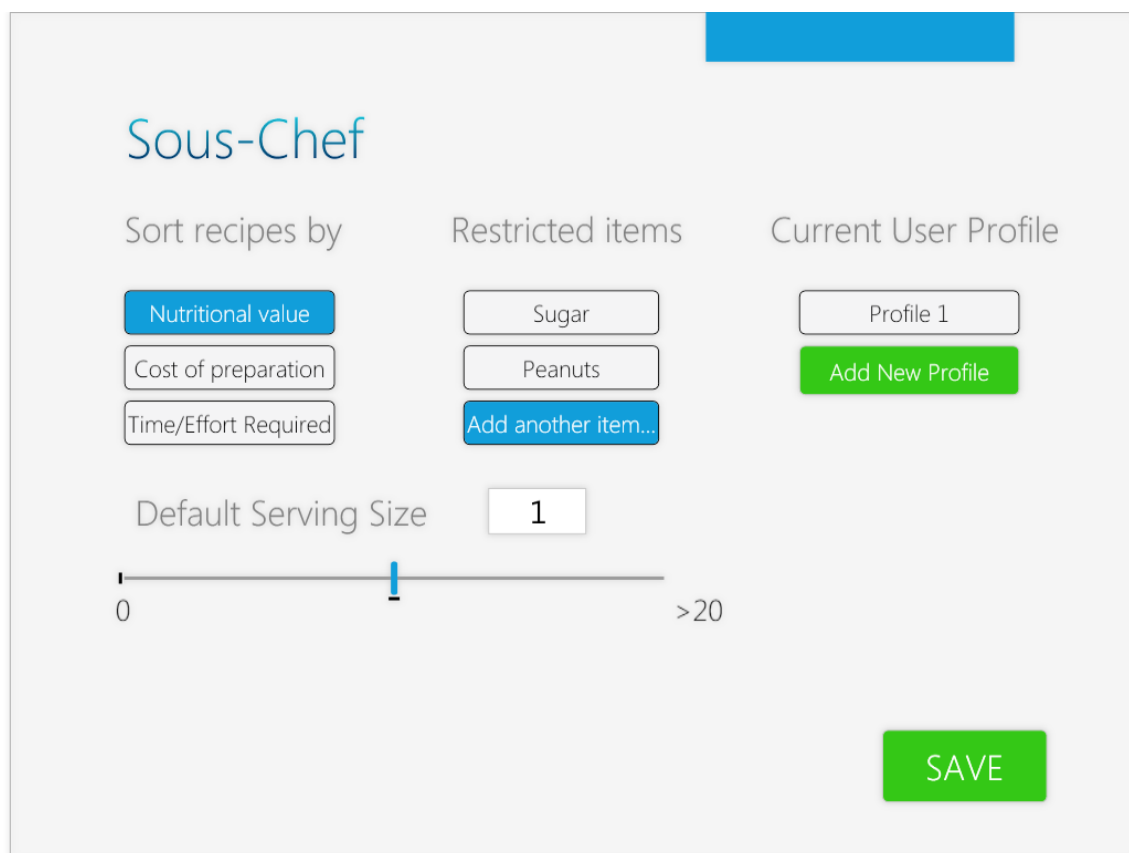


Fig 2: Preferences

The preferences screen (Fig 2) allows the user to set his default preferences and restrictions that the app should use when displaying recipe suggestions. Additional options can be found under

the profile creation and editing screen, where user can specify much more granular values individual nutrients. (such as allowed fat, sodium and so on)

The design is built to reduce complexity, even when performing complex tasks such as recipe selection (Fig 3 and Fig 4). Most applications try to provide too many options which can at times make the process overwhelming for the user. In our approach we split up the options across multiple screens which have fewer options. The application also tries to be intelligent about the options that it suggests to the user based on his preferences that he has already set up as a part of his profile.

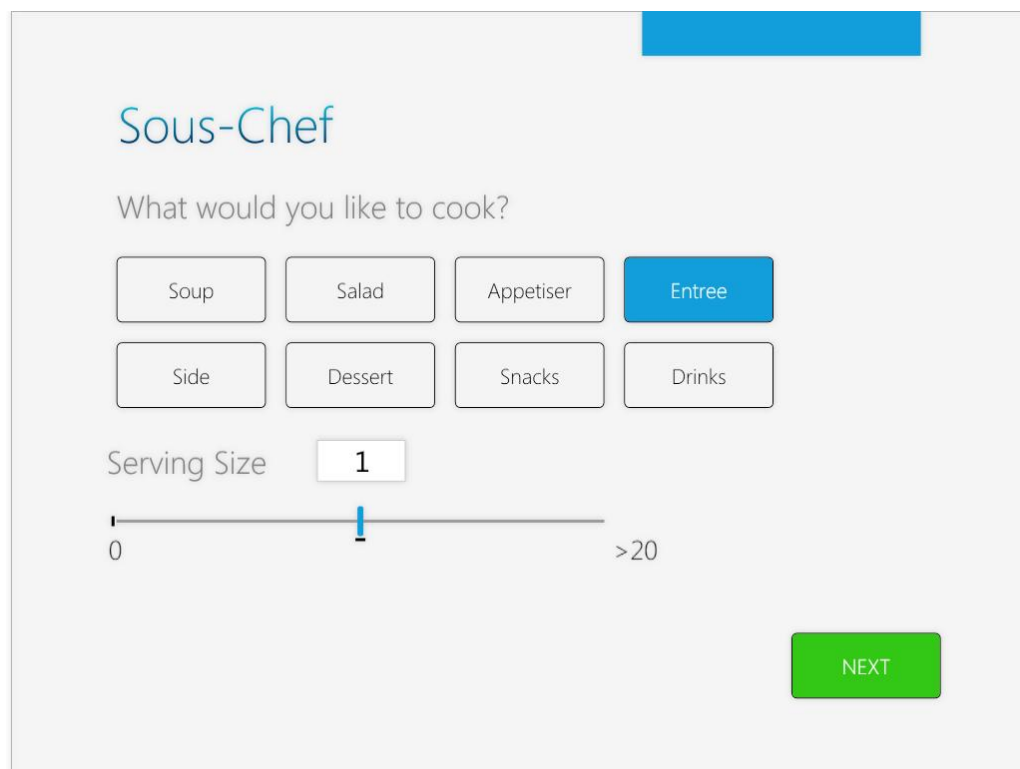


Fig 3: Recipe selection - I

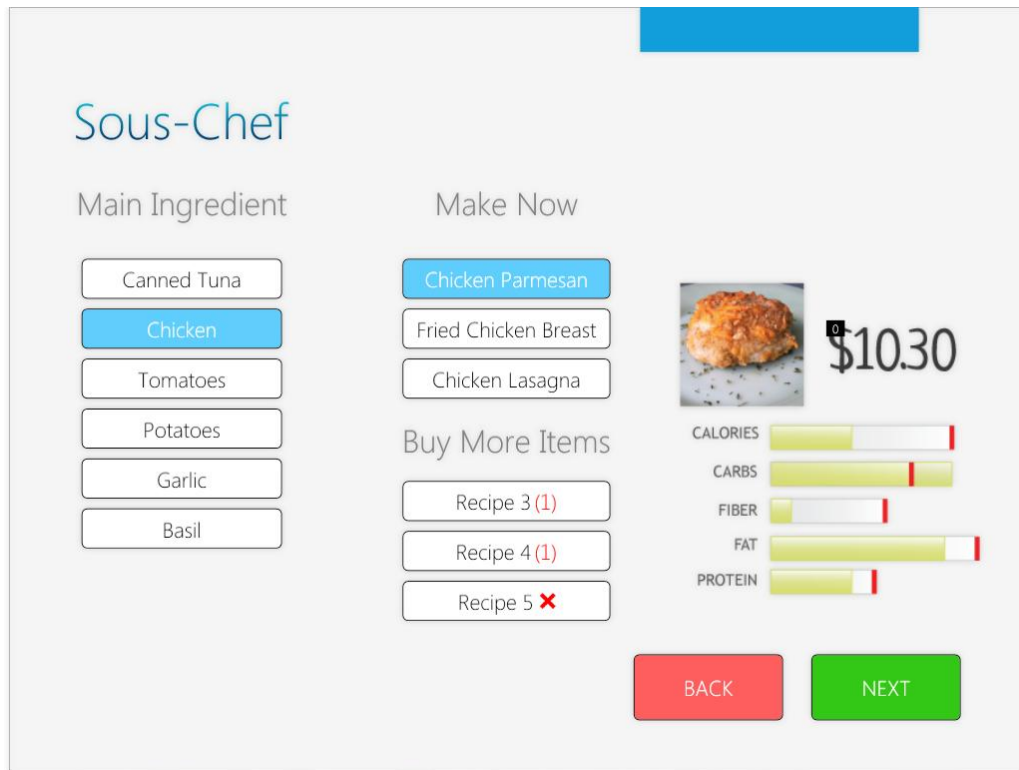


Fig 4: Recipe Selection- II

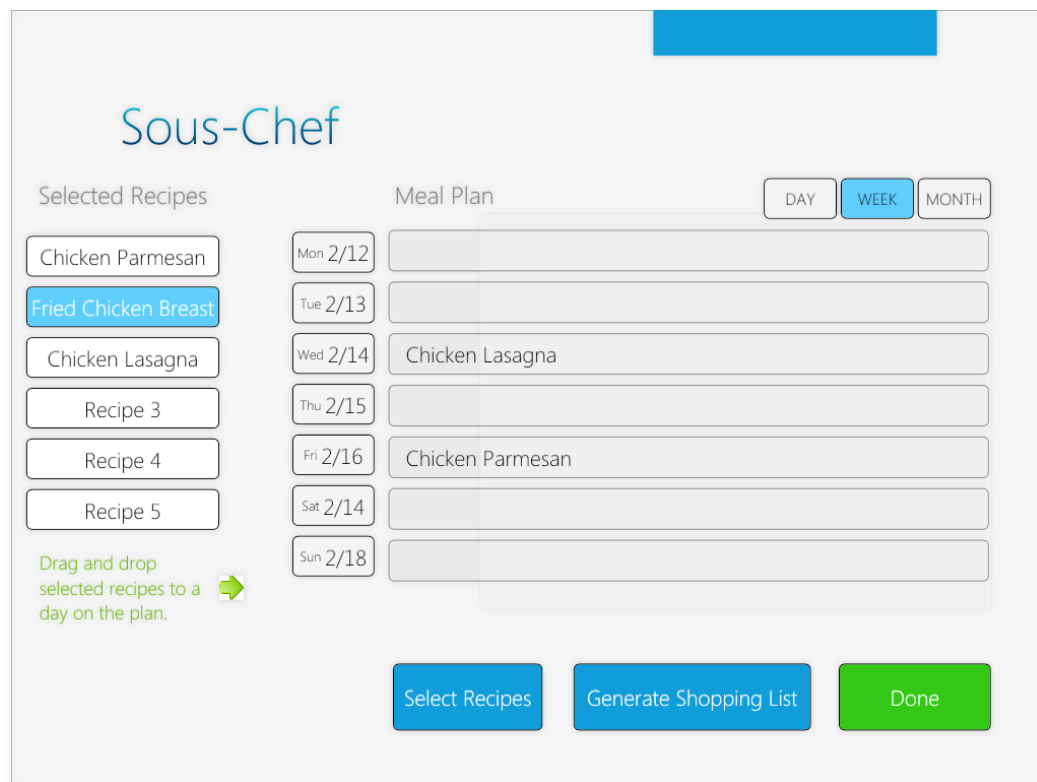


Fig 5: Meal Planning

This design also allows for Meal Planning and Shopping List generation for users who are more focused long term planning and management of their dietary habits. The calendar views allow the user to switch between daily, weekly or monthly views where the user can create his recipe lists and quickly generate a shopping list which can be either printed or sent to an email for later retrieval.

In conclusion, this app design aims to strike a balance by providing support for both novice users with limited cooking and planning expertise through easy recipe selection wizard, as well as sufficient power for advanced users to plan and manage their inventory and micro manage their nutritional requirements through their personal profiles, meal plans and preferences.

DESIGN RATIONALE

We chose this design because its Wizard-style interaction model solidifies this application as a learnable and enjoyable kitchen helper. A large number of respondents to our initial questionnaire report a pattern of short-term meal planning, with 85 percent acquiring ingredients for recipes only a few days ahead. This design sacrifices the robust scheduling interface of other proposed designs. However, if we are designing a tool to help short-term planners, and we infer from our interviews that power cooks have already established meal-planning routines, we feel confident prototyping the design that supports the target user population who need more encouragement and structure when selecting recipes for the short term.

This design features the ability to create user profiles that set default serving sizes that limited recipe yields and thus, cost of necessary ingredients. Thus, it's well suited to the needs of our first user group. This group describes one-person households where meals are usually prepared alone, but occasionally with others as a social activity. They have low motivation to plan ahead since they are responsible for no one else's nutritional welfare but their own. However, if they are busy their meals are planned spontaneously. They are highly motivated to save time and reduce cognitive load when selecting what to cook immediately. The Sous Chef design makes recommendations for meals based on the items in the user's inventory without setting explicit criteria (though these criteria are still available for the app's functional comprehensiveness based

on situated behavior in different contexts, such as searching specifically for recipes with chickpeas or without ham if they are cooking for a vegetarian guest). Sous Chef also displays cost and nutritional informational data about each recipe based inform their recipe selections, which respondents indicated as useful information contributing to their ultimate selections. Finally, the design integrates appropriate affordances for the touchscreen medium on which it's deployed: Buttons and input boxes are large.

3. Prototyping Method

The digital prototype is implemented on a laptop computer using Blend. The backend database layer is hardcoded and dynamic information visualizations based on users' recipe selections are simulated with static images. The pantry platform hardware is implemented via an Atmel microcontroller and force sensors that indicate the presence or absence of an object and provide feedback respectively.

4. Prototype

Demonstrated with a cognitive walkthrough on March 28. Revised and demoed with a cognitive walkthrough on April 4.

5. Evaluation Plan

TESTING METHODS

Two members from the group will be present to run each participant. One member will conduct the experiment and prompt the user to complete tasks, while the other will observe facial expressions and take notes during the usability test. This second member will also ensure that testing materials and equipment are available and working. Running the experiment with two group members in the room with the participant will allow one to facilitate the scripted experiment while the other is free to take notes that capture moments when the participant experiences difficulties or satisfaction. Additionally, by limiting the number of experimenters in the room, we take precautions to protect participants privacy participants and ensure confidentiality to the best of our ability.

Upon their arrival at the GVU usability lab, participants will be briefed on the nature of the experiment, sign a consent form and begin the experiment. The experiment consists of a number of tasks to carry out the four use cases of the Sous Chef application (Select a recipe to cook, manage inventory, add a nutritional profile, and assemble a meal plan). Each participant will be prompted to complete tasks in a different order. By consciously mixing the sequence of tasks participants are asked to complete, we hope to counterbalance any order effects that might skew the data to suggest certain tasks are easier than others when the cause might simply be prior exposure to similar functions in the course of the experiment.

Participants will be read a scripted set of prompts in order to ensure each participant gets equal treatment and reduce external factors introduced by variation in experimental procedure than lead to certain participants exhibiting faster times to completion because the experimenter deviated from a script and provided help before the task was completed. Since we are assessing the learnability of the system by measuring time to complete certain tasks and counting the number of errors users make, the participants will be instructed to complete the tasks as quickly as they possible while still maintaining accuracy. We considered asking participants to think out loud, but decided against it on the grounds that the need to explain their process in situ would negatively impact the speed of task completion.

The usability test will end with three minutes allotted to the user to explore the interface on their own, followed by a short questionnaire of Likert scales to gauge subjective levels of satisfaction and measure the quality of the user experience. The opportunity for independent exploration gives the user a chance to navigate between screens; the questionnaire ask their level of agreement to questions about the clarity of language and navigational workflow. To wrap up, we hold a short structured interview to elicit more detailed explanations about their interactive experience and take any suggestions for improvement that the questionnaire did not address.

Sous Chef is a task-based application that helps users through a process they already undertake without the assistance of technology. The questionnaire and interview elicit participants opinions about the utility of the application and whether its functions are comprehensive enough to

support their current needs. We also ask the user to rate their level of confidence that this application would be a useful tool to make informed decisions based on immediate availability of determining factors (cost and nutritional benefits) while selecting recipes.

The session will be conducted in the GVU Usability Lab. It will be video recorded to get confirm quantitative metrics (times to completion and error counts), and to capture participants verbal and bodily feedback for insight into the quality of user experience at certain points in the program.

SCRIPTED INSTRUCTIONS

This section holds the script that will be read verbatim to participants during our usability test. *Prompts are in italics, and should not be read aloud.*

Setup:

<place video camera so it records the user's hands and screen. Cue it up, but do not start recording.>

<open the meal-planning application.>

*<Place **milk** carton on shelf near computer. Place **peanuts** near the shelf, but not on it.>*

<Have cue cards handy and in order for the particular participant>

<Place questionnaire face down on a table nearby.>

<Check that you have the sheet of interview questions.>

Introduction:

<Introduce yourself and everyone in the room. Explain that from here on out, you will be reading from this script so that each participant will be treated the same way.>

<Throughout the usability test, the note taker should record instances when the participants asks for help.>

Thank you for participating in this experiment. Today we will be recording how you interact with this application in order to understand how and where we can improve it. It's important that you understand that we are not testing your ability to use technology, we are evaluating the clarity and usability of the application. This application is designed to help people plan meals over a period of time, based on different criteria.

During the experiment, we will ask you to complete a number of tasks using the application. I will prompt you with the task to complete, which you should carry out as quickly as possible without sacrificing accuracy. The first part of this experiment will be video recorded. Your face will not be recorded, only your hands on the keyboard and mouse as you interact with the system.

We will follow the experiment with a short questionnaire to get your opinions on specific elements of the interface. No audio or video recordings will be taken while you complete the questionnaire.

Then we will hold a short interview to gauge the quality of your overall experience using the interface, and answer any questions you may have. The interview will be audio recorded. Confidentiality is important, so only the four members of our research team and possibly our course instructor will have access to your data, and all data will be coded with a number that cannot be linked to your name. The written questionnaire, visual and audio recordings will not exist for the duration of the study, after which the questionnaire will be shredded and digital audio and video files will be erased.

All in all, our session will take no longer than one hour.

We will begin by asking you to read a consent form. The most important thing to know is that your participation is voluntary and you can quit the experiment at any time with no penalties whatsoever. Your signature is not necessary. By completing the usability test, the questionnaire and the interview, you consent to participate in the study.

Here is the consent form. It is yours to keep. Please take a minute to look it over and ask if you have any questions.

<Give the user their copy of the consent form>

<While they read: maximize the program on screen, begin video recording the keyboard to record time to completion. Synchronize with screen capture.>

Any questions?

<if not, continue.>

Without further ado, let's turn our attention to the program on the screen. I'll be prompting you to complete a number of tasks using the application. Remember, we are **not** testing you, we are testing the application.

Tasks:

First I'll explain the setup.

<Point to the platform>

This platform represents a shelf in your pantry. Items placed on the shelf are added to the application's inventory list automatically, and items removed from the shelf are removed from the application's inventory list. For example, <Name the item on the shelf, ex. a **milk carton**> is currently on the shelf, and will appear in your inventory list within the application.

i. Add item to Inventory

This task involves adjusting your food inventory. You want to add an to your pantry and receive confirmation that the system has completed your request.

Please demonstrate how you would add **peanuts** to your inventory, and tell me when you think the application has understood your request.

<Note whether participant immediately places an item on the shelf, or whether they first manipulate the interface.>

<If participant places an item on the shelf, press the ___ key to simulate feedback from the “networked” device>

<Wait for user to indicate they have received confirmation from the system>

Thank you.

ii. Remove item from inventory

This task involves adjusting your food inventory. You want to remove an item from your pantry and receive confirmation that the system has completed your request.

Please demonstrate how you would remove **milk** from your inventory, and tell me when you think the application has understood your request.

<Note whether participant immediately removes an item from the shelf, or whether they first manipulate the interface.>

<If participant removes the item on the shelf, press the ___ key to simulate feedback from the “networked” device>

<Wait for user to indicate they have received confirmation from the system>

Thank you.

iii. Select a Recipe to Cook Immediately (Select scenario: 1 - Tomato and Broccoli / Calories)

<If the application is not at the home screen, navigate to the home screen>

Imagine that you just got home from your work, you are hungry and your goal is to eat something right away without going to the store. Select the item on screen that you believe will lead you to the next step in accomplishing this goal.

<Wait for participant to make a selection>

<Note errors, or any other difficulties expressed verbally/ through body language>

<place “select scenario 1” cue card where the user can reference it.>

You want to select a main course that contains these two ingredients. Please use the application to search for recipes that fit this description.

<Record time to make selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

Please select the recipe with the *fewest calories* containing these ingredients that you can cook immediately.

<Wait for the participant to choose *tomato and broccoli soup*>

<Record time to make selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

Thank you, we are finished with this task. Please return to the home screen.

iv. Select a Recipe to Cook With More Ingredients (Select scenario: 2 - Cheddar Cheese, Chicken / Cost)

<If the application is not at the home screen, navigate to the home screen>

For this task, imagine that you are on a limited food budget, but you're bored with the food you currently have in your fridge. You're willing to try something new, and you plan on going to the grocery store tomorrow. In this task, your goal will be to select a recipe that you cannot make with the ingredients currently in your pantry.

Select the item on screen that you believe will lead you to the next step in accomplishing this goal.

<Wait for participant to make a selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

<place "select scenario 2" cue card where the user can reference it.>

You want to select a main course that contains these two ingredients. Please use the application to search for recipes that fit this description.

<Record time to make selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

Please pull up the cheapest recipe with these ingredients that you cannot cook tonight.

<Wait for the participant to choose *Cheddar Broccoli Chicken and Mashed Potatoes*>

<Record time to make selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

Thank you, we are finished with this task. Please return to the home screen.

v. Add Nutritional Profile (nutritional profile)

<If the application is not at the home screen, navigate to the home screen>

This application allows you to create user profiles with nutritional goals customized for each user.

<Give the user the notecard with the name of the user and the values for nutritional benchmarks that they should set for this user>

This card lists the desired daily nutritional intake for a user named James. Starting from this screen, please navigate to the screen that allows you to create a new user profile associated with these nutritional goals.

<Wait for participant to make selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

Proceed to enter the given values for each macronutrient, give a name to this user profile and save the information.

<Record time to make selection>

<Record number of errors>

<Note any other difficulties expressed verbally or through body language>

Thank you. This concludes the task. Please return to the home screen.

vi. Assemble Meal Plan (meal plan)

<If the application is not at the home screen, navigate to the home screen>

We will now use the application to search, select and schedule a recipe. Your goal for this task is to schedule a recipe with the following ingredients on the date listed here.

<Give user the cue card with the ingredients and date.>

Find the item on screen that will let you add a recipe to your meal plan for the week.

Once you believe you have found it, proceed with the task of adding any meal with these ingredients to the date listed.

<Record time to make selection>

<Note number of errors, or any other difficulties expressed verbally/ through body language>

Thank you. Please return to the home screen.

vii. Explore the interface (2 minutes)

Please take the next two minutes to explore the application on your own. The questionnaire that follows this exploration will ask your personal opinions about the ease of use and navigation. Please note that the prototype is not fully developed, so certain controls and buttons will not work.

<Give the user two minutes to explore the interface. Do not explain aspects of the interface. If they ask, reply with reflexive questions of your own, like “What do *you* think it means?” or “How might you find this confusing?” The note taker should record insightful responses. >

<After 2 minutes have passed>

Thank you very much. This ends the first part of the experiment.

Questionnaire:

Now we'd like you to complete this questionnaire. It asks about your level of satisfaction and confidence using this application to carry out the tasks you just finished. After you fill this out, we will have a short interview, and at that time you can feel free to explain more about your experience using this application. Take as long as you like.

<turn over the questionnaire on the table>

Interview:

Now we are going to ask you a few questions about your experience interacting with the application. We want to see what you liked and did not like about the design and functionality, and give you an opportunity to explain your opinions in more detail.

Some questions may ask you to recall certain points of interaction using the application. At these points, feel free to return to the application and navigate to particular screens. This time is very informal.

<ask interview questions>

Conclusion:

<thank the participant for their time>

<offer to answer any questions about the application and the experiment>

<show participant out>

CRITICAL USE CASES

1. Select a Recipe to Cook Immediately

Users will be prompted with the name of a common recipe. To complete this use case from the start screen, they will have to identify the navigational menu item that returns recipes. Once on the recipe search screen, they will have to filter recipe search results by

selecting component ingredients. Once they see the specified recipe appear within the list of results, they select the recipe to cook.

This use case will be performed twice in non-consecutive order to assess the learnability of the application.

2. **Manage Inventory**

This use case is subdivided into two tasks:

a. **Add Peanuts to your inventory**

Participants will be presented with a can of peanuts and a flat surface, which represents a pantry shelf. Participants will be told that anything they set on the shelf will be added automatically to their inventory list within the application.

They will then be told to add Peanuts to the inventory. Feedback will be displayed as an updated inventory list to reflect the addition.

b. **Remove Milk from your inventory**

From the start screen, participants will have to navigate to the screen that manages inventory, find the milk label in the inventory and select to remove it. They can also remove the physical milk carton from the “shelf” to remove it from the inventory list.

3. **Add Nutritional Profile**

Participants will be given a list of nutritional benchmarks to enter into a new user profile named “James.” This task requires them to navigate to the correct screen, select the option to create a new profile, customize the profile by adjusting the nutritional benchmarks to match the given values, and save the new profile under the name “James.”

4. **Assemble Meal Plan**

This multi-directional use case is reflected with a more specific task that measures the usability of the interface for this process:

a. **Schedule a recipe with <specific ingredients> to the meal plan for Thursday of this week.**

Participants will be provided a notecard with the ingredients by which to search for the recipe, and the note that this recipe will require more ingredients in their inventory than they currently have. Filter by the specific ingredients will only return one result.

TARGET COMPLETION TIMES

The completion time goals for the critical use cases, for a new user and for a more skilled (practiced) user are captured below. It is assumed that the user starts performing all the tasks from the home screen. All times are in **seconds**.

Goal	Practiced User	New User
Manually Add Item to Inventory	15	25
Manually Remove Item from Inventory	5	10
Search Recipes by Specific Ingredients	25	40
Select recipe by nutritional criteria from a number of results	30	55
Select cheapest recipe from a number of results	30	55
Create new user profile with name and nutritional information	40	60
Search recipes by ingredient and add to meal plan	30	40

QUESTIONNAIRE

Questionnaire administered to participants after they have interacted with the application.

Target completion time: 8 minutes.

Personal Information

How many days a week do you prepare recipes at home? _____ days

How many days ahead do you usually shop for meals? _____ days

Generally, if you were prompted with the name of an ingredient, spice or food staple, could you say with certainty that you do or do not have it in your personal inventory without looking?

yes/no

Do you have an established food planning routine that you follow?

yes/no

How important are the following in determining the recipes you prepare at home?

nutritional benefit

(not important less important more important very important)

calories

(not important less important more important very important)

cost

How easily could this application be implemented into your current routine?

(1 2 3 4)
not very easily easily

How useful might this application be to answer questions that inform your personal recipe selections?

(1 2 3 4)
not useful very useful

I would recommend this application to another person.

(1 2 3 4)
unlikely likely

How much would you be willing to pay for this application?

\$ _____

INTERVIEW

Interview questions for participants after they have completed the questionnaire.

Target completion time: 20 minutes. (Average less than two minutes per question)

1. When you select recipes to cook, what are the most important factors that influence your decision?
2. Overall, would you say that using this application helps or hinders your current process of recipe selection?
3. Assuming a fully functional prototype with access to online recipe databases, would you say the information presented gives you more or less control over your personal food choices?

4. Were there any points when you felt the application presented information in a way that was confusing? If so, explain that experience.
5. How sure were you that the application understood and completed your requests?
6. Was it always clear what each control (buttons, selections, etc.) would do based on visual and textual clues?
7. Were there any tasks that were particularly difficult? If so, what made them difficult?
8. At any point in performing any action, did you feel lost or unable to determine what to do next?
9. What is your least favorite aspect of the system? Why?
10. What is your favorite aspect of the system? Why?
11. What, if anything, did you learn about meal planning that you did not know before?

6. Reflection

Our team has gained an appreciation for having well-defined requirements stated outright for the application. For the scope of our product, it is very easy to become overwhelmed with features and potential features. There is clearly value in having a precisely defined user base demographic and design space in which to work. Since our designs were mostly non-working, the narrative walkthroughs were particularly helpful in determining where potential pitfalls and logical fallacies were within them.

Initially our project was based on the idea of simple inventory management. However, our project scope has changed due to our focus being oriented more towards our surveyed user

demographic and less towards our own expectations. Beginning with the modest goal of allowing for users to shop and cook based on their current grocery inventory, our application has evolved into support and assistance for food planning and preparation decisions.

We have confidence in our prototype, however, due to the time constraints, it was difficult to fully implement as robust and error tolerant design as we would have preferred. More visible indications of inaccessible objects would aid in keeping the user from taking a fall. Other minutia such as not allowing the user to create a profile without first inputting a name would have also been preferred. We also would have liked to have a more built up dialogical interactive structure to aid users in understanding the capabilities and limitations via “just-in-time” help and assistive error messages.

Time also played a factor in what features we were able to implement. It was desirable to have more affordances in the navigation of meal plans through time. Since we are allowing for multiple methods of inputting inventory, it would have been nice to allow for feedback of entry to be recognized from any screen through the use of a pop-up type message.

Ultimately, our design would consist of a “smart” pantry and our interface embedded into it for a single stand-alone unit. The prototype will consist of both a computer and a digital scale to simulate a “smart” pantry. Our prototype setup will likely not be portable and so we will be further limited in that our testing will need to be performed in a lab environment instead of in an actual home. Use of this custom hardware could be distracting to our tested user.

Since our prototype will be implemented on a keyboard-and-mouse computer as opposed to the intended touch-screen computer, we will be severely limited in many ways. For any text inputs we must rely on the keyboard as opposed to the more realistic on-screen digital keyboard. We will also require the user being tested to navigate with a mouse when our design is not intended to have or need one. The use of a computer instead of a small tablet could potentially allow for our application to operate faster than it would in actuality on the final hardware. Although there are many issues with the design of our prototype, we are confident that effect on the items we are assessing will be negligible. Still, we will be vigilant for the issues that may arise.

Breakdown of Task Assignments

Bala worked on the Final Design Summary and report formatting. Bala programmed the digital interface of the design using Microsoft Blend. He wrote the “Recipe Search” for the scripted instructions in the evaluation plan. He also obtained the target completion times.

Ashton assembled and submitted the IRB form for approval. She created and maintained the outline and each of the subsections of the report. She assisted with writing the Final Design Summary. She also wrote the “Create Nutritional Profile” use case for the scripted instructions. Ashton wrote the testing methods for the evaluation plan.

Mia wrote and assembled the interview and questionnaire. She also wrote the “Assemble Meal Plan” use case for the scripted instructions in the evaluation plan.

Mason assisted with assembling and assessing the Interview and Questionnaire questions. He also assisted with the IRB approval. He wrote the “Manage Inventory” use case for the scripted instructions in the evaluation plan. Mason programmed the microcontroller and designed the hardware setup for our prototype. He also wrote the Reflections section of the report.