

INVENTory: Project Report Part 2  
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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 and freshness.
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 selected ingredients*.
5. Convey recipes' nutritional value with *graphical representations*.

## 2. Design space

### OPPORTUNITIES & CONSTRAINTS

The set of all potential solutions is vast for an application that purports to aid decision-making in the realm of food planning and preparation. Preparing meals at home is an activity most people do (accounting for 78 percent of our survey respondents), for themselves or for others, and as a

social or private activity. The digital interface occupying this space must provide the flexibility to accommodate these scenarios, since the number of actors and their dietary restrictions is as mutable and varied as our personal palettes.

To create an application that provides the greatest degree of utility, it is necessary to impose constraints on the population whose needs it fulfills. We assume that users are computer literate and willing to import technology into their meal-planning process. Our interface will capitalize on the digital platforms that computer literate users already own and carry on their person throughout their homes and beyond, into their daily spaces of work and life. We also assume that users are open to cultivating a deeper knowledge about nutrition if they actively cook at home and enjoy the control over personal intake that it affords. Our initial data-gathering research revealed that potential users care most about cost and nutritional balance when selecting recipes. The interface should provide values for these two properties of each recipe in a format conducive to immediate decision-making and comparing similar recipe choices.

Just over 75 percent of survey respondents indicated that they cooked at home, yet 75 percent also indicated that they had no set routine for meal planning. There is an opportunity here to design an application that provides a structured methodological approach for a task that people perform quite frequently and often inefficiently (nearly 50 percent responded that they considered the process “time consuming”). Therefore, the interface should output information as a metaphor for planning structured events. Our design incorporates temporal design conventions from the digital and physical worlds such as date-picker widgets, calendars, and appointment books.

We would be remiss if we explored possible solutions to inefficient meal planning if we focused on the user’s needs without considering the environmental impact of wasting spoiled food. A recent study for the Food and Agricultural Organization of the United Nations revealed that the amount of food lost at the consumer level in North America is 120kg per person each year (Gustavsson 2011). Consumers have realized that these traditional patterns of consumption and waste are unsustainable. In fact, only 10 percent of our survey respondents said they “never” purchase additional ingredients for a recipe if it means they can use a food before it spoils. Likewise, only 5 percent said they never make decisions about what to cook based on ingredients they already own. We decided to design an application that encourages a sustainable approach to cooking by allowing users to begin their recipe search with an ingredient they already own and use it before it spoils.

## TRADEOFFS

Since food is integrated so deeply in our lives as both a tangible thing and an activity, decisions about what we eat are not made independently of other economic, social and personal factors. We make the bold but obvious statement that all technological systems are value-laden because they are designed, and design does not happen without constraints that include some features at the necessary exclusion of others. We took as our starting point users’ ability to maximize use of the grocery inventory they already have in order to save money and to encourage healthy eating. Now we turn to tradeoffs that surfaced while crafting solutions, mentioning briefly where our different designs occupy different ends of a Cartesian spectrum.

*Immediate legibility of the interface: learnability vs utility*

Ours is a task-based application that enhances decisions people already make independently of technology's intervention. Hence, users will approach the system with expectations of the functions it should be capable of. Power users may require a robust feature set that tracks nutrition and cost at various levels of granularity to help them decide which recipes to remove within the context of their overall weekly plan. More options within the system empower the user to carry out the broad range of tasks related to meal planning, but require more controls embedded in the interface to provide that range of functionality. The Dinner Spinner design is an example of an interface that affords effective meal planning approached from different perspectives of holistic nutritional value and total costs, but the various operations that can be performed on any screen (remove items, change quantity, switch user profile) sacrifice the application's immediate legibility. It is not an easily learned interface, as is the Sous-Chef and Inventory App designs. These latter interfaces offer no more than four operational actions on any one screen, and these operations are clearly labeled for users who want to carry out a task right away without spending time to understand the power of the system.

*Navigational ability: focused attention vs multitasking*

A person's use of the application to compare, think and make decisions grounds this application firmly in the realm of a tool for reflective cognition. The tradeoff in this realm is between guiding users directly to information they want, versus exposing them to new ideas tangentially related to their query. The unisequential navigational structure of Sous-Chef, with its constrained conversational procedures that funnel users through a selection process based on meal type (salad vs dessert) offers a much simpler road map to the end goal healthy and affordable home-cooked meals than Dinner Spinner, which provides multiple features for planning menus, switching between user profiles and changing inventory items' quantity from any screen at any time. Constrained procedures like those afforded by Sous-Chef and Inventory App allow users to focus attention on the immediate goal of preparing food with ingredients on hand. Conversely, an application that allows users to multitask between a variety of operations related to food planning (tracking nutrition, cloning previous meal plans, managing inventory items) supports holistic decision making and discovering new combinations yielding tasty, healthy and cheap results at the expense of focusing action on one task with minimal distractions.

*perception of options: literal representation vs textual interpretation*

Food is bound to our senses of sight, smell, taste and touch. Users will approach data about ingredients and meals with prior associations both good and bad. Respondents during our data-gathering research frequently mentioned the pleasing aroma of cooking, and how that smell heightened their anticipation of tasting the final product. Inventory App displays items in the pantry as a list of pictures, inviting users to recall their personal relation to food. Sous-Chef displays photos of the prepared recipe, but Dinner Spinner restricts the list of ingredients and recipes to textual representations. The textual list constrains users' decisions to cerebral processes, whereas pictures of these ingredients and dishes invites users to operate at the visceral level, that low-level part of our brain that responds automatically to triggers in the physical world. Whether pictorial or textual representations are more conducive to healthy eating remains an interesting question for further testing.

**DIFFICULT REQUIREMENTS**

### *User-controlled inventory management*

This inventory tracker will work today, but not without conscious effort from the user to manually input and delete their items either through controls provided on the interface, or by scanning bar code information. This requirement is a major obstacle to usability and widespread adoption by power users, but we take a futurist mentality. Not without precedent (“Wireless electricity is coming to your kitchen and grocery stores” 2011) we imagine embedded sensor technologies that scan items as they are added or removed from shelves, and log differences in weight to track quantity. We also imagine that grocery stores could make purchase data available to the customer. By including a code at the bottom of each receipt, one simple scan could transcribe purchase data into a digital format other applications like this could use. If the data is stored in a database, computationally monitoring grocery inventory by quantity and freshness is simple to achieve and query. However, implementing this requirement in today’s technological environment asks the user for an unrealistic level of participation on a daily basis. This we acknowledge.

### *Making nutrition personally relevant*

The requirement that nutritional information be displayed graphically may be difficult to realize, since it requires multiple levels of computation, especially when the user has the option to assess the health benefits of the plan as a whole. First, the user profile must be queried to set threshold values against which each recipe’s nutritional benefit can be assessed. Taking an average of the users’ recipe selections adds another layer of complexity, and its benefit to users cannot be fully determined until user testing. For example, one extremely caloric meal for a special occasion can misrepresent an otherwise healthy week if average nutritional values are rendered graphically from this information and provided to users as a means to determine healthiness of the plan as a whole.

### *Assisting users on touchpad devices*

A challenge we ran into is how to provide contextual help or indicate operational areas on touchpad devices. With traditional mouse-input displays, the affordance of the hover state communicates items that support operations performed on them, or indicate other spaces on the interface where they can be dropped to trigger outcomes and feedback (deleting an item from your pantry, for example). Designing a learnable interface on a touchpad is a spatial challenge, since it requires allotting the areas for instruction, or including semantic icons that users can tap for further information.

## **EASILY SUPPORTED TASKS**

Searching recipes is something our respondents already use technology for (90 percent of respondents said they search for recipes online). Thus, supporting that task is easy if the design communicates digital conventions of the search function: encapsulating a text field in horizontal box with actionable instructions to “search,” and providing controls to filter results somewhere near that search field to suggest paired functionality.

Creating shopping lists from users’ meal plan is a natural extension of the meal-planning process. Without the use of technology, cooks manually compile lists before they shop to surmount limitations of their short-term memory. Compiling shopping lists by hand requires that they extrapolate missing ingredients from selected recipes, but this is exactly what our inventory

application already does. Thus, by outputting this data in a human-readable digital or printed list, the task of aiding grocery shoppers outside their home environment is easy to support.

## ALTERNATIVES

We had considered alternative interface types for our application, but ultimately rejected any mode that strayed too far from established customs of meal planning or hampered portability and discrete use in public space. Encouraging efficient meal-planning implies designing for use outside the kitchen. The final interface design excludes input through air gestures or voice recognition since someone using these interface models in public or at work would be acting unconventionally and perhaps inappropriately.

Our survey respondents also indicated that they enjoyed the “meditative” aspect of cooking, the “good smells,” “chopping,” and “tasting the flavors.” We interpreted these as sensual experiences that could be captured and imposed on the earlier meal-planning stage. For this reason, we favored touch interfaces over the traditional keyboard and mouse input. We saw the latter as a typical interface convention that so many people encounter in their workplaces, and from which cooking provides a welcome escape. A touch interface preserves the tactile nature of recipe selection: thumbing through recipe books, marking pages, writing lists and touching pantry ingredients to assess their freshness or remaining quantity.

## 3 DESIGNS: DESCRIPTIONS & JUSTIFICATIONS

**Dinner Spinner** is an interface that seeks imbue the meal-planning process with affective qualities to capture the fun and experimentation that our respondents said they enjoyed while cooking. The view of ingredients clustered into food groups around the diameter of a wheel affords a quick assessment of personal inventory, and the interaction style when selecting ingredients encourages experimentation through the ease of combinatorial creativity. With a focus on creating meal plans via direct manipulation of labels dropped onto a calendar, the design appropriates the familiar conceptual framework of penciling future plans into a datebook. Through this lens, users can assess choices at a high level, surrounded by context for a more holistic vision of their health.

**Sous-Chef** is a simple-to-use, dialog-driven system that encourages immediate decision-making by narrowing users’ range of choice. The flow through the user interfaces is largely unsequential to focus novice cooks on the task of selecting recipes and encourage them to operationalize their choice by preparing the recipe displayed on screen. Our data-gathering stage illuminated the fact that respondents often feel intimidated to plan meals because they do not know where to start. The Sous-chef design seeks to provide a helping hand and a strong guiding voice for less confident users who still want enough information about cost and nutrition to make rational choices without the noisy distractions of online recipe sites. This design decision stands to increase learnability by surmounting the cognitive burden of labored rationalization so users can eat as quickly as possible following a simple streamlined process, but still have the option to save tasty discoveries for later retrieval.

**Inventory App**, as a compact visualization of inventory deployed on a portable device with limited abilities to search and filter recipes and plan meals, accommodates users who--due to busy life styles or restricted access to computers in their kitchen--could benefit from the

integration of mobile technology to reduce memory loss and provide inspiration on the go. The option to view inventory as a list as well as pictures of food on a shelf is appropriate for visual thinkers or those who cook for others but do not spend much time in their kitchen to be intimately familiar with the contents of the pantry. Deployment on a mobile device also provides immediate information recall to support the portion of our respondents who say they purchase ingredients for a meal the same day that they prepare it (about 40 percent) or a few days ahead (another 40 percent).

### **3a. Design: Dinner Spinner**

#### **RATIONALE**

##### *Direct Manipulation*

The design space is saturated with applications that help users cook, but fewer that help users overcome the less enjoyable but necessary precursor to that social activity: food planning. Respondents indicated that they considered cooking “enjoyable” (74.2%) with open-ended questions elaborating on that sentiment, using words like “fun,” “imagine,” and “experimentation.”

By providing controls as sliders, tabs, and labels that can be dropped onto a calendar, the interface incorporates metaphors for physical controls people use in the physical world. The affordance of digital manipulation through a touch interface injects the fun and experimental facets of cooking back into the meal planning process that precedes it. Direct manipulation makes the actions that can be performed on an object immediately visible. Thus, it makes it easier to learn how to accomplish the task of filtering recipes with sliders, or using tabs to switch between recipes that can be cooked now or later, or assigning recipes to certain dates, or nutritional tracking for different users.

##### *Information Visualization*

This design forgoes photos of food and renders inventory data instead through information visualizations. The pie chart groups inventory according to food group (protein, carbohydrates, fruits, vegetables, staples, etc) to give users a quick overview of their pantry. This seeks to help them make sense of their stock and spot trends or patterns that require action or behavioral change. If they are running low on produce, that sliver of the pie will wane while others will seem to expand, indicating that a trip to the market is in order, or that their recipe selections will necessarily be constrained to protein-rich meals (which cost more money). Likewise, the nutritional data chart at the bottom of the meal planner and recipe selection screens uses a bar chart that overlays data gleaned from selections atop the user’s baseline nutritional goals to afford quick comparisons between ideal and actual values.

On the screen to “Search Recipes,” clicking a recipe label updates the values of the nutritional chart and the cost of the recipe. This information is displayed in a consistent location (rather than underneath each recipe) so the user’s eye does not have to move around to make comparisons between different recipes. By abstracting away numbers and units of measurement from the task of determining a recipe’s nutritional benefit, this design makes this characteristic more readable, meaningful and therefore actionable. Most respondents to our survey had ranked “nutritional

balance” as the leading factor that determines their grocery selections. The decision to omit photos of inventoried items and search results also tailors this design to the user who has specific objectives for healthy eating that are realized best by viewing data translated into relational visual shapes to spot anomalies and trends.

### *Navigation*

Main menu items are not grouped together in a list. However, they are placed at the top and bottom according to the similarity of their functions, and the depth of their functionality. Items on the top are utility tasks and extend only one level deep. By contrast, menu items on the bottom lead to further areas of functionality beyond the user’s immediate choice. For example, “Find plans” leads to screen that allow users to “Assemble Plan” and “Search Recipes”, while “Search Recipes” leads uses to “Assemble Plan” and customization options pointing to “Set Nutrition Profile.” Menu items on the top, “Set Nutrition Profile” and “Manage Inventory” provide no links to other features in the application.

### *User Profiles*

The design supports switching between more than one user profile directly from the screens to search recipes and plan meals. The reason being that 80 percent of respondents said they cook for more than one person and 50 percent considered cooking to be social activity. The ability to compare search results against multiple nutritional profiles without having to reset the application provides a high degree of usability and promotes efficient planning for users with nutritional edge cases, or for those feeding guests who are lactose intolerant, vegetarian, or gluten free for example.

## NARRATIVE WALKTHROUGH

The welcome screen gives users four points of entry. Two of them, “Manage Inventory” and “Set Nutrition Profile”, are one level deep and act as utility functions that enhance the operation of the other two, “Find Plans” and “Search Recipes.”

From “Manage Inventory” users view the items they own, tap the item’s label to alter quantity or drag the label onto the square with a trash icon to remove it. Users can add items from this page, optionally specify the quantity or click “Scan Barcode” and take action once the screen switches to camera view.

Setting a nutrition profile also operates through drag and drop. The central pane displays nutritional stats with acceptable values for the user currently selected from the leftmost list. Adding a user is as simple as clicking “add profile” from this left column, typing a name under which to save the information, and dragging selected stats to track from the list at left. Then users can select a range of acceptable nutritional values using the sliders.

Users can arrive at the screen to search recipes in two ways.

1. By selecting “Search Recipes” from any screen in the application
2. By selecting “Find Plans,” creating a new plan and selecting “add Recipes” to begin populating the newly created plan.

Users can search recipes by name or by ingredient, but we have constrained our prototype to



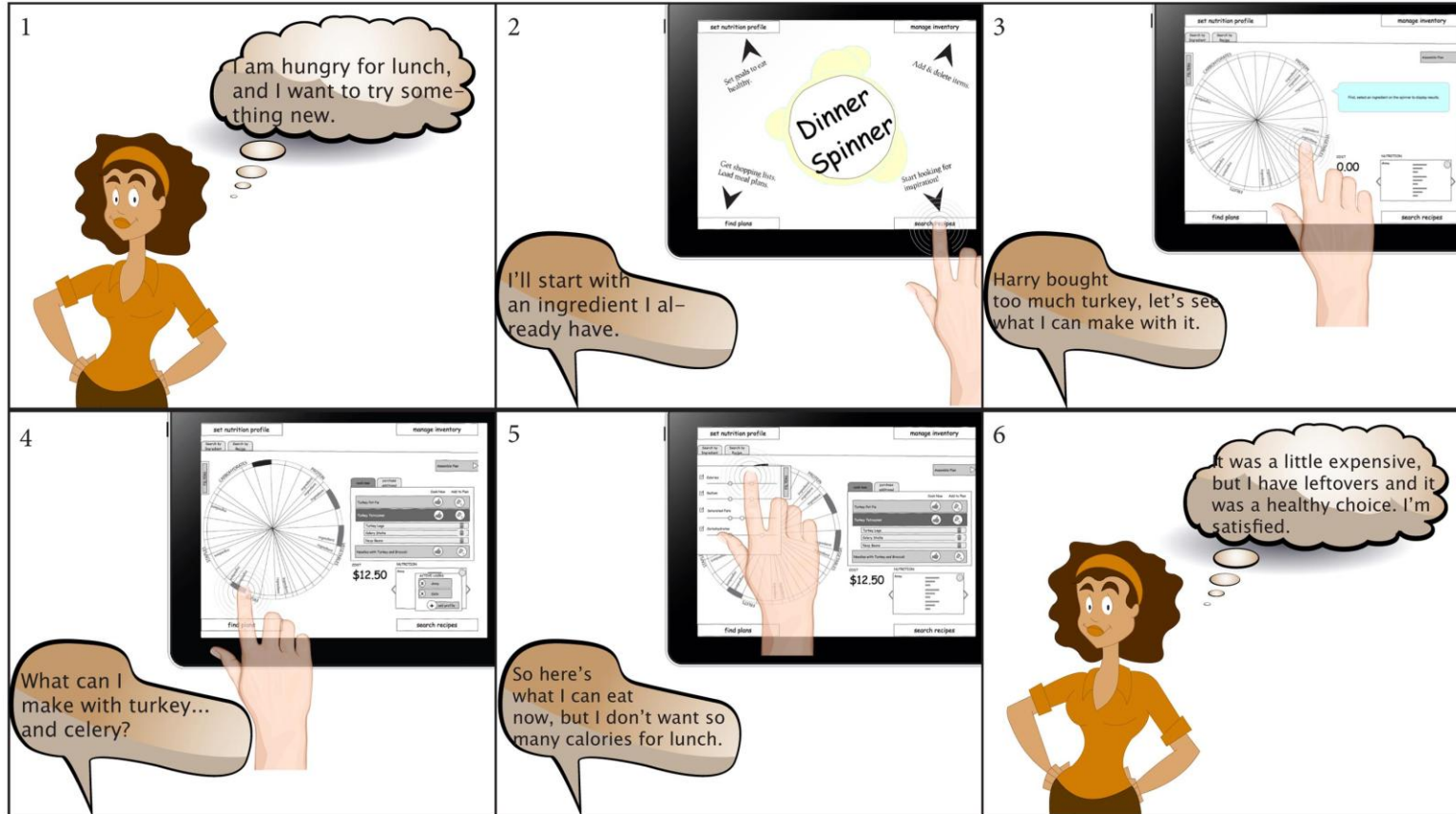
search by ingredient since it showcases the power of the built-in inventory tracker and encourages sustainable consumption. Users are prompted to select an ingredient on the pie chart to display results. This process of selecting items from the inventory is iterative, and each selection reduces the number of results returned. Optionally, users can click “filters” to reveal a tab with sliders to set upper and lower bounds for segmented nutritional values that returned recipes should conform to. The left half of this screen controls the recipe results returned, but the right half is reserved for detailed views of those results. Tabbed panes separate recipes that can be cooked immediately because the user has all the ingredients from the recipes that require additional purchases. Each recipe contains information about total cost, nutrition and component ingredients. (If the user no longer has an ingredient, clicking the trash icon next to that ingredient will remove the item from the inventory, and also the recipe from the “cook now” tab).

Users can move on to “Assemble Plan” from the button with an arrow pointing to the right side of the screen, a design metaphor for turning pages to advance. From here the list of selected recipes appears in the left. These recipes can be dropped onto certain days for a visual overview of the plan. Totals are displayed at the bottom for the cost and average nutritional benefit according to the number of days planned. Additionally, when users tap a recipe, the cost of that recipe is displayed. This lets budget-conscious users decide which recipes they should remove if the total budget gets too steep. The plan is saved automatically (no need for the user to hit a Save button). Once the plan is assembled, selecting “Get Shopping List” outputs the ingredients missing from the inventory but contained in selected recipes as a list to print, send to a mobile device or email.

# Use Case 1: Select A Recipe

User decides to search recipes by ingredients.

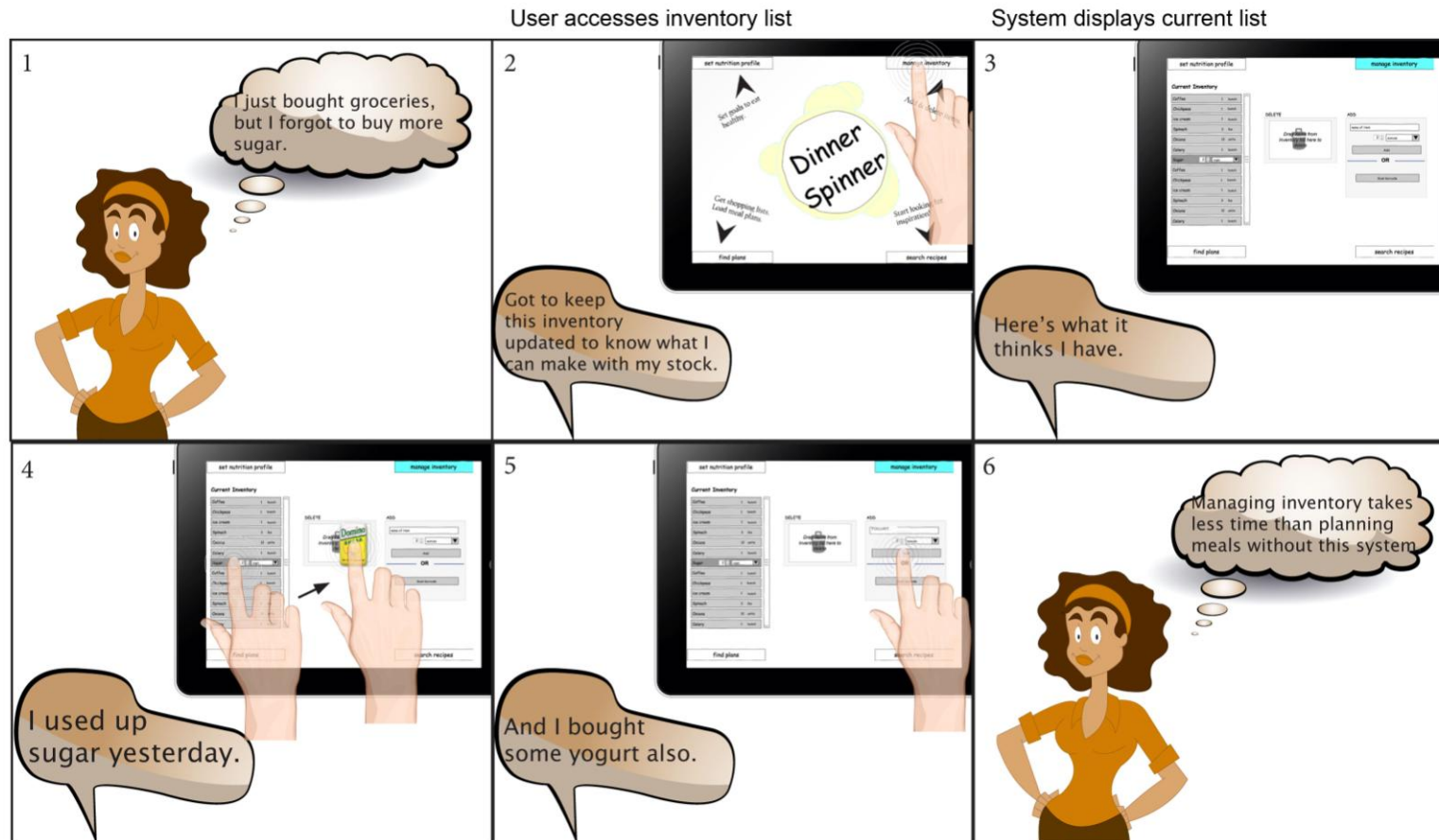
System offers all ingredients in inventory.  
User selects an ingredient.



system returns recipe results.  
User filters again by selecting another ingredient.

User views recipes that can be cooked now, and filters results again by nutritional data.  
System displays cost and nutrition.

## Use Case 2: Manage Inventory



User accesses inventory list

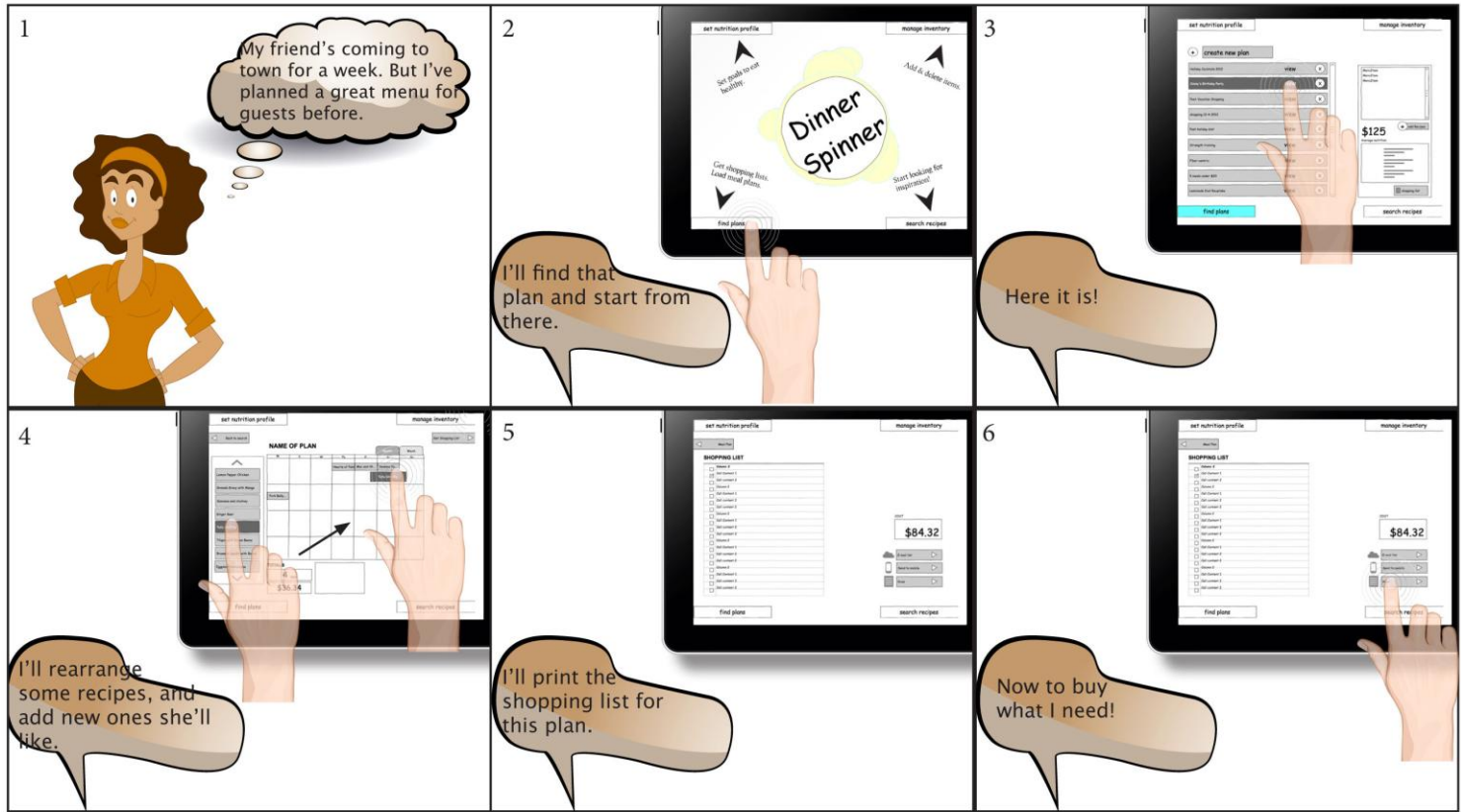
System displays current list

User drags item from list to delete it.  
System removes it from inventory list.

User adds new item, providing the quantity purchased.  
System adds it to inventory list

### Use Case 3: Assemble Meal Plan

user requests list of assembled plans. system displays list with overview and options. User selects to view a plan.



System provides scheduled recipes. User associates meals with dates.

User requests shopping list for meal plan. System provides list.

User selects the format to receive the list.

### **3b. Design: Sous-Chef**

#### **RATIONALE**

##### *Design Focus - Short Term Planning*

While the other two designs have a major focus on long-term planning and decision support, this design aims to support decision making in the short term, and helps users make smart choices during recipe selection and food preparation.

Survey respondents indicated that their least favorite part of food preparation (besides “cleaning up”) was the labored decision-making process without any indication of where to start. Sous-chef tries to solve this problem through a design pattern that provides feedback and decision support by displaying only limited, but relevant and intelligent options that are generated based on the context as well as user profile and food preferences.

##### *Interface Visualization - Wizard metaphor*

In terms of the general approach for this design, we followed a streamlined and step-by-step Wizard style pattern that helps with learnability by guiding the user through each step of the process. The recipe-selection screen allows users to compare multiple recipes on criteria such as nutritional value, preparation costs, time and other factors before they settle on their recipe of choice. Also the design provides the flexibility to traverse backwards and make changes to previous selections. This type of error recovery lets the user to easily reverse any decisions or choices made earlier in the process.

##### *Dialogue Style - Conversational*

The language used in all the dialogues are very conversational in nature and mimic the user’s conceptual model of selecting a recipe with a personal helper. Instead of using short labels like “Recipe type,” we chose to use longer sentences and questions, such as “What would you like to cook?” followed by common preparation categories. This approach helps novice users get used to the system quickly and encourages experimentation by reducing opportunities to commit mistakes due to lack of familiarity.

#### **NARRATIVE WALKTHROUGH**

The Home screen of the app has four main activities. Out of these, the “Manage Preferences” and “Manage Inventory” are one-step dialogues that mainly set the context of operation for the other two activities - “Cook Now” and “Meal Plan.”

“Manage Preferences” allows the user to set various criteria that the app should consider when making a recipe search and recommendations. The user can choose to sort the recommendations by specific criteria such as nutritional value, preparation cost, time and so on. This screen allows the user to set exclusions (such as sugar, peanuts and so on) and default serving sizes. Finally the user can save these preferences as a profile and change the current profile from this screen.

The “Cook Now” link on the home screen is the core functionality of this design, which provides the user with recipe suggestions and instructions based on user preferences. Once the user selects “Cook Now,” the first screen displays a list of meal types, which the user can use to narrow down the search. Typically these meal types are displayed based on the time of the day. However the user can choose to ignore these meal types and perform a generic search of recipes. Also this

screen allows the user to set serving sizes.

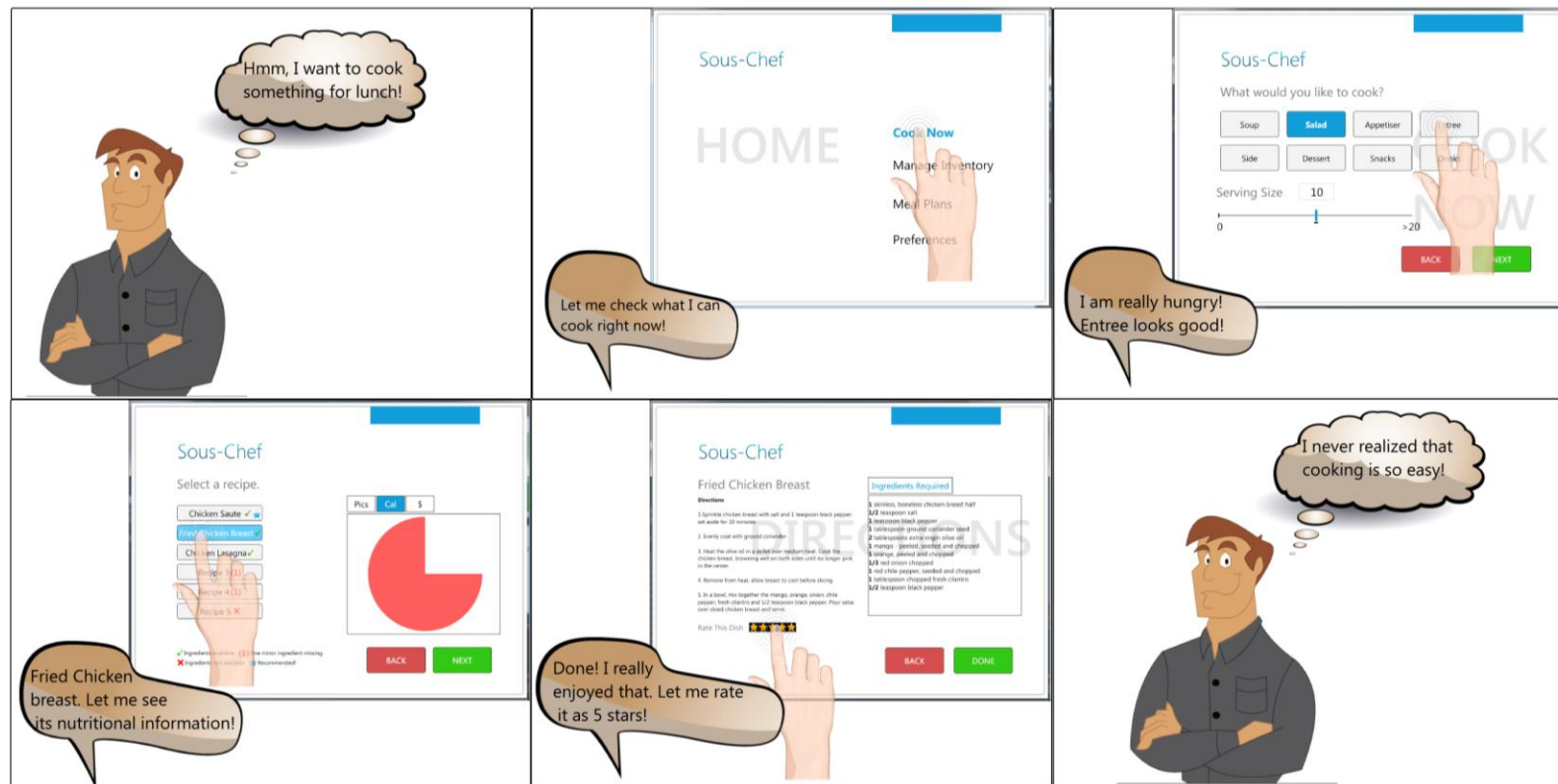
After this, “Select Recipe” screen is displayed, which provides a list of suggestions based on current inventory, user preferences and meal types selected on the previous screen. On this screen, the left side displays a list of suggested recipes and smart indicators, which indicate whether the recipe can be cooked with items in the inventory. The list is by default sorted by availability of items in inventory. Additionally, a small “star” indicator indicates recommended items. The recommendations are based on preset user preferences as well as prior rating activity. The right side displays a details area where the user can view nutritional information, cost information and preparation related information in the form of tabs. This area is updated whenever the user changes the selection on the left side. The user can then finalize a recipe and touch “next”, which takes him to the “Directions” screen, where the user is provided with directions for preparation of the selected recipe on the left side. The right side contains a set of tabs, which contain the list of necessary ingredients as well as other related media to the recipe (such as YouTube videos of the dish, pictures of the dish and so on). Finally a rating link is present at the bottom that allows the user to rate the dish to indicate his satisfaction with the dish. This rating allows the system to monitor user taste over a period of time and use this information in providing smarter recommendations that are closer to the user’s tastes. Clicking on “Done” button takes the user back to the home screen.

The “Meal plans” screen displays a weekly calendar which displays the recipes for each day if they have been previously set. The user can remove recipes from the meal plan by simply dragging an item out of the slot. To add an item to the meal plan, the user can just touch an empty slot in the calendar to add a new recipe to that slot. This action opens the “Select Recipe” (described previously) window, which provides a list of suggestions based on the selected day and time. Finally, selecting a few recipes and clicking on next adds these items back to the selected day on the meal plan.

Finally, the “Manage Inventory” screen allows the user to track items present in his/her inventory. While this screen contains the necessary input mechanisms to manually add or remove inventory items, the ideal scenario is that the items are automatically scanned in a smart system with RFID/Bar code reader in order to eliminate repetitive and cumbersome task of manually updating the inventory. However if the user so chooses, he may add or remove items from his current inventory by using the “Add” and “Remove”. The left side contains a Text field that displays a look ahead when the user starts entering text into it, As the user fills in more characters, the look ahead displays all the possible items that contain the filter string. Then the user can select an item from this list, and click on the “Add” button, to add the selected item into the current inventory. This pops up a small dialog with a slider where the user can set the quantity of the item to be added into the inventory. Setting the quantity and clicking on “Add” will add the item into the list on the right. The user can also remove items from his inventory by selecting an item on the right and clicking on “Remove”, to remove the item permanently from his inventory.

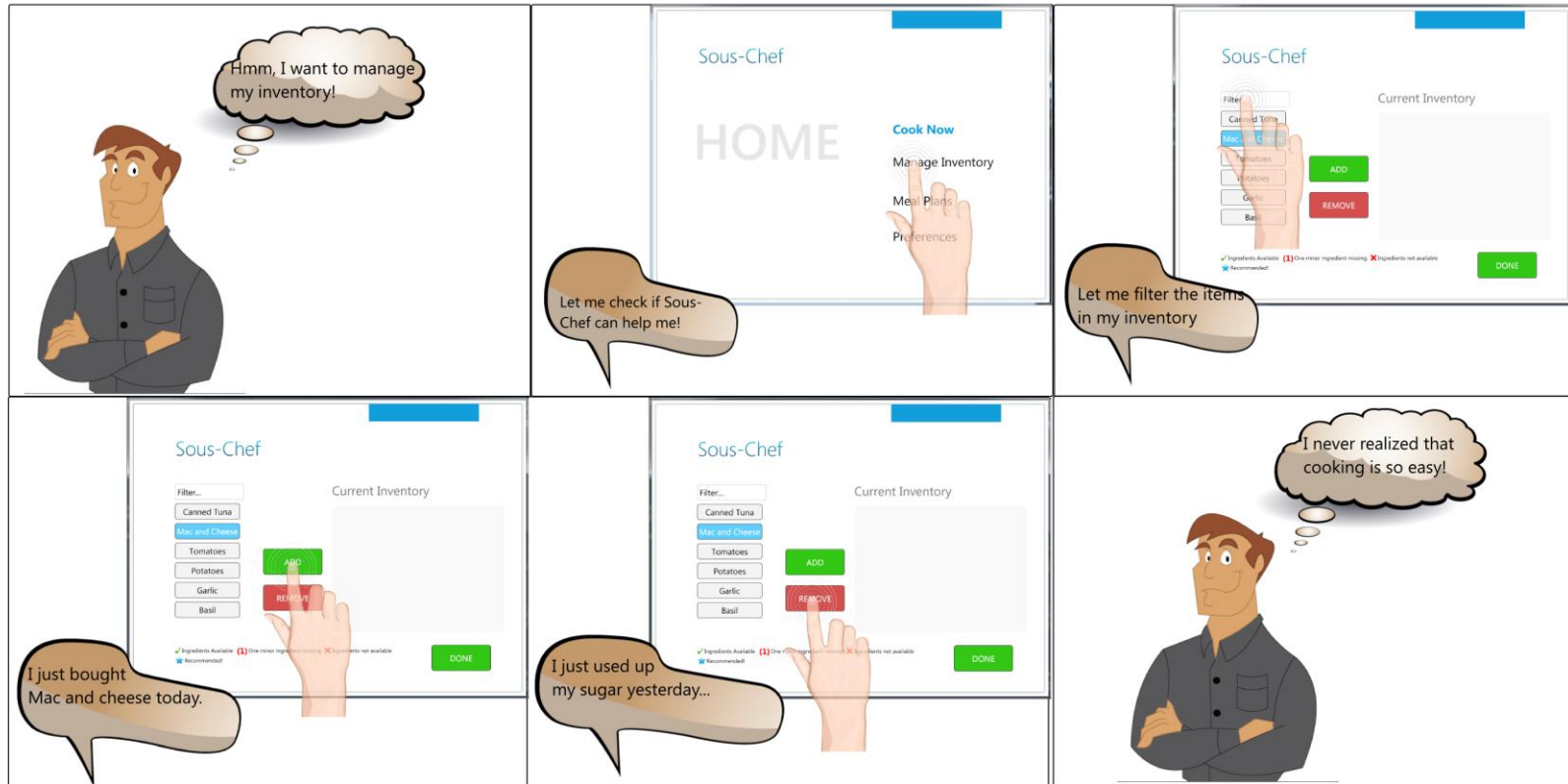
Use Case 1: Select a recipe.

This screen also allows you to set serving sizes



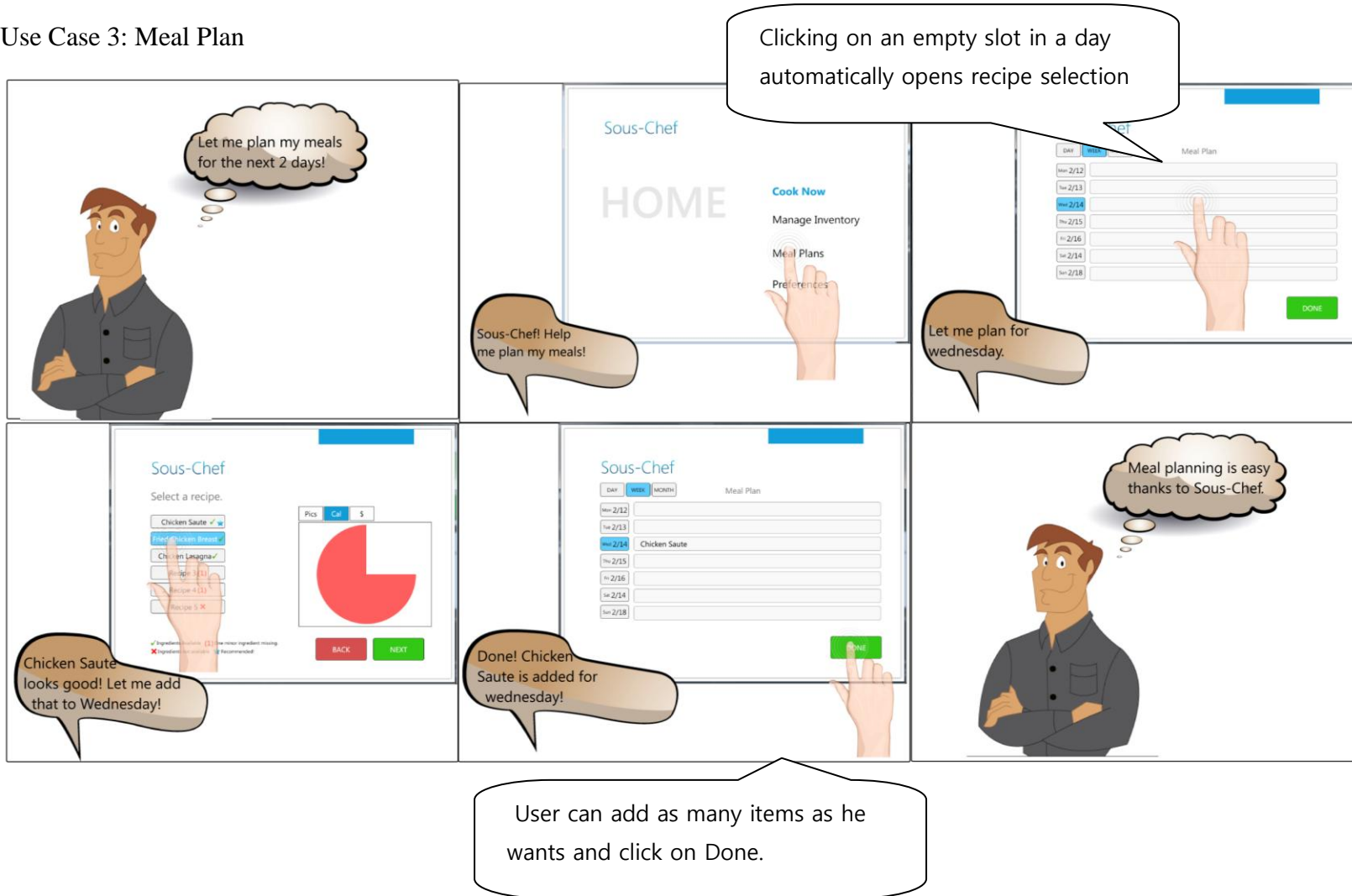
Here you can view nutritional information as well as preparation costs and time

## Use Case 2: Managing Inventory





### Use Case 3: Meal Plan



### **3c.Design: Inventory App**

#### **RATIONALE**

##### *Visualizations*

The app is intentionally kept simple since its key distinction is its portability and remote accessibility from a variety of locations. Visualizations of each recipe are a crucial feature to allow users to recognize unfamiliar dishes. Also, pantry items are represented visually in the “Visual” tab to aid in mental modeling of the user’s current stock for better meal planning. This will help people recognize what they currently have, even when they are away from home. It also accommodates users who have an emotional connection to food, and feel certain emotions in response to realistic photos. According to Ortony’s emotional design model, people operate quickly at this visceral level since decision-making is based on alternatives immediately perceived as pleasing or disgusting. For those users who prefer to make judgements on a higher level without the gut reaction that photos may provoke, a textual list of inventory is available on the same screen under the “list” tab.

The organization of the list in the pantry is designed to emphasize items that are in need of attention by changing their font color to red and making the feature that is in need of attention also red. So for instance, if an item is going to expire soon (~10 days), the date and the item name appears in red. Or if the user is out of an item they normally buy, the quantity is also displayed in red text. The grocery list is grouped so users can find items where they are typically grouped in the store. The user can either go through the list and check off each item (just as on actual paper), print, email, or save the list for later once it is generated from a meal plan.

##### *Icons*

Users can access all main features from every screen with exception to editing screen. With limited screen space, it was necessary to try and add more data to a smaller space by utilizing icons. For example, the Home, Plan, Search, and Inventory icons at the bottom of the screens. Also the quantity and expiration bubbles on each pantry item. A brief overview could be incorporated for first-time users so that there is no confusion with icon meanings.

With regards to the icons, an image of a house is typical to indicate going back to the initial screen of an application. The Load Plan icon has a rectangle with the word plan and lines underneath to indicate a paper with the header “PLAN” and words. A magnifying glass is typically used to indicate some type of search feature. The most ambiguous icon is the one used for viewing current food stock items. For this, we use a small refrigerator. In the inventory management screen, a trash can is displayed to allow dragging items to the trash, a pictographic convention for deletion on the Web. Due to the general ambiguity of iconography, it may be necessary to explain them in an introductory tutorial included with the application.

##### *Buttons and Options*

The options are purposefully limited when editing to ensure users do not accidentally delete or change an item. Back buttons allow users to return to the previous screen or exit their current task. On the Meal Plan screen, “Generate List” is at the bottom since one reads a list top down and printing a shopping list is the final task in the process of meal planning. The Meal Planning view buttons are at the top of the screen so the user can change it before having to sort through more information than necessary.

### *Add/Remove Features*

The “ADD” feature of the pantry is purposefully left out, although the ADD button and remove icon are present. There are two main scenarios that could play out for the use of this feature. The least ideal is that the user would have to manually enter each item by hand and type in the expiration dates, nutritional info, etc. A more ideal situation is where the user gives the name of the product and more information is obtained externally and the user must only fill out quantity and expiration date. Our ideal situation is that the user adds the item or removes it from a “smart pantry” and the quantity and item description is automatically obtained from the item itself. This feature could be implemented either by passive RFID tags with all pertinent information attached, or passive electronic IDs and the appropriate sensors in the pantry or refrigerator to read these tags, determine weights, or even food spoilage. Since at this point our focus is on the interface, this detail need not be laid out fully at this time.

### **NARRATIVE WALKTHROUGH**

The interaction style is a compact, touch screen interface (a smart phone). There are four main functions of the application: Creating a Profile, Finding Recipes, Loading plans, and Managing Inventory. The profile allows the user to set food choices such as allergy considerations and favorite foods. This information will be used in the search function to deliver customized recipe results based on the preferences indicated here. Search is found either from the home screen, or from the magnifying glass icon at the bottom of the interface window. The search function allows the user to search for recipes in a database or directly online. The search is filtered by current inventory considerations such as expiration date, by food allergies and preferences listed in the user profile, by estimated preparation time of the meal, and by cost of the items not already owned by the user. The search results are displayed on a new page where the user can see all pertinent information such as ingredients, cost, preparation time, and an additional screen also gives nutritional information about the meal.

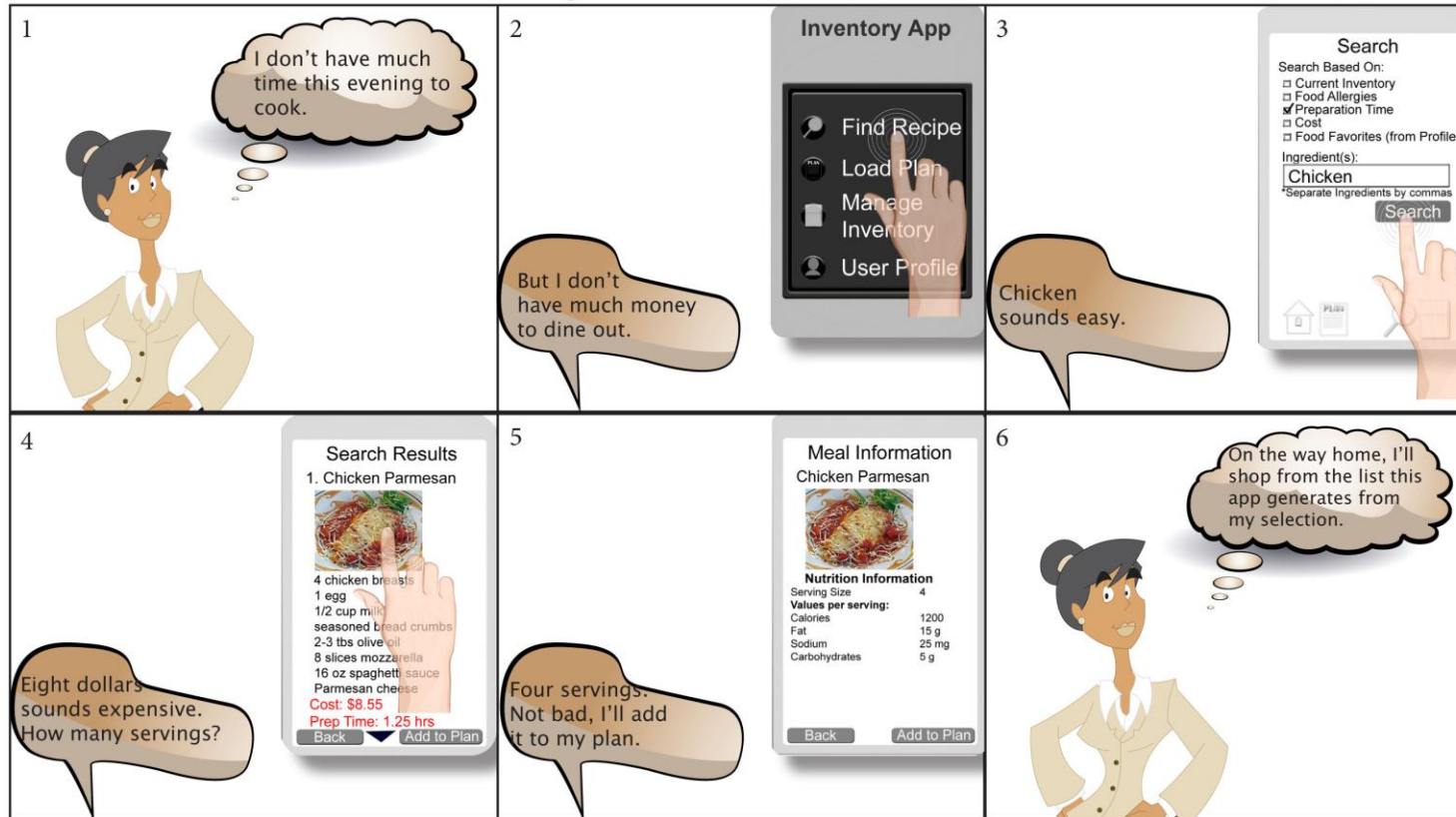
After adding a meal to a plan, the user can view that plan in the Meal Planning screen. Once plans have been created, they can also be accessed through the Load Plan button on the home screen, or the Plan icon at the bottom of the interface. Each meal plan consists of the meal information (same screen as the search), the name, and the date. Only the date and name of the meal plan may be edited in this design. Multiple meals can be added to the same date. Also, multiple plans can be selected to generate the shopping list. The shopping list is a dependent feature on the meal planning, i.e. a shopping list cannot be generated without a meal plan.

The current food stock is managed under Manage Inventory, which is indicated by the refrigerator icon at the bottom of the interface window. The list of items is output in two formats: Visual and List view. These are toggled by touching the tabs at the top of the screen. Items can be added by pressing the add button, or by physically adding an item to the “smart pantry,” (For a more detailed description of this see Justifications: Add/Remove features). To remove an item, one may either manually drag the icon of the food item to the trash icon and release, or physically remove the item from the “smart pantry.” To view more detailed information on an item, the user can tap the icon of the food item and they are brought to a new screen with information such as: nutritional values, expiration date, days until expiration, and quantity (qty, oz, lbs, etc.).

# Use Case 1: Select A Recipe

User decides to search recipes by ingredients.

System offers search filters.  
User selects ingredients.



system returns recipe results.  
User selects photo to get detailed nutrition information.

User can add meal to plan, or go back to previous search screens.

## Use Case 2: Manage Inventory

User accesses inventory list

System displays current list

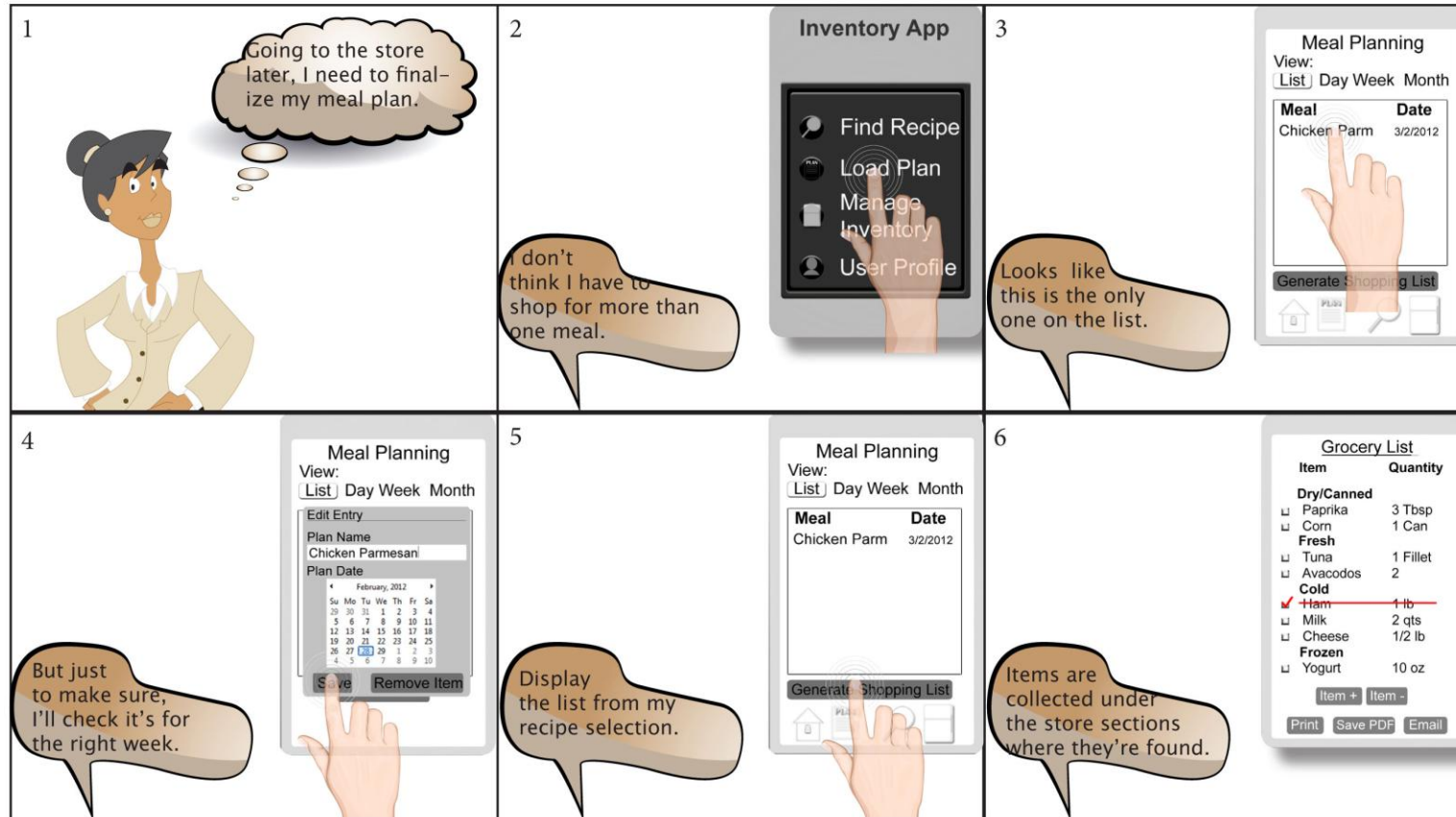


System displays quantity and expiration data.  
User selects item to modify.

User deletes the item from the details page.  
System returns user to list view when user hits "back"

### Use Case 3: Assemble Meal Plan

user requests list of assembled plans.  
 system displays list and view options.  
 User selects to view a plan.



System provides scheduled recipes.  
 User associates meals with dates.

User requests shopping list for meal plan.

System provides list.

#### 4. Assessment

##### ACTION COUNTS

The following totals for each design reflect the number of actions the user needs to take in order to achieve each of three critical use cases. (These critical use cases are provided in the appendix.)

	Sous Chef	Dinner Spinner	Inventory App
<b>Manage Inventory</b>	5	5	3*
<b>Select Recipe</b>	6	9	9
<b>Assemble Meal Plan</b>	7	6	13

\*This is based on the best case scenario where multiple paths may exist to complete the action.

##### PROS & CONS

###### *Dinner Spinner*

This design excels at offering **granular information** about cost and nutrition at different parts of the meal-planning process to help power users make decisions about what recipes to prepare in isolation or in context of the entire meal plan. This quantitative information presented without the distraction of visual photos **encourages rational decisions** related to the nutritional benefit and cost-saving potential of food, and discourages the gut reaction to visually appealing foods that might encourage unhealthy eating.

Like Sous-Chef, Dinner Spinner is designed for deployment on a touch screen, so buttons and menu items are wide and tall to **afford precise selections**. One spot where this truism breaks down is the pie chart. The usability of the **widget does not scale**; the narrower slivers of the chart become difficult to select as the inventory grows. This design flaw undoubtedly detracts from Dinner Spinner's usability and requires more iteration before an optional solution presents itself.

On the "search recipes" screen, a variety of **optional nutritional filters** are available to limit the returned results, and two **tabs clearly demarcate** what can be cooked immediately and what can be prepared with more ingredients. The **ability to switch the visualization** of nutritional benefits for different user profiles is available on this same screen, eliminating the need to interrupt the task of recipe selection and navigate away to a separate screen. This shortcut supports multitasking meal-planners who might need to compare one recipe's nutritional benefits for multiple people in the household quickly and easily, and move on to assembling their meal plan.

All three designs provide the ability to assemble meal plans on a calendar, but Dinner Spinner also **saves meal plans** as collections of recipes assigned to abstracted time intervals. Plans can be

cloned or reused. However, unlike the other two designs, Dinner Spinner provides **no way to adjust the serving size** of the selected recipes, nor does it **track the expiration date** of inventoried items.

### *Sous-Chef*

Through a **conversational interaction pattern**, this design removes a lot of the cognitive load associated with the decision making process of selecting an appropriate recipe. While making recommendations to the user, this design takes into consideration not only on the ingredients present in the inventory but also accounts for **user preferences** with regards to nutritional requirements, budgetary and time constraints. This design also incorporates a **rating system** for recipes, which allows the app to record user preferences over a period of time and use this information to provide **recommendations** that are a close fit for the user's taste.

Sous Chef is also the only design that allows users to **adjust the serving size**, providing dynamic calculations of the quantity and cost of the recipe's component ingredients. This feature makes the application especially useful for the portion of target users who cook for themselves are are frustrated by the spoilage and cost of preparing too much food when a recipe yields four to six servings.

The **limited long-term planning** capabilities of this system are not as strong as the other design alternatives and therefore, has lesser influence in improving the purchasing habits of the user. Also, this design follows a fairly **linear approach** that aims to restrict the number of options present on the screen at a given point of time, which might not be the best choice for power users who like to control every aspect of the decision making process in every step of the way.

### *Inventory App*

This design is offers a **descriptive visual representation** of inventory by simulating the immediate overview of looking inside an actual refrigerator or pantry. This overview is enhanced by indicating items' quantity and days until expiration without having to click through to a deeper screen. By **calling out items** nearing their expiration date, and keeping depleted items on the shelf with the note to "reorder," the application caters to the home cook who is comfortable with a relatively unchanging inventory.

Because this app is deployed on a mobile device an makes quantity easily accessible from the Inventory menu, the design provides short-term shoppers a **way to avoid repurchasing items** they already have. The **grocery list is segmented** according to the items' placement in a grocery store, facilitating the actual shopping experience and saving time.

For its focus on inventory and restocking, this design **sacrifices the robust search interface** that invites users to compare similar recipe results on the same screen without returning to the previous search overview. The detailed view of meal information displays nutritional information, but it **does not provide contextual framing** from the user profile to make nutrition personal or immediately relevant to the user. Rather, profile information is called before searching recipes to narrow search criteria by allergies or favorite foods.



COMPARISONS ALONG CRITERIA

	<b>Visual representation of options</b>	<b>Search and Filter functionality</b>	<b>Customization of User Profiles</b>	<b>Operational potential for digital artifacts</b>
<b>Inventory App</b>	Photo-realistic images of inventory items aids visual thinkers and consistent shoppers.	Filters are applied before search returns results.	Used to find favorites and filter out allergens in recipe search. Information doesn't further understanding of a recipe's personal health benefits.	Generates interactive digital shopping list from meal plan data.
<b>Sous-Chef</b>	Simplified lists with smart indicators that assist the user in making informed choices in recipe selection	Search and filters are mainly used in manage inventory.	Supports multiple user profiles, with preferences and rating systems.	Actual recipe is displayed inside the app, so users can quickly take action and cook their search result.
<b>Dinner Spinner</b>	Abstract data visualizations focus users' attention on balance and benefits rather than lust for visceral images.	Ability to narrow results by nutritional criteria, immediate availability and range of ingredients.	supports multiple profiles, and allows users to switch between them as a peripheral operation while doing other tasks (like search and assembling plans)	Calendar view of meal plan provides a culinary datebook for future reference and reflection.

COMPARISONS ALONG CRITERIA (continued)

	<b>Immediate legibility of the interface</b>	<b>Multi-user capability</b>	<b>Saved States</b>	<b>Potential for emotional connection</b>
<b>Inventory App</b>	Semantic icons correspond to the app's 4 main functions. Borrows conventions like tabs and buttons to navigate through screens.	Supports one user profile. Can email grocery list to others.	Saves user profiles, one meal plan and inventory data.	Images of food conjure personal associations. Portable interactive grocery list is like a companion.
<b>Sous-Chef</b>	Directed flow through the process of selection and planning makes this design highly legible.	Supports multiple user profiles.	Saves user profiles, one meal plan and inventory data. Also tracks food rating information, allowing the system to make better recommendations for the user.	Conversational guide through meal selection assuages insecure cooks. The recommendation system can improve emotional connection, especially if the recommendations are perfectly in tune with the user tastes
<b>Dinner Spinner</b>	Myriad customization settings and entry points are not immediately apparent to first time users.	Supports multiple user profiles. Can email grocery list to others.	Saves user profiles, multiple meal plans and inventory data.	Cerebral analysis of food and stark visuals stymie immediate emotional connection. Could be seen as a valuable helper with more use.

## 5. Reflections

We started in on our discussions about interface designs by looking at the data we received from Phase 1 and narrowing the feature set to things respondents said influenced their planning decisions most. Once we narrowed that list, we assessed the computational feasibility of their incorporation, and thought about the abstract organization of information as nodes in a relational database. By considering users' needs and our abilities under the pressure of time and resources, we decided to privilege the display of nutrition and cost of each recipe to assist with decision making.

Then we moved to the whiteboards and outlined the screens that branched off two central features of our application: inventory management and meal planning. The ability to search recipes and print grocery lists were tied to these hubs of functionality, and grew organically as desirable functions. Additionally, these were tasks respondents said they already used technology to achieve, so the conventions were in place to implement them without much reinvention.

After establishing the primary feature set, we collaborated on rough sketches of different interfaces over two meetings. These sketches were also executed on the whiteboard, so iterations were fast and the collaboration total. Paper sketches and photos of these whiteboard sessions are attached in the appendix. Then we separately mocked up the designs using different digital wireframing software. We conceived the designed together in the whiteboarding sessions, and the separate refinements were necessary since our group lacked the uniformity of tools and operating systems to work jointly on the same digital files. Ashton worked on Dinner Spinner using Pencil, Bala on Sous-Chef using Blend, and Mason on Inventory App using Photoshop. Xuejiao assembled our storyboards and collocated our designs into a cohesive narrative to elucidate how our disparate designs each fulfill the functional requirements established in part 1. We shared our first round of designs through postings on a private Google Group, made suggestions to each other, and iterated before Friday's poster session. After the poster session, we returned to our designs and added missing screens for the storyboards illustrating critical use cases.

Overall, the balance between aesthetics and utility was a beacon that guided our initial discussions about the best way to design an interface to support (immediate/holistic/habitual) decision-making. We were successful in rooting our ideas in the assumption that one should not overpower the other, and reined in any ideas that threatened that equilibrium. Next time, it would behoove us to step away from the details of widgets and controls to focus on transitions between screens, the appearance of system messages and other procedural sequences (like "undo"). We created interaction maps after the designs were finished to document and illustrate our application's functionality. Perhaps mapping those flows initially and abstractly, without the distraction of concrete displays and controls, would reduce the navigational adjustments that were necessary after the first rounds of design.

## Citations

Gustavsson, J., et al. "Global Food Losses and Food Waste: Extant, causes and prevention." Study conducted for the International Congress. Interpack2011, Dusseldorf, Germany. 2011. [http://www.fao.org/fileadmin/user\\_upload/ags/publications/GFL\\_web.pdf](http://www.fao.org/fileadmin/user_upload/ags/publications/GFL_web.pdf). Last accessed March 5 2011.

"Wireless Electricity is coming to your kitchen and grocery stores." YouTube, Uploaded Jan 11 2011. <http://www.youtube.com/watch?v=QJGSmpfkJB0>. Last accessed March 5 2011.

## Appendix

### Critical Use Cases (revised)

#### 1. Select Recipe

USER INTENTION	SYSTEM RESPONSIBILITY
Decide to search recipes by ingredients	
	Offer all ingredients in inventory
Choose an ingredient	
	Offer recipe list Offer ingredients in inventory for another selection
Choose another ingredient	
	Offer recipe list Offer ingredients in inventory for another selection
Specify criteria and their values by which to filter results	
	Provide filtered results
Select recipe	
	Offer recipe details
Check if recipe can be cooked immediately	

	Provide information about missing or lacking ingredients
Request expected cost of ingredients	
	Provide expected cost
Request nutrition information	
	Provide nutrition information
Add to meal plan	
	Save recipe in meal plan

## 2. Manage Inventory

USER INTENTION	SYSTEM RESPONSIBILITY
Access inventory list	
	Retrieve inventory information
Request to add/ delete item	
	Request item name, quantity, expiration date
Provide requested information	
	Save to inventory

### 3. Add Nutritional Profile

USER INTENTION	SYSTEM RESPONSIBILITY
Access nutritional profiles	
	Retrieve profiles
Request to add profile	
	Request name
Provide name	
	Provide options for nutritional tracking
Select nutritional statistics to track	
	Provide values for nutritional options
Enter acceptable values	
	Save options and associated values with name

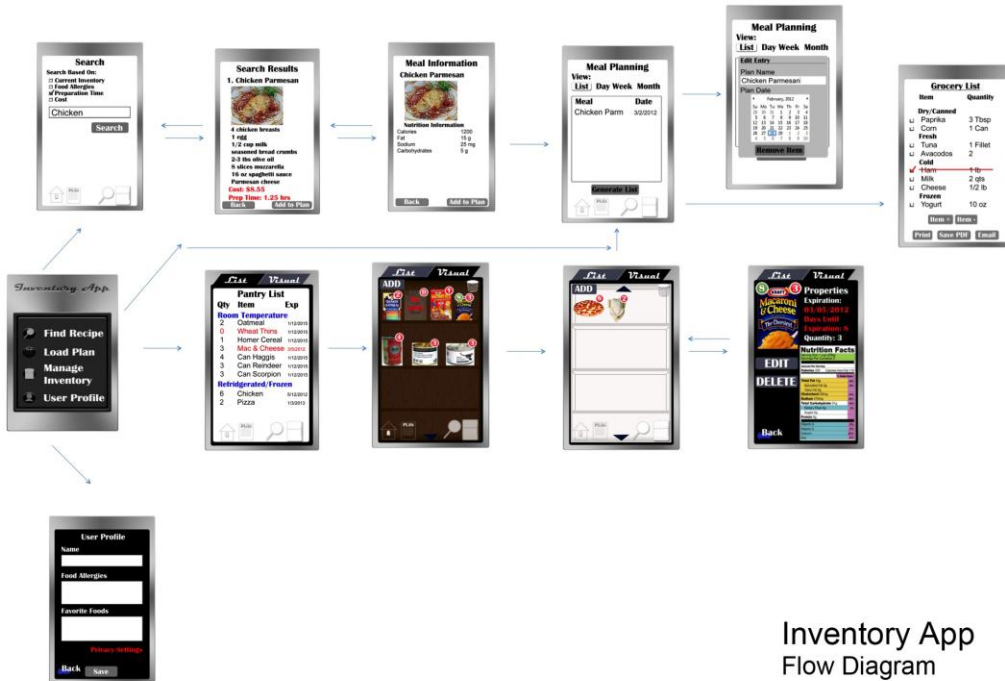
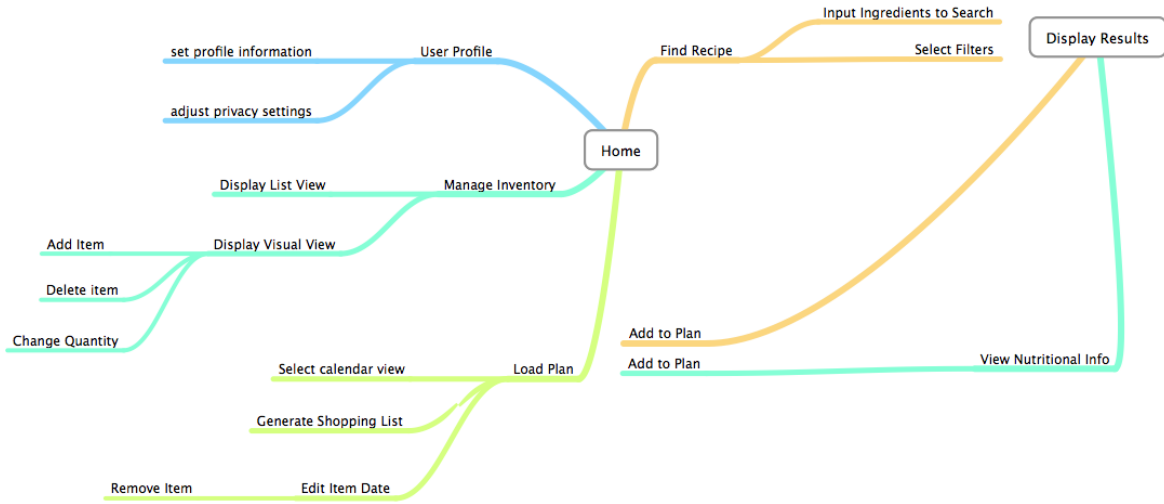
### 4. Assemble Meal Plan

USER INTENTION	SYSTEM RESPONSIBILITY
Request to assemble a meal plan	
	Provide recipes associated with current plan

Associate meals with appointed date	
	Confirm user selection Save user selection
Alter date for scheduled meal	
	Update to reflect alteration Save user selection
Request shopping list	
	Provide shopping list

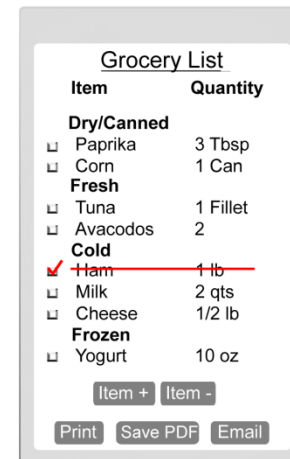
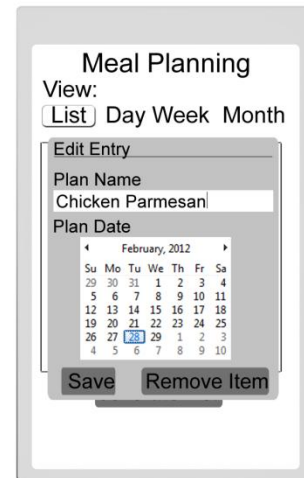
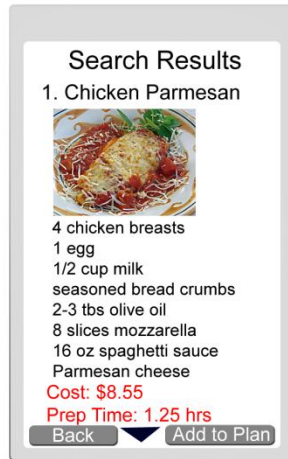
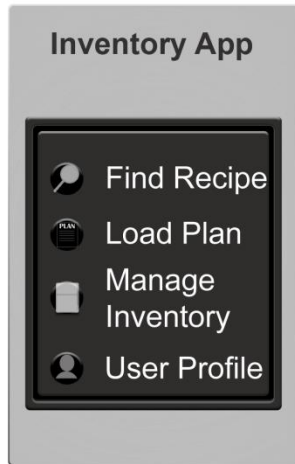


# Flow Diagrams: Inventory App



Inventory App Flow Diagram

Screenshots: Inventory App



**List / Visual**

### Pantry List

Qty	Item	Exp
<b>Room Temperature</b>		
2	Oatmeal	1/12/2015
0	Wheat Thins	1/12/2015
1	Homer Cereal	1/12/2015
3	Mac & Cheese	3/5/2012
4	Can Haggis	1/12/2015
3	Can Reindeer	1/12/2015
3	Can Scorpion	1/12/2015
<b>Refridgerated/Frozen</b>		
6	Chicken	5/12/2012
2	Pizza	1/3/2013

Item +    Item -

### Search

Search Based On:

- Current Inventory
- Food Allergies
- Preparation Time
- Cost
- Food Favorites (from Profile)

Ingredient(s):

\*Separate Ingredients by commas

Search

**List / Visual**

ADD

**List / Visual**

ADD

**List / Visual**

EDIT  
DELETE

Back

### Properties

Expiration: 03/05/2012  
Days Until Expiration: 8  
Quantity: 3

### Nutrition Facts

Serving Size: 1 (100g)  
Servings Per Container: 2

Amount Per Serving	Calories 250	Calories from Fat 110
	% Daily Value*	
<b>Total Fat</b> 12g	18%	
Saturated Fat 3g	18%	
Trans Fat 3g		
<b>Cholesterol</b> 30mg	18%	
<b>Sodium</b> 470mg	95%	
<b>Total Carbohydrate</b> 31g	18%	
Dietary Fiber 5g	9%	
Sugars 5g		
<b>Protein</b> 5g		
Vitamin A	4%	
Vitamin C	2%	
Calcium	20%	
Iron	4%	

### User Profile

Name

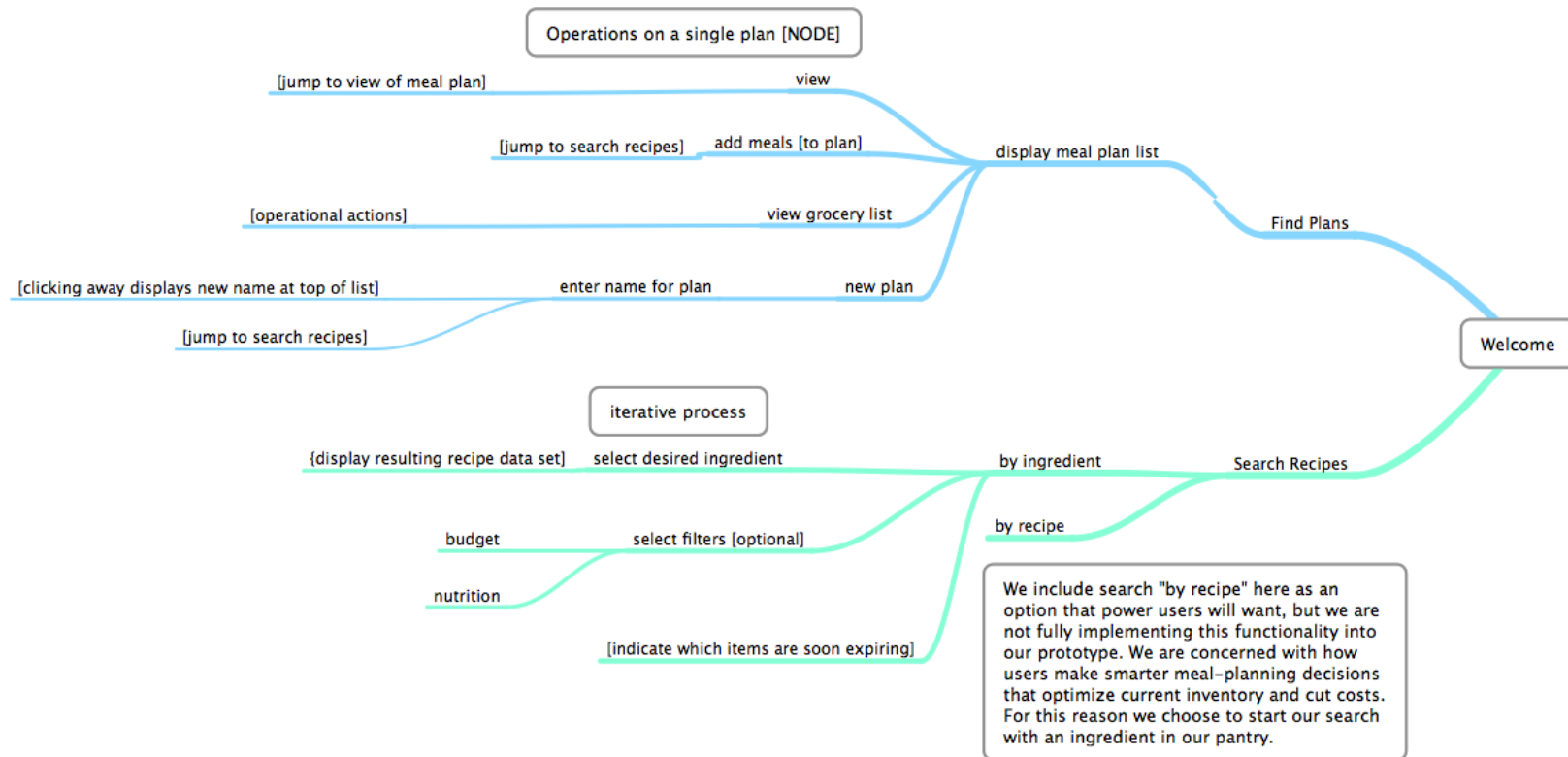
Food Allergies

Favorite Foods

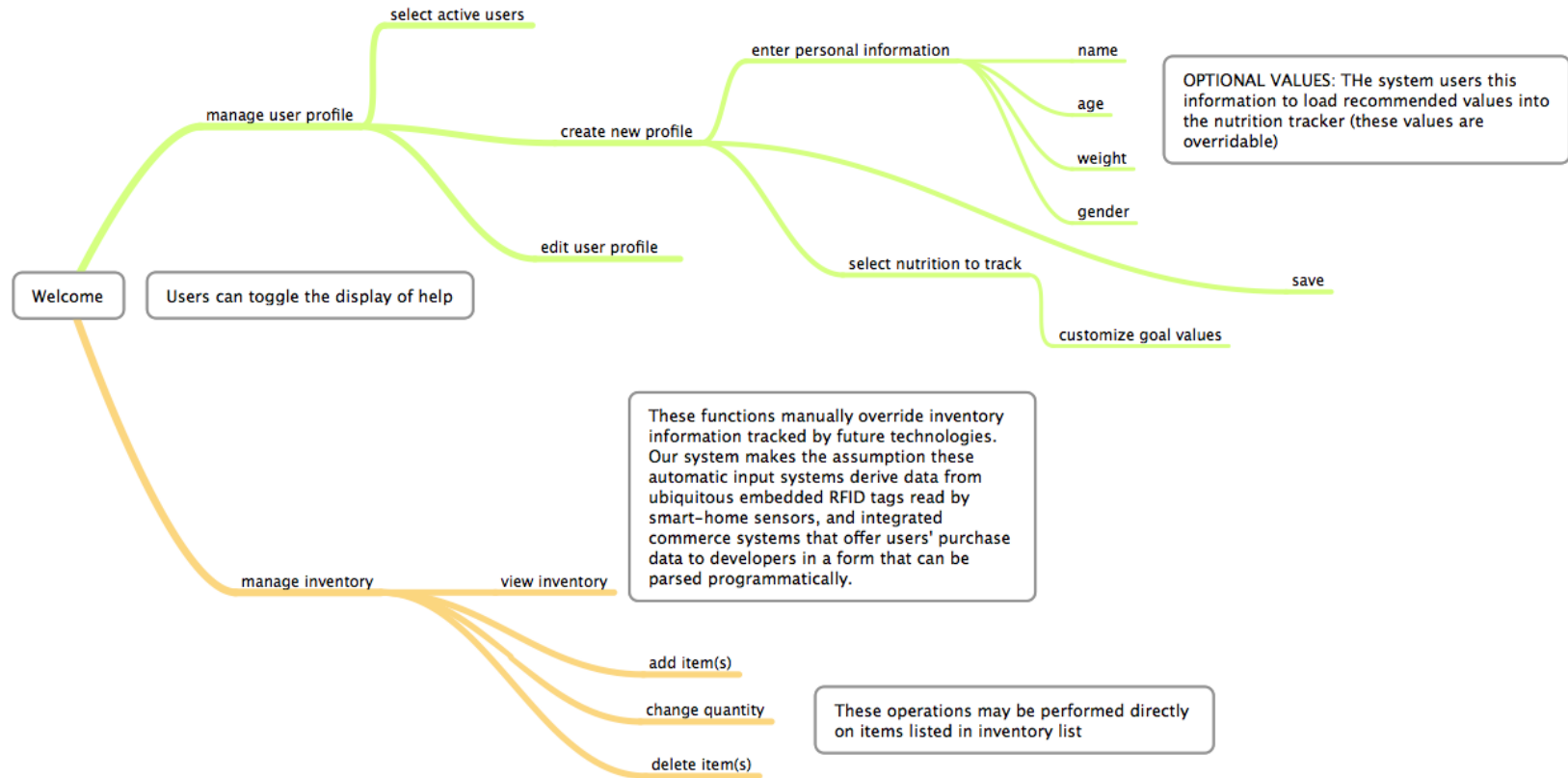
Privacy Settings

Back    Save

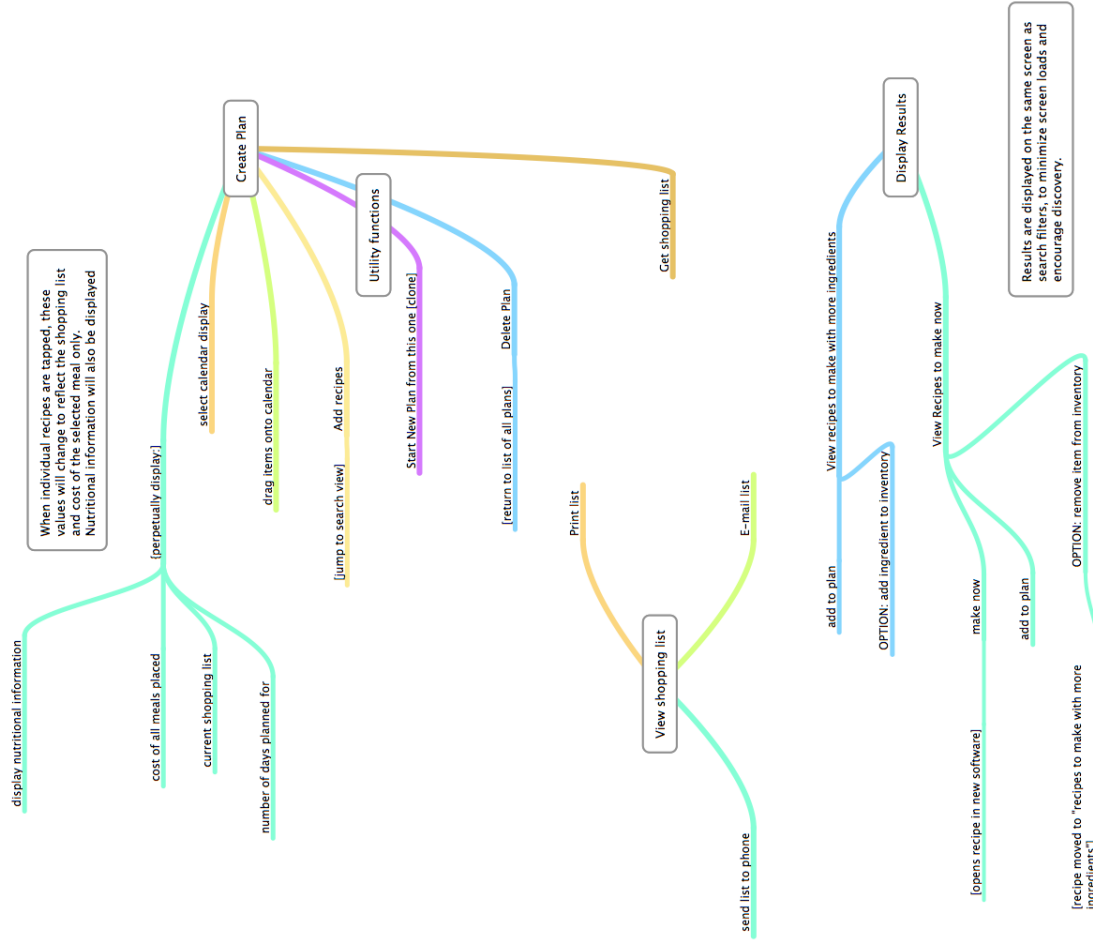
## Flow Diagrams: Dinner Spinner



## Flow Diagrams: Dinner Spinner (continued)



# Flow Diagrams: Dinner Spinner (continued)



# Screenshots: Dinner Spinner

**set nutrition profile**      **manage inventory**

Set goals to eat healthy.

Add & delete items.

**Dinner Spinner**

Start looking for inspiration!

Get shopping lists. Load meal plans.

**find plans**      **search recipes**

**set nutrition profile**      **manage inventory**

**Current Inventory**

Coffee	1	batch
Chickpeas	1	batch
ice cream	1	batch
Spinach	3	lbs
Onions	12	units
Celery	1	batch
Sugar	2	cups

DELETE: Drag items from inventory here to delete

ADD: name of item, units, Add, OR, Scan barcode

**set nutrition profile**      **manage inventory**

**Nutrition to track**

Carbohydrates, Sodium, Calories

Drop to enable nutritional tracking for information on the right

CALORIES, SATURATED FATS, SODIUM, FIBER, CARBOHYDRATES, VITAMIN B, VITAMIN C, POTASSIUM, SUGAR

**find plans**      **search recipes**

**set nutrition profile**      **manage inventory**

**create new plan**

- Holiday Cocktails 2012 view
- Zenny's Birthday Party view
- Post-Vacation Shopping view
- Shopping 12-4-2012 view
- Post-holiday diet view
- Strength training view
- Fiber-centric view
- 5 meals under \$20 view
- Lemonade Diet Recipe view

Menu/Item, Menu/Item, Menu/Item, \$125, Average nutrition, Shopping list

**find plans**      **search recipes**

**set nutrition profile**      **manage inventory**

typ add Recipes

- Holiday Cocktails 2012 view
- Zenny's Birthday Party view
- Post-Vacation Shopping view
- Shopping 12-4-2012 view
- Post-holiday diet view
- Strength training view
- Fiber-centric view
- 5 meals under \$20 view
- Lemonade Diet Recipe view

Menu/Item, Menu/Item, Menu/Item, \$125, Average nutrition, Shopping list

**find plans**      **search recipes**

**set nutrition profile**      **manage inventory**

Search by Ingredient, Search by Recipe, Assemble Plan

First, select an ingredient on the spinner to display results.

COST 0.00

NUTRITION

**find plans**      **search recipes**

set nutrition profile manage inventory

Search by Ingredient Search by Recipe

Assemble Plan

Filters: Carbs, Protein, Fat, Fiber, Sugar, Sodium, Cholesterol, Saturated Fat, Carbohydrate

Ingredients: Turkey Pot Pie, Turkey Tetrazzini, Turkey Leg, Celery Strips, Honey Buns, Noodles with Turkey and Broccoli

Cost: \$12.50

Nutrition: Anna

set nutrition profile manage inventory

Search by Ingredient Search by Recipe

Assemble Plan

Filters: Carbohydrates, Protein, Fat, Fiber, Sugar, Sodium, Cholesterol, Saturated Fat, Carbohydrate

Ingredients: Turkey Pot Pie, Turkey Tetrazzini, Turkey Leg, Celery Strips, Honey Buns, Noodles with Turkey and Broccoli

Cost: \$12.50

Nutrition: Anna

set nutrition profile manage inventory

Back to search Get Shopping List

NAME OF PLAN

	M	T	W	Th	F	Sa	Su
Heart of Palm							
Mac and Ch.							
Seasoning Cl.							
Tofu Stir Fry							
Tilapia with Green Beans							
Brussels Sprouts with Bacon							
Eggplant Parmesan							
<b>TOTALS</b>	<b>4 days</b>						
	<b>\$36.34</b>						

Ingredients: Lemon Pepper Chicken, Grains Gravy with Mungo, Sausage and chutney, Ginger Beer, Tofu Stir Fry, Tilapia with Green Beans, Brussels Sprouts with Bacon, Eggplant Parmesan

Cost: \$36.34

find plans search recipes

set nutrition profile manage inventory

Back to search Get Shopping List

NAME OF PLAN

	M	T	W	Th	F	Sa	Su
Heart of Palm							
Mac and Ch.							
Seasoning Cl.							
Tofu Stir Fry							
Tilapia with Green Beans							
Brussels Sprouts with Bacon							
Eggplant Parmesan							
<b>TOTALS</b>	<b>4 days</b>						
	<b>\$36.34</b>						

Ingredients: Lemon Pepper Chicken, Grains Gravy with Mungo, Sausage and chutney, Ginger Beer, Tofu Stir Fry, Tilapia with Green Beans, Brussels Sprouts with Bacon, Eggplant Parmesan

Cost: \$6.34

find plans search recipes

set nutrition profile manage inventory

Back to search Get Shopping List

NAME OF PLAN

	M	T	W	Th	F	Sa	Su
Heart of Palm							
Mac and Ch.							
Seasoning Cl.							
Tofu Stir Fry							
Tilapia with Green Beans							
Brussels Sprouts with Bacon							
Eggplant Parmesan							
<b>TOTALS</b>	<b>4 days</b>						
	<b>\$36.34</b>						

Ingredients: Lemon Pepper Chicken, Grains Gravy with Mungo, Sausage and chutney, Ginger Beer, Tofu Stir Fry, Tilapia with Green Beans, Brussels Sprouts with Bacon, Eggplant Parmesan

Cost: \$6.34

find plans search recipes

set nutrition profile manage inventory

Meal Plan

SHOPPING LIST

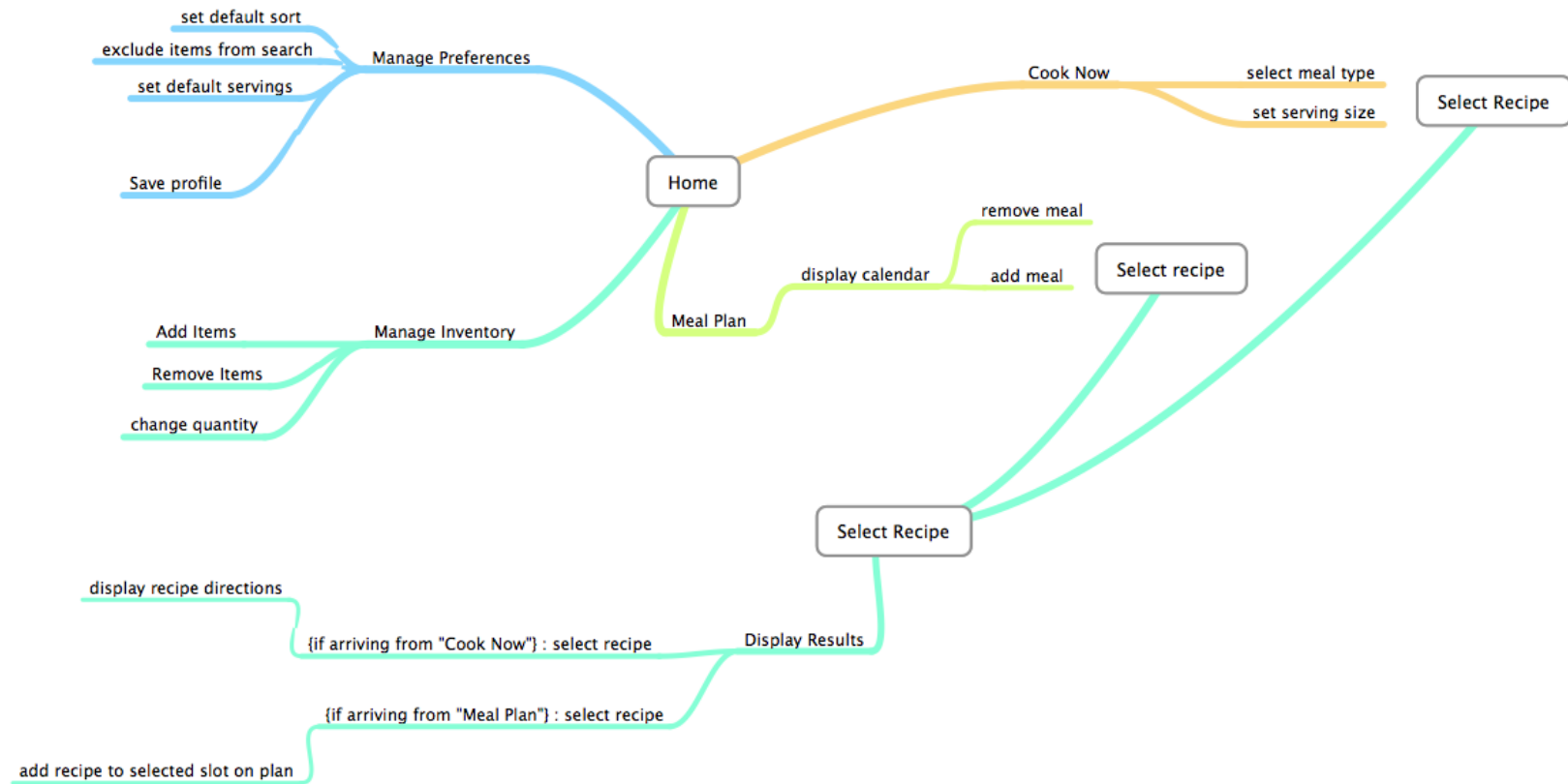
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- Cell Content 1
- Cell Content 2
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Cost: \$84.32

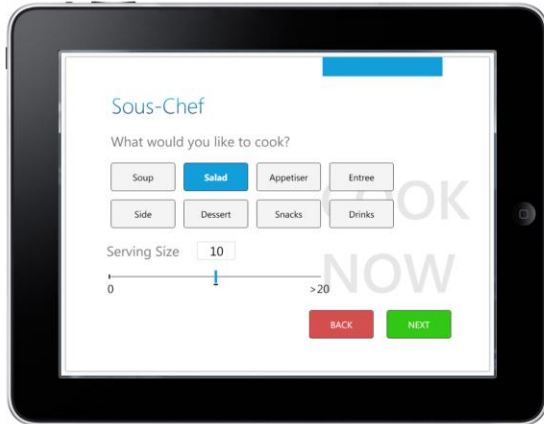
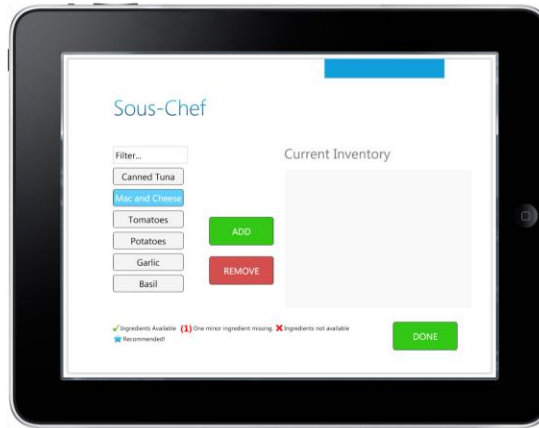
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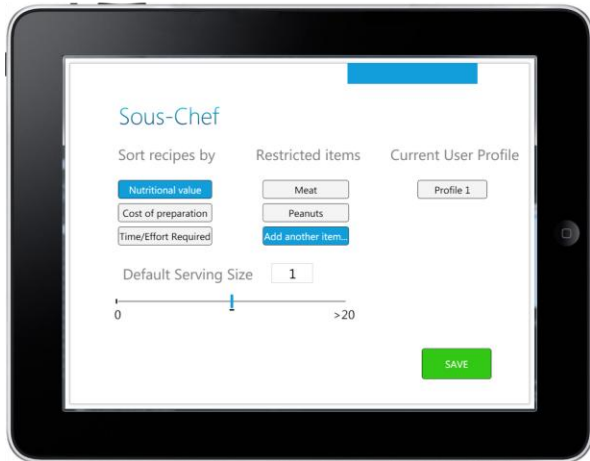
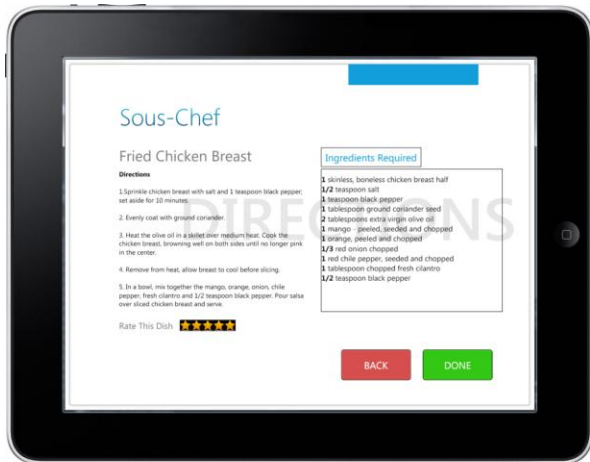


# Flowchart: Sous-Chef



Screen Shots: Sous Chef





# Design Sketches and Whiteboard Sessions

