

Cook and Eat Healthy: Project Report HCI

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ABSTRACT

This paper is a project report of “Cook and Eat Healthy”, a prototype developed for Human Computer Interaction course. The prototype mainly focuses on assisting the individuals to cook healthy food according to their nutritional demands and promote healthy eating. The paper discusses about how the prototype evolved iteratively by performing various evaluation techniques like ethnography, paper prototyping, heuristic evaluation and user testing at various stages of the prototype.

The primary tasks for the prototype were as follows:

1. “Create own recipe”, where users can create/customize their own recipe using the ingredients as per their nutritional demand.
2. “Share recipes with friends” – My Wall, where users can share their recipes with their friends.
3. “Read recipes” – Recipe Book, where users can read their own, friends’ and experts’ recipes.

The paper discusses the design of the prototype thoroughly, its implementation, various evaluation methods, how the results of the evaluation methods helped in evolving the prototype. It also discusses about alternative approach that could have been adopted for designing the prototype.

Author Keywords

Human Computer Interaction; User Interface; User Centered; Recipe Book; Healthy Cooking

ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

General Terms

Human Factors; Design; Measurement.

1. INTRODUCTION

Most people today live on junk food for various reasons [1]. Junk food may result in high nutritional deficiencies and intake of high calorie diet [2]. The percentage of people having some nutritional deficiency is high [9]. People lack information about what to consume to overcome their nutritional deficiencies [3]. Hence, it becomes extremely important to guide them to overcome these problems by assisting them in healthy cooking. Several times, people have ingredients with high nutritional value, but fail to prepare something healthier with those ingredients. Therefore, it is important to help such users.

“Cook and Eat Healthy” aims at providing healthier food solution. It is an online application, which helps users to create/customize the diet menu as per the nutritional requirement of the body. Also, users can read the recipes created by their friends, experts and share their own recipes with their friends.

“The advances in online social networks now allow individuals to change attitudes and behaviors on a mass scale” [8]. Social networks act as strong persuasive technology. People like to share their content with other people in their social network [4,5,6,7,8]. Hence in order to promote healthier lifestyle, social network was thought to be the best option for “Cook and Eat Healthy”.

The target audiences are people who wish to eat and promote healthy eating, people who are suffering from nutrient deficiency problems or who would like to limit the intake of high calorie meal. Also, people who would like to share their own recipes with their friends.

Technology is a good solution to help such set of people as use of technology has been increasing over past few years [11]. Latest surveys show that new technologies have had impact on one of the oldest human activities i.e. cooking” [10]. Hence, having an online web application to address these issues will be a good solution.

2. RELATED WORK

Currently there are various sites, which address similar problem. One of them is Taste Book [12], which has a section of creating recipes and saving them in my recipe section. However, users are not provided with a list of ingredients and images of ingredients to chose from while creating their recipes. Also, there is a website called Choose

My Plate [13], which has a section that helps us to know about the nutritional value of various ingredients. However, it lacks in providing what recipes can be cooked using these ingredients.

3. DESIGN

“Cook and Eat Healthy” aims at providing healthier food solution. It is an online application, which helps users to create/customize the diet menu as per the nutritional requirement of the body. Also, users can read the recipes created by their friends, experts and share their own recipes with their friends. The primary goal of the application is to promote healthier lifestyle by helping individuals in cooking healthy food. The application will be a web-based application that will be available to any individual who has access to Internet. The applications can be accessed on desktops, laptops, tablets*, mobile phones* or any device, which has access to the Internet.

3.1 Functional Requirements:

3.1.1 Create your own recipe:

In this section users can filter ingredients that they want to include in their meal as per their nutritional requirement. Along with the nutrients, they can also specify the amount of calories they want their meal to have. After selecting the nutrients and calorie intake, ingredients are displayed that users can use in their recipe. Users can either drag the ingredients that are displayed at the top of create your own recipe section or can select from the list displayed in the left navigation. Once the user has finalized his/her ingredients, he/she can hit the done button. After hitting the done button, user is provided with two options; viz. “Customize recommended recipes” or “Create your own recipe”. Selecting the first option, the user will be provided with the recommended top recipes for the selected ingredients. User can select one of it and can further customize according to his/her needs. On the other hand, selecting the second option, the user can create his/her own recipe from start. After the user has created/customized the recipe, user can save that recipe to his/her own recipes.

3.1.2. Share recipes with friends – My Wall:

In this section users can search and add their friends. They can also share the recipes that they have made with their friends. This section also acts as a profile page for the user where he/she can see her basic information that he/she will be sharing with his/her friends. Also, the list of recipes and videos that the user has saved/uploaded will be shown here. This is the section where user is given the option to upload the videos.

3.1.3. “Read recipes” – Recipe Book:

In this section user will be shown with the list of all recipes with their ingredients, method, time to cook, and rating and nutritional value. If the user is not signed in, he/she can read the recipes suggested by experts. If the user is signed

in, he/she can read his own recipes, friend's recipes and expert's recipes.

3.2 Non-Functional Requirements:

3.2.1 Usability:

a) Learnability: The design of the system is easy to understand. Sufficient interaction metaphors and probing mechanisms help users to easily perform actions. The design of the system follows the Nielsen’s heuristic principle of “Aesthetic and minimalist design”. Also, there is a help section that will help users to understand the working of the entire application.

b) Consistency: The design of every page is consistent with the other page. Users can every time view all the tasks they can perform. This is in accordance with Nielsen’s “Consistency and Standards” principle.

3.2.2 Extensibility:

The prototype has been developed using Microsoft’s latest web development tool WebMatrix [13], which is a free, lightweight, cloud-connected web development application. Thus, in future if there is a need to extend the prototype, the WebMatrix provide easy methods modify, publish and maintain the application.

3.3.2 Robustness:

In case, if the user performs some unwanted actions he/she can go back to any page without any error. This is in accordance with Nielsen’s heuristic principle “Help users recognize, diagnose, and recover from errors”.

3.3.3 Scalability:

WebMatrix is used to develop the system, which is a cloud-connected platform. Hence, even if the database for users increases the system would be scalable enough to accommodate large number of users.

3.3 Evolution of Design:

Initially the development of the prototype started with ethnographic studies, where we interacted with the target users to gather and clarify our requirement analysis. These studies also helped us to prioritize our functional and non-functional requirements. Then we had three design ideas to cater to the functional requirements. First, The “MealMall”, a mobile-based application that categorizes all healthy recipes and allows users to search a particular recipe, read recipe and email that recipe to friends. Second, “Digital Menu Card”, a menu card that will be used in restaurants to help users to select all the ingredients that they want in their dish and they will also know about the nutritional value of the dish that they want to order. As a result, customers will get more options to customize. Then they can place their order using the digital menu card. Third was “Cook and Eat Healthy”. We finalized “Cook and Eat Healthy” as from our ethnography studies we found that the target users were not only interested in customizing their recipe/meal but also

wanted to cook it on their own. Among the three designs that we had proposed “Cook and Eat Healthy” best compliments our ethnography studies.

After finalizing the design, we developed a paper prototype and conducted pilot test on two users and user test on four users. After the evaluation, we drastically changed the design. Initially for our home page, foveal viewport (Foveal area) was not considered while positioning the modules [14]. Navigation was not consistent and was confusing for user to understand. Hence we updated the prototype as per the feedback.

After finalizing the paper prototype, we developed a medium fidelity prototype. The prototype was given for heuristic evaluation to other team in the class. From the feedback of heuristic evaluation, we again drastically changed the design of our system. Following were the recommendations and our actions on them.

1. Recommendation: The user was wondering if the users are allowed to add videos on to the System because she saw videos on the page ‘Wall’ and no functionality or information on how to add or delete them was provided anywhere.

Action: We added the placeholder for Add and Upload a video.

2. Recommendation: The user had recommended, “All the features can be implemented only if the user logs in to the system. But how does the user log out of it. Hence, the system fails to facilitate user privacy and security.”

Action: Sign in-Sign out functionality was added and passwords were encrypted.

3. Recommendation: The user had recommended, “The label used for the menu item ‘Wall’ does not signify that the user can add friends, see videos or share recipes. It can lead to confusion when the user sees ‘Friends Recipes’ on the menu but does not know how to add friends”.

Action: Currently most of the people follow Facebook [15] and are comfortable with “Wall” which is like profile where one can read “About me”, “My Videos”, “My photos” etc. Hence we did not change the name “Wall”.

4. Recommendation: Clicking on “Experts’ Recipes” on homepage takes the user to ‘My Recipes’.

Action: We changed the functionality. Now Experts’ recipes redirects to Expert’s Recipes page.

5. Recommendation: No help or documentation provided on the system. Novice users may often need help while navigating through the system.

Action: We have added help section to our system to help users to get acquainted with the several tasks that a user can

perform in the application.

6. Recommendation: It was not clear on how the users will be notified on being added by their friends.

Action: Considering the scope and priorities of the primary functional requirements, we did not consider this functionality to be implemented in this version of the prototype.

7. Recommendation: Most pictures of recipes do not match the name recipes.

Action: We have changed all the pictures in the system and now all the pictures match with the names of the recipes.

8. Recommendation: User searching for friends, not finding their name as suggestion.

Action: We have added a temporary functionality to cater to this requirement.

9. Recommendation: My recipes are there in both read recipes and wall. Should be removed.

Action: We did not implement the above recommendation as we felt having my recipes in two places helps users to provide multiple entry points to the same information. Also, my recipes in the wall section only have a snippet describing about the recipe. When a user clicks on it, the recipe is opened in the read recipe section.

10. Recommendation: Can't delete friends

Action: Considering the scope and priorities of the primary functional requirements, we did not consider this functionality to be implemented in this version of the prototype.

4. IMPLEMENTATION

1) We have developed the entire website using WebMatrix with ASP.NET 4.0 pages and Razor syntax. The website that we have developed is a dynamic website which pulls data as per user query from the database that we have created. The database is stored in the form of SQL Server Mobile File (.sdf). For client side scripting, we have used JQuery and JavaScript.

2) The top navigation for the entire website was kept constant to maintain the consistency throughout the system. Also, the images used in the top navigation mapped to the real world interaction metaphors, for example, create own recipe has a picture of a chef with a pan in his hand. Along with realistic pictures, we have also provided relevant tool tips that help users to navigate through the system.

3) As our website is a social application, we have sign-in functionality to address user authentication. For sign-in, we have not directly stored the passwords in the database; instead we have encrypted them.

4) We have a help section, which helps users to get acquainted with the several tasks that a user can perform in the application.

5) We have embedded the videos on our website using iframes.

6) For the slider on the home page, for dragging the ingredients, calorie meter, auto complete in search and add friends we are using a JQuery plugin.

7) In recipe book, when the page is loaded for the first time, we query all the recipes and bind to each tab. This reduces the overhead of querying the database and fetching the updated HTML again and again when the user clicks on read recipe. Thus, increasing the performance of the system.

8) Cross-browser compatibility has been implemented so that the users with different browsers have consistent view of the website.

4.1 Important Design Decisions:

a) Navigation:

Having a top navigation with self-explanatory images and relevant tool tips. Also, the consistency was maintained throughout the system adhering to Nielsen's "Consistency and Standards" principle. Please see the image below:

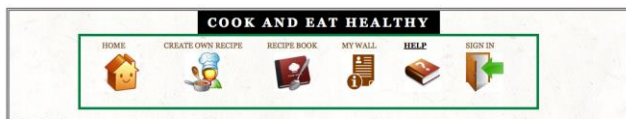


Figure 1

b) Background Color & Image:

We have selected a light and aesthetic background color with a light colored image. This was done so that user is not distracted by a very eye catching image. Also, light background color increases readability of the main contents of the website. Thus, this decision adheres to Nielsen's minimalistic design principle.



Figure 2

c) Foveal Viewport Centric Design:

The primary functionalities are placed at the foveal viewport of the website i.e. the main contents of the website are placed in the middle section of the webpage.



Figure 3

d) Rating using stars:

The star rating images catch more user attention than the rating shown in numerical form and are easier to understand. Hence, the star rating images have been used to rate the recipes in the application.



Figure 4

e) Displaying Ingredients after Filtering:

A user search result of ingredients after selecting the filter parameters can result in several ingredients. Thus, showing the images of all the ingredients in the top navigation would have resulted in cluttering of data and may have resulted in a horizontal scroll bar. Hence, we just show some of the ingredients below the top navigation and rest are shown in the left pane. Please see the highlighted content in green box below.

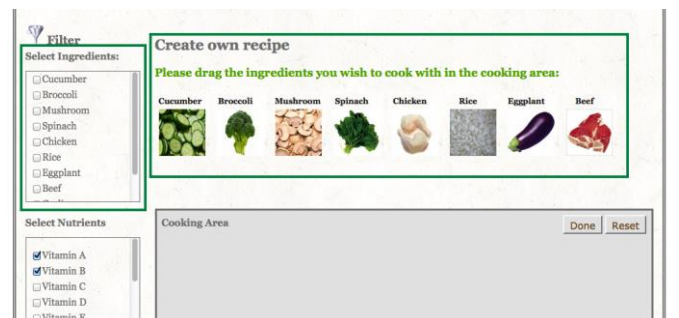


Figure 5

f) Confirmation Box:

Whenever, a user wants to share or unshare a recipe, the recipe is not shared or unshared directly on users first action. However, the user is prompted with a confirmation box so that user does not share/unshare the recipe by mistake.

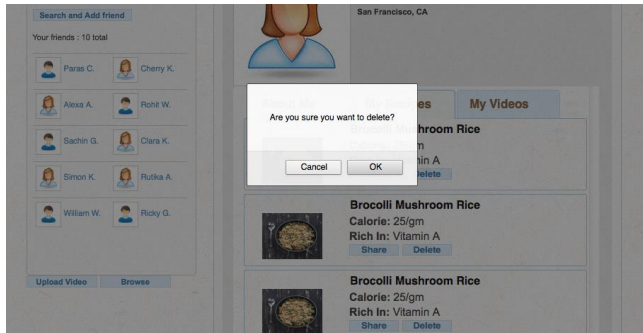


Figure 6

g) Slider for calorie meter:

We have implemented the calorie meter in create own recipe section using a slider instead of asking the user to manually type in the calorie count. This, helps us to reduce the overhead of validation of the calorie count entered by the user.

h) Probes:

Wherever possible we have used textual probes to help users to perform the task easily and without confusion. Thus, acting as error prevention mechanisms.



Figure 7

5. EVALUATION METHOD

After the final prototype was developed, we conducted user tests on three users. The main goal of our testing was to identify, if the prototype is meeting our functional and non-functional requirements.

5.1 Metrics for Functional Requirements:

Functional Requirement	Effectiveness measures	Efficiency measures	Satisfaction measures
Read Recipe	Different types of recipes read	Time spent in section > 2 mins	Rate out of 10

	viz. friends', experts', own		
Share Recipe	Three recipes are shared. When a user clicks share, an alert is shown stating that the recipe is successfully shared.	After entering My Wall, the task should be performed in < 30 seconds	Rate out of 10
Create own Recipe	User is able to create a recipe from start	Users saves the recipe after proper creation	Rate out of 10
Customize Recipe	User is able to customize the recommended recipe	User is customizing the recipe by atleast more 30%	Rate out of 10

5.2 Metrics for Non-Functional Requirements:

Non-functional Requirement	Effectiveness measures	Efficiency measures	Satisfaction measures
Usability	The user should be able to navigate and perform tasks easily.	User should be able to perform tasks without m	Rate out of 10
Performance	The user should be able to perform task effectively without any delay.	The page load time should not be greater than 5 seconds	Rate out of 10

5.3 User Testing

We conducted user testing by using think aloud evaluation for our system. Users were briefed about the application as follows: "We are building a social network to promote healthy cooking and eating where people can customize their own recipes, share and read other user's recipes." They were given the following tasks:

1. Read recipes
2. Customize recipe.
3. Create own recipe
4. Share Recipes

Users were asked with the following questions:

1. Would you like to be presented with a site offering you the option to customize your daily meals with something to help you gain what nutrient you are lacking in?
2. Would you like to share the delicious recipes you cook with your friends?
3. Did you like the layout of the home screen and where specific details are provided? Do they make sense at their respective locations?
4. What do you think would happen if you click on either (vegetable, meat or any other item)?
5. Did you expect this item you selected to be added to the cooking area?
6. Could you possibly locate the button, which allows you to 'Save', 'Done', 'Reset' your recipe?
7. Are you finding customizing recipe portion of the requirement easy?

De-briefing questions:

1. Did you enjoy cooking virtually? Was it something new you never thought before?
2. How did you like the idea of getting to know the count of calories and other vital nutrients before you actually cook the meal?
3. Do you think it would help planning your meal and change your eating habits for better?
4. Would you recommend this application to your friend so that most benefit from it?

5.4 Users for testing

We conducted the user tests on 3 people. The characteristics of the users are as follows:

1. All were very comfortable with use of social networks.
2. People we tested were concerned about eating healthy food hence found the overall idea very useful. Following were their details:

Age	Gender
23	Female
25	Male
21	Female

The first person is our teammate's neighbor. He is a graduate student at MIT studying Material Science. The second person that we interviewed came across us in the

university library. He is a Computer Science student at Northeastern University. The third person is a roommate of one of our teammate. She is an intern (Under graduate student) at Harvard Medical School.

5.5 Affinity Diagram

With the help of affinity diagram we jotted down the observations while user testing. Later, we followed a bottom up approach and grouped the common observations under one category. This helped us to understand where our system lacked to fulfill the requirements. Following (Figure 8) is the affinity diagram that we created.



Figure 8

6. EVALUATION RESULTS

6.1 Results of Affinity Diagramming Analysis:

From the user testing, and later on making affinity diagram we categorized the observations into three main categories viz. read recipes, share recipe and create own recipe.

Our application was able to meet the following requirements:

1. Read my recipes
2. Read my friends' recipes
3. Read experts' recipes
4. Create own recipe
5. Customize recommended recipe
6. Share recipe
7. Un-share recipe
8. Delete recipe
9. Login to the system
10. Log out from the system

Our application was not able to meet the following requirements:

1. Add reviews/comments to friends' or experts' recipes.
2. Add rating to the recipes
3. Search/filter recipes for reading
4. Search/filter videos
5. In create own recipe, creating recipe by selecting a method that can be applied to ingredients.

6. Editing own recipe

Our top green level categories include tasks related to:

1. Create own recipe
2. Help
3. Share Recipe
4. Read Recipe
5. Login

6.2 Detailed analysis of “green label” categories

In create own recipe, we identified that users would have preferred to cook a recipe without actually writing the text in the textbox. Instead, we got suggestions if we would include various methods like boil, roast etc. that can be applied to the ingredients. Also, we were asked if more filters could be applied to filter the ingredients.

In read recipe, users would have appreciated if there were section to add review, read review, and share the recipe on social external media like Facebook, Twitter etc.

In share recipe, we got a suggestion that exact live updates of recent postings of recipe by friends could have been shown.

Overall, from our affinity diagram analysis, we figured out that we were able to meet basic primary requirements of the application. However, every requirement could have been improved.

6.3 Usability Problems

a) In create own recipe, Users were not able to delete the ingredient from the suggested list.

Solution: If a user deletes a particular ingredient, the next suitable ingredient would appear in the list.

b) In Read Recipes, in Friends'/Experts' recipes users were not able to see the Friend's/Expert's name along with the recipe.

Solution: The name of Friend and Expert can be shown along with the recipe.

c) In Read Recipes, Filter/Search recipe functionality was not available.

Solution: Filter can be shown below the navigation where users can search the recipes by applying various filters.

d) While registering a new user, the information about himself or his city and gender is not captured yet it is shown on the wall.

Solution: While registering as a new user, the necessary information about the user can be captured.

e) In Create Own Recipe, if the System fails while creating a new recipe. It should be saved as draft so that user can later continue working on the same.

Solution: The recipe state can be saved after some fixed time interval and can be retrieved back later.

7. REFLECTION

Redesigning user interfaces on the basis of user testing can substantially improve usability [17], which we noticed during the development of our prototype. This is the essence of iterative design, a purposeful design process which tries to overcome the inherent problems of incomplete requirements specification by cycling through several designs, incrementally improving upon the final product with each pass.[18] We learnt in the iterative process to start from the very basics, think on the minutest detail and then proceed with bigger ideas. We used the Incremental prototyping method to gain user feedback about 'Cook and Eat Healthy' prototype. After our ethnographic study we developed each of the separate components i.e. 'Create own Recipe', 'Read Recipe-Recipe Book' and 'Share Recipe - My Wall' module independently. These main modules were again divided into subsequent smaller modules and developed separately. Once the system was complete, we tested it with users using paper prototyping followed by heuristic evaluation and user-testing. Each time we received a feedback, we iterated through our system to best solve our problem.

The shortcomings that we found with 'incremental prototyping method' was that it became very difficult and time-consuming to make higher level changes (such as the layout of our home page had to be completely changed as it seemed way too complex, the addition of ingredient list near the filters section on 'Create Your Recipe' page to avoid infinite list of ingredients above the cooking area) suggested by the user after developing all of the modules separately and then testing it. So if we were to work again on the application, we would replace our prototyping method to 'Evolutionary prototyping' where we could test each of our new developments that follow the previous developments; thus providing thorough user requirements. Having followed 'Incremental' approach, we believe 'Evolutionary' approach would be much better as feedback at each step is crucial to our system; considering that user's interaction with the system is highest and also we can save on our resources spent on later high level changes.

"It is formative assessment that has a strong research base supporting its impact on learning" [19]. Hence apart from evolutionary prototyping, to gain thorough understanding of user requirements, we would like to implement different formative evaluation methods such as providing users with a questionnaire before they see/start to work on the system to know their expectations with the system. Second method would be to observe the working of the user by recording there each and every movement and voice. Last requirement gathering method would be focus group discussions (FGDs). The team decided upon FGDs method mainly because sometimes the suggestions by users are contradictory about a certain feature and if they are made to discuss about the same with each other, we could arrive at a common decision to implement regarding that feature. By

using a focus group, you will learn about users' reactions to ideas or to prototypes. However, you do not learn how users really work with the system and what problems users have with the system. [20] Hence, we would try to video record the user testing session (as mentioned in the second formative assessment method) on the prototype along with their audio.

CONCLUSION

Finally, we conclude this report by some facts about “Cook and Eat Healthy” and also would describe the best practices that can be followed in order to create aesthetic, minimalistic and user centered designs.

As explained earlier, for developing “Cook and Eat Healthy” we followed a systematic approach and performed various analysis techniques at every stage of the design. Taking the feedback from user at every analysis step, helped us to improve our design drastically after each iteration.

During our course of Human Computer Interaction we learnt the overall process of designing effective user interfaces. Following are the things we learnt:

- 1) Ethnography: This taught us how to gather the requirements from the target users. This gave us insight that user's opinion or suggestions play most important role before starting the system design.
- 2) Detailed Analysis of functional and non-functional requirements: Hierarchical Analysis of requirements taught us about how to categorize and prioritize subtasks within a task.
- 3) Paper Prototyping: This helped us in figuring out the flaws in the proposed system before actually starting the implementation.
- 4) Heuristic Evaluation: This taught us how to evaluate the basic principles that should be followed while designing a user-centered system.

ACKNOWLEDGMENTS

We extend our appreciation to all the volunteers who participated in user testing and Ethnography. We would like to thank Dr. Judith Mabel for providing some useful insights for our ethnography. We are grateful to Team 4 for heuristic evaluation of our prototype that really helped us to improve further. We would like to thank Professor Andrea Parker and our teaching assistant, Serkan Orkur, who guided us and provided us with very valuable feedback during the entire course. Last but not the least; we would like to thank all our classmates.

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