ABSTRACT
In this paper, we describe the Nutrition Monitor system, which assists users in monitoring their food intake and analyzing it for a range of nutrition information. Users create an account and enter in the foods that they eat. These foods are located within a database, and nutrition information is displayed. The database includes packaged foods, non-packaged foods such as fruits and vegetables, and some restaurant meals. The system tracks this information over time, and users can look at trends in their food intake. Users can use this information to inform their future eating choices, allowing them a greater degree of control over their health.

Keywords
Health, nutrition, monitoring trends, personal health

Credits
Rob Akbarian – Project backbone, main function programming, UI Tutorial, layout
Andrew Guthrie – CSS, general appearance, Interactive data chart, YouTube video, Presentation
Vicki Jones – administrative, testing, final report, general editing
Chun Yen – Food Database, Autocomplete functionality, YouTube video, Presentation

1. INTRODUCTION
In today’s society, many people have difficulties with health and nutrition. People are too busy to eat well, particularly when doing so requires a great deal of research and effort. Keeping track of a diet over time is a difficult proposition; one “bad day” can quickly lead to another, and one’s eating habits may soon return to what they originally were. The degree of effort required causes many to give up their health goals.

Many people have health reasons for monitoring their nutrition, particularly their intake of calories and cholesterol. They may be attempting to lose weight, to manage a pre-existing health problem. While some tools are available to assist people in these goals, many require a great deal of individual note-taking, the completion of complex formulae, or for the individual to keep track of their own data over time. The goal of Nutrition Monitor is to simplify this process, requiring only that the user inputs the names of the foods they consume. Looking up that food’s nutrition information, displaying this information in an easily understood way, and tracking this information over time for the user makes this part of health much simpler.

Previous work in this area frequently put a great deal of the task on the user’s shoulders. The USDA maintains a database (USDA and ARS, 2011) which, while not comprehensive, covers the vast majority of foods that a user might eat at home, as well as a fairly wide selection of chain restaurant foods. However, there is no way provided to add several different food items into a meal, or to track consumption over time. Additionally, the information is presented in a difficult-to-read table which may overwhelm users with information that they did not actually need.

When attempting to change this data into useful information, a user may be at a loss. The government’s dietary guidelines are incredibly complex; the full version is over a hundred pages (USDA and HHS, 2010), and even the simplified guidelines for daily choices (USDA and HHS, 2000) are of such complexity that a user would need to devote a considerable part of every day to planning their food intake in compliance with the recommendations. Even when narrowed down only to the goal of weight management, the information can be overwhelming. (FNIC and NAL, 2011).

Nutrition is, of course, a complicated topic, and the materials provided by the government must reflect this reality. Resources such as the Food and Nutrition Information Center are ideal for users who wish to know more about nutrition in general. (FNIC, 2011). For users who merely want to track their consumption and their progress towards their goals, however, this wealth of information is not useful.

There are resources available for daily meal planning, which may be more helpful, but they do not track the meals that the user has consumed, or allow them to track how closely their actual consumption has matched their plans. (AHA, 2011). Some users may prefer this, but there are others who would benefit more from something which would allow them to view their past and current nutrition. Nutrition Monitor attempts to fill that gap.

2. DESIGN
2.1 Approach
The Nutrition Monitor approach takes into consideration both the fact that good nutrition is a matter of more than just a single meal and the assumption that most users will not want to dedicate large amounts of time every day to nutrition. If, as we propose, the complexity of choosing and maintaining a healthy diet is a large barrier to most people, the simple and easy to use system we have created should be extremely attractive and helpful to users.

A huge variety of nutrients could be examined; the database from which we drew mentioned around a hundred. Including all of this data would be overwhelming for most users. Some of it was clearly unnecessary, but deciding what to focus on was a challenge. In the end, we chose to examine two factors, calories and cholesterol. We selected these because they are vital both for weight management, an extremely common goal, and for the management of several common health problems.

2.2 Layout
Users create accounts (register), which allow them to return to add new information and view their results at any time in the future. Then they may begin inputting the food or foods that they have eaten that day (add food). This process is made as simple as possible; users simply enter the date, the name of each food eaten that day (add food). This process is made as simple as possible; users simply enter the date, the name of each food (assisted by autocomplete functionality) and the number of servings.

After that, they can see what they have eaten both that day and over the entire time that they have used the site (summary chart). This data can be broken down in a variety of ways, to examine the trends in their calorie and cholesterol consumption both during the day and over time. Figure 1, the transition diagram, illustrates the simple layout of the web site.

This simplicity is the key to the Nutrition Monitor approach. Users do not have to look up any information themselves; Nutrition Monitor handles that, as well as the process of determining target calories and cholesterol based on weight. Users need only look at the data display, and they will see whether their behavior is bringing them closer to their goals or not.
Screenshots from the current version of Nutrition Monitor can be found in the appendix included at the end of the paper.

![Transition Diagram](image)

**Figure 1, Transition Diagram.**

### 2.3 Tutorial
This tutorial outlines the process by which a new user creates a Nutrition Monitor account, enters food information, and views the data presented by the site.

#### 2.3.1 Home
Visit the Nutrition Monitor homepage and click on ‘Join’.

#### 2.3.2 Join/Create Account
The user is required to select a username and password and to provide their age and weight. After all fields have been entered click ‘Join!’ If successful a screen will pop-up confirming a successful registration and will give a link to the homepage to login.

#### 2.3.3 Login
The user is to enter a registered username and associated password and press login to access the system. If the user wishes to stay logged in after closing the browser window they can tick the ‘remember me next time’ box.

#### 2.3.4 Main Data Entry
After a successful login the user is taken to the food entry page. The user needs to first enter the current date or the date for which the foods eaten are being added. Next each food is to be filled in. Begin typing a name of a food and it will auto-complete for you. Next enter the number of servings eaten to your best estimate. Submit the information. Several different foods may be added by filling out more than one row of data.

#### 2.3.5 Submit
After submitting foods for a certain day the nutritional values are calculated and displayed on the screen. If an item was changed a debug notice will be displayed telling you what values have been modified. Nutrition information for the entered foods will be displayed.

#### 2.3.6 View Data
Clicking on view data shows you the current nutrition for the current day as well as calculating if you are above/bellow your dietary values for calories and cholesterol (based on weight). This screen also displays a graph showing your trends in caloric intake. Also available is the current user’s history (foods eaten in the past) as well as a chart displaying the daily totals of each user in the database.

### 3. PROCESS

#### 3.1 Prototype
The low-fidelity prototype did not have full database or data display functionality, but was otherwise functional. Screenshots are below.

*Figure 2, Login Prototype*

The image shown here was considered as a logo for Nutrition Monitor, but ultimately rejected. Although the simplicity of this login page was important, in the final version it was supplemented with a paragraph of explanatory text.

*Figure 3, Registration Prototype*

Again, in the prototype, the emphasis was on simplicity. The current iteration keeps the same functional simplicity, but moves away from the starkness of the blank white background.
Figure 4, Food Entry Prototype
The data entry page has remained largely unchanged throughout the iterations of Nutrition Monitor. The ability to add a date was included due to requests from usability testers.

Figure 5, Data Display Prototype
The prototype did not have the extensive data modeling options included in the final version.

3.2 Procedure
After the creation of the low-fidelity prototype, user tests were run. The feedback from these tests showed that users felt positive about the site, but desired expanded functionality. The design of the site was made less sparse, a larger database was included, and increased personalization and computation were added.

Although we did add some of the recommended features, we felt that simplicity was key. Keeping the site to only a few pages would prevent frustration, and help users to continue using the system for the extended periods of time necessary for nutrition and health.

Including the live chart was difficult, but we decided that it was worth the challenge. Users would want to be able to see results immediately, and to look at their trends right away. The current data display options should have enough information to satisfy the needs of most users.

3.3 Usability Testing

3.3.1 Pre-Test
Users were asked for their gender, age, major (if applicable), level of experience with nutrition, and level of computer experience. They were reminded that the tests were not meant to test their ability as users, but to test the usability of the Nutrition Monitor prototype.

3.3.2 Task List
Three different use scenarios were designed to test different features of the prototype.

3.3.2.1 Scenario 1
You are an active internet user who found our site through a search engine. You want to build a nutrition history for your own record, and you would also like to develop your own diet plan.

Tasks:
- Go to the Nutrition Monitor homepage
- Create an account by clicking on “Create an Account” option
- Fill out the required information forms. Make both your username and password “test1”
- Hit “Submit” to submit your account request
- Hit “Refresh” to refresh the page and log in
- Enter the following meal:
  - One chicken breast
  - One serving of spaghetti
  - One serving of tomato sauce
  - One fresh mushroom
  - One fresh bell pepper
- Hit the “Calculate” button to see the results
- Hit the “Save” button to save your information
- Hit “Log Off” to sign out of your account

3.3.2.2 Scenario 2
You are a current user of nutritionmonitor.com. You want to put in a meal and look at your long-term trends. You will log into an account that we have already set up, and go from there.

Tasks:
- Go to the Nutrition Monitor homepage
- Log in with username “test2” and password “test2”
- Enter a meal from McDonald’s with the following items:
  - One big mac
  - One serving of spaghetti
  - One serving of tomato sauce
  - One fresh mushroom
  - One fresh bell pepper
- Hit the “Calculate” button to see the results
- Hit the “Save” button to save your information
- Hit “Log Off” to sign out of your account
• Hit the “Save button to save your information
• Find out how much above the recommended weekly intake of cholesterol user test2 is for this week. Write this down.
• Hit “Log off” to sign out of your account

3.3.2.3 Scenario 3
You are a long term user of nutritionmonitor.com, and wish to find out which part of your diet contributes the most to your caloric intake, along with which days in particular you eat the most.

• Go to the Nutrition Monitor homepage
• Log in with username “john_doe” and password “password”
• On this profile, two months’ worth of entries have already been recorded
• Go to this profile's diet history, and find the date September 23, 2011
• On this date, find which item had the most calories.
• Also find which item had the most cholesterol, sodium, and fat, and record all of these items.
• Return to the diet history, and find the date when the person consumed the most calories.
• Hit "Log Off" to return to the main page.

3.3.3 Post-Test
Users were asked what features of the site they felt positive about, what criticisms they had, and if they would suggest any improvements.

3.3.4 Results
The five usability tests had the following results.

3.3.4.1 Test 1
Subject: 20 year old female, nursing major. Basic internet experience, no programming background.
Test type: interview with guidance from the tester.
Positives:
• Website was very neat and clearly labeled
• Very similar to an existing Food Pyramid calculator but has the potential to be better
• Liked the fact that it stores members’ data for future reference
• Liked the way the functions are set up so anyone can use it (not just members)
Criticisms:
• Changing of label names to suit the functionalities better. Ex, Calorie tracker ☞ My Daily Intake
• Should allow users to add more food per meal than currently allowed (starters, drinks, main meal, deserts)
• Members’ data should be automatically stored without any actions of the users
• Data retrieval for members should use a calendar UI
Possible Add-ons:
• Have a compare function that takes the user’s height, age, weight, and food intakes and compare that with national averages with a “Health Message”. If the calculation shows unhealthy eating, the functions should display a warning message to the user

3.3.4.2 Test 2
Subject: 21 year old male, chemistry major. Basic internet user, no programming background.
Test type: 10 minutes think-aloud test with guidance by the tester
The user feels the website was constructed well. There are a few things he feel could be added. First on the first page when you select a restaurant, there should be an option on the page for adding side items, drinks, and desserts, that way you can see the nutritional value of a whole meal will be instead of one item. Second there could be a reward system built in place to help motivate people to eat better. For example if a user can reduce the amount of fat they eat for a week, and then they earn a title on their account that demonstrates they have worked harder than others.

3.3.4.3 Test 3
Subject: 21 year old male, English/Linguistics major. Extensive internet use, no programming background.
Test type: interview with guidance from the tester.
Positives:
• The data display page was set up well
• Basic idea is good
• Functionality seems complete
Criticisms:
• Labels on entry page were confusing
• Services like this already exist
• Visually very bare-bones, aside from the display page

3.3.4.4 Test 4
Subject: 21 year old female, Classics major. Basic internet experience, no programming background.
Test type: 10 minutes think-aloud test with guidance by the tester
The user felt positive about the site, and stated that she might be willing to use it, but would probably forget to do so every day. She thought that a feature for adding food to a previous day rather than simply the current one would be helpful. She also wanted to be able to track more than just calories and cholesterol.

3.3.4.5 Test 5
Subject: 58 year old female, non-student. Limited computer experience, no programming background.
Test type: interview with guidance from the tester

The user found the site easy to use despite her limited programming experience. She liked the idea of being able to keep track of her weight daily. She also liked that the website was simple and that she didn’t have to go through many steps. She would like to see a help link and a direction link. She didn’t really like the coloring and the logo. She did like the login part of the website and she said that it would be nice to have her own page. She was particularly interested in the idea of being able to see how her diet was going throughout the week.

3.3.5 Outcomes
The overall appearance of the site was dramatically changed to reduce the confusion and the feeling of inconsistency on the part of the subjects. The autocomplete functionality should also help reduce confusion. Calories and cholesterol are now compared to recommended amounts, so that people have an idea of how they stack up against these recommendations. These recommendations are personalized based on basic data provided by the user upon account creation. Several food items can be added on one screen, to enable users to add an entire meal rather than one item at a time. The user now enters a date before entering foods, enabling the entry of foods consumed prior to the present date.

Although not all of the suggestions could be incorporated at this stage, they may help to guide future directions for this project, as outlined in section 4.

4. CONCLUSIONS
As it now stands, Nutrition Monitor is a system for tracking one’s calorie and cholesterol intake over time. The system takes basic data from the user, and makes recommendations based on this data. Although it is impossible for a database of foods to be entirely comprehensive, given the incredibly wide variety of foods eaten around the world, the current database is extensive, and should be sufficient for the needs of most users. The system concentrates on calories and cholesterol, allowing users with these common concerns to focus on them without being distracted by unnecessary information.

The two major draws of Nutrition Monitor are its simplicity and its ability to track trends over time. Users need only perform a few simple tasks a day to create a long-standing record of their nutrition intake. Calories and cholesterol are of course an incomplete measure of total nutrition, but they are extremely important when moving towards a goal of good nutrition and good health. Users can spend only a few minutes a day inputting their foods, and can use the data provided to see what changes they should make in their habits to help them move towards their goals. In this way, the simplicity of Nutrition Monitor can help people make significant life changes, leading to better nutrition, better health, and a better life.

4.1 Future Recommendations
Future work may go towards expanding the scope of Nutrition Monitor, particularly by adding more nutrients than are currently displayed. A greater degree of customization would also be desirable, allowing users to enter their personal health concerns, such as diabetes or high cholesterol, and perhaps taking into account users’ varying activity levels. As users’ health information changes, it would be good to allow them to change the data that they entered upon account creation.

Another feature, which our testing feedback indicated would be well-received but which have been unable to implement as of yet, would be a “quick entry” option available without account creation. This option would allow a user to see the health content of one meal, or perhaps of an entire day, without creating an account. This feature could conflict with an extended personalization of health feedback, but would be an excellent way for users to test the site before creating an account.

5. ACKNOWLEDGEMENTS
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6. REFERENCES
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<http://www.nal.usda.gov/fnic/foodcomp/search/>


APPENDIX: SCREENSHOTS
These images are from the current version of Nutrition Monitor.

Figure 6 shows the login page, where returning users log in and new users create accounts. Having an account allows users to track long-term trends.
Figure 6, Login Page

Figure 7 is a zoomed-in view of the registration page, showing the information required on account creation.

Figure 7, Registration

Figure 8 shows the food entry page, where a user (in this case, “chun”) enters new food. They also enter the date on which the food was eaten. This page has autocomplete functionality, drawing from the USDA’s extensive database of nutrition information.
Figure 9 shows the page which users see upon submitting their foods. Two tables summarize the food they just entered and their entire diet for the day.
Figure 10 shows the data display page. Users can see how their intake has changed over any interval they wish. A summary of their diet for the day is below, followed by a table of all the foods they’ve eaten (displayed ten at a time). Their intake of calories and cholesterol is shown and compared to a target based on their age and weight.