Project Proposal submitted to

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I. Project Problem Summary

Due to the media and governmental focus on issues such as food deserts and obesity, a large quantity of nutritional information (and ways to redesign the information to make it more "user-friendly") has flooded the internet. In addition, the government proactively targets specific user groups using specialized programs that target the underprivileged and school nutrition programs. Both of these methods, however, are detached from the locations at which the decisions on food purchases are made. The main method of information delivery in the context of the supermarket is the nutritional label. While the label effectively communicates the amount of nutritional contribution of each individual item to the diet, an understanding of a complete nutritional balance is difficult for the consumer to achieve on their own.

II. Project Background

A. Government Involvement with Food: The roles of the FDA and USDA

Government involvement in food matters did not take place until food production became an industry. The construction of the transcontinental railroad meant mass transport of resources, especially livestock and foodstuffs. This, coupled with the rapid flourishing of the corn and wheat belts in the 1850's meant that more quality control was needed to ensure food safety [5]. In response to this growth, The United States Department of Agriculture (USDA) was created in 1862 with the intent of preventing the spread of diseased foodstuffs via thorough inspections.

As the USDA was expanded and modified to fit the needs of the people, nutrition slowly became a concern. A bulletin published in 1902 by Wilbur Atwater and his associates became the first move towards educating the general public on their daily nutritional needs. Atwater advocated a diet of legumes, vegetables, and proteins with limited fats and sugars included [6]. However, Atwater's views were overshadowed by a USDA publication in 1917, which pushed a balanced diet of five food groups: milk and meats, vegetables, fruits, cereals, fats and sugars. Continuous revisions have been applied until the "Hassle-Free" food guide was released in 1979; the first effort by the USDA to incorporate the increasing amount of research urging the reduction of fats and sweets in the daily diet.

This low-fat, low-sugar focus has been maintained in the most recent renditions (in 1992 and 2010) which are presented in the familiar pyramid format [12]. In addition, the USDA has written extensive guidelines meant to guide the daily nutritional decisions of the American people. The USDA website also offers a bounty of nutrition and diet management tools. However, it is not known how often these tools or guidelines are accessed and used.

The Food and Drug Administration (FDA) is also a governmental proponent of nutrition management. Created in 1907, the FDA's original intent was to ensure the safety and wholesomeness of the foods, drugs, cosmetics, and other chemicals that would be used or ingested by the American people [7]. Because the FDA cannot prevent ingestion of foods that may not be entirely "wholesome", the administration has made an effort to provide the people with necessary information regarding what they are eating. In 1994, food labeling became

mandatory with the National Labeling and Education Act (NLEA) [8]. It provided valuable information, such as serving size, caloric information, and vitamin/mineral content. Each food would contribute to a daily total of nutrition consumed, and once the percentages were added up, could tell the consumer what they may be missing from their diet.

B. The Obesity Epidemic and Current Solutions

Food is one of the fundamental needs of all living organisms. Its ubiquitous presence in our lives has only become more apparent as digital media pervades our daily rituals. Consumers are swamped with advertising media in which food plays a central role. One report from 2010 states that a five year old has seen 4,000 television commercials and that at least one food ad is shown every five minutes [1]. Fast food companies in particular have taken advantage of persuasive media's omnipresent qualities and created a channel of communication that especially resonates with adolescents [2]. This relationship has often become the target of news sources which blame the media and the fast food industry for the still-inflating obesity epidemic [3,4].

The new nutritional guidelines released by the FDA presented a challenge to the public as a new form of information delivery. Clever metaphors such as "Making Cents of the Daily % Value" were tested, though not widely practiced [9]. While consumers are able to understand the information, they are unable to understand how that food contributes to their daily diet [10]. Because of this gap, many health-conscious consumers look instead to marketing lines that advertise "low calorie" or "no trans fat" to help them make their decisions [11].

Perhaps most notable of the recent efforts to battle obesity, especially in children, is Michelle Obama's Let's Move campaign. The campaign targets schools, families, and communities, encouraging kids and parents to eat healthily and get active [13, 14]. The government's current approach to improving dietary habits is two fold: by providing information-rich material that is generally accessed through the web such as the Let's Move website; or by enforcing programs such as the HealthierUS School Challenge (HUSSC) which focuses on improving diet and increasing time spent for physical activity in schools [29].

Figure 1. Infographic of standard food group proportions as suggested by the USDA.

To manage the micro-aspects (item by item) of the American diet, the USDA has mandated the nutrition facts panel that provides detailed information on the food item. While current nutrition fact panels deliver necessary information, the format of delivery is difficult to comprehend. In a literature review done by Cowborn et al, "Consumers seemed to find it particularly difficult to use nutrition label information to place an individual product into the context of their overall diet" [10, 30]. Another issue is that nutrients and their possible benefits (e.g. Thiamin, Niacin, or Riboflavin), are not commonly known amongst the general consumer population. A study done by Levy et al suggested that the current nutritional labels are difficult to interpret. The study suggested that "consumer nutrition

guidance will be more effective if it instructs people how to balance their diets in ways that do not require quantitative tasks" [10].

In an effort to communicate the necessary dietary balance between the food groups, the FDA and USDA have agreed to replace the food pyramid with the MyPlate icon, The graphic has been well-received as more relatable than its predecessor, the food pyramid. However, a closer look reveals that the graphic loses much meaning in its generalization of the food groups. Dietician Betty Kovac explains:

> "In terms of nutrition, it is not accurate to call a food protein. There are six groups that foods are divided into based on the nutrients that they contain...The plate would have been more accurate to say 'meat or meat alternative'" [31].

In addition, the graphic itself does not reveal the size of the plate, or the amounts that should be eaten within each section. For instance, it remains unknown whether one serving size of pasta would be adequate for the "grains" portion of the graphic. While more specific information on the plate's composition can be found online, this requires the self-motivation of consumers to do the research.

C. Consumers and the Context of Use

While the effects of the Let's Move campaign are yet to be seen, nutritional facts have been proven to help the consumer in dietary decisions in empirical studies [17,18,19]. However, these studies have also proven that much of the positive relationship depends on the consumer, the environment in which the label is presented to the consumer, and the design of the label itself [16].

Consumer use of nutritional labels depends much upon the consumer's socioeconomic status and personal preferences. Three main factors that are central to whether or not the labels are used are the consumer's education, health concerns, and also their financial/social situation[16, 20, 21]. Literacy, particularly in the limited English vernacular, has become a major challenge for the design of these widely used materials. Even for those who have had up to a 9th grade education, interpreting the information on the labels can be challenging [10]. While direct questions about the percentages and grams on the label are easy to answer, the difficulty lies in the act of balancing the nutrients of an item with everything else in the diet [20, 22].

Environment is a large part of whether the consumer pays attention to the label or not. For example, if nutrition labels are placed in the fast food environment, the consumer is more likely to choose the cheaper or tastier item rather than pay any attention to the provided information. Comprehension of nutrition labels also has a correlation with gender: women seem to have a better grasp of the necessary daily calorie consumptions, and pay more attention to nutrition labels then men [23, 24]. Consumers who eat only organics or spend more time in grocery stores are also more likely to pay attention to the labels and decide between products [20].

Figure 2. Minimalistic nutrition facts redesign by ffctn.

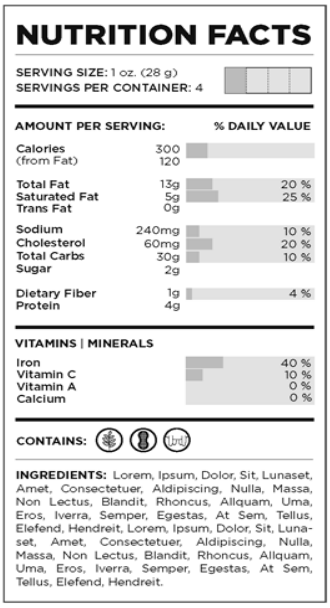


Figure 3. Using bars and icons to communicate instead of pure numbers.

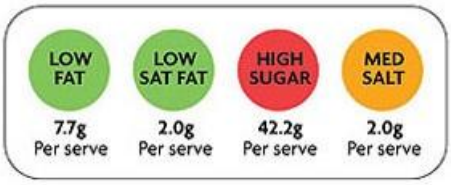


Figure 4. The proposed TLS system that would ideally be shown on the front of a package.

D. Review of Existing Projects

Studies have shown that educational interventions to increase the literacy of the labels to be effective [9, 26]. However, these results are generally short-term solutions only. The design of the nutrition label itself is a deciding factor in whether consumers use it or not [25]. Alternative label designs have been presented across the world. One particular redesign that was well-received in the graphic design field was done by a Canadian design company named Ffunction. The design focused on presenting a minimalistic label that would over the entire surface area of the package (figure 1). Another graphical redesign by a team of industrial designers suggested using bars to convey the information instead of using pure numbers (figure 2).

This idea was also tested in Europe and the UK the "Traffic Light Signal" (TLS) system has been widely tested [27]. The system tackles the issue of numeracy on nutrition labels by presenting a traffic-light signal instead. Certain aspects of the label were chosen (such as salt, sugar, fat, and saturates) and then their status represented by red, green, or amber color codes, green being a positive or reduced level, and red being a negative or above-recommended level. While users were generally able to decide on whether one particular item would be a positive contribution to a diet, they were unable to decide if a whole basket of goods put together would provide a balanced (or amber-green) diet. However, consumers did make a noticeable effort to avoid "red-light" items, which in the long term would have benefited their health. The light system was also effective for those who wanted to avoid high levels of fats, sugars, or salt.

As digital and interactive experience increase in popularity, many have proposed systems that would fit into the grocery experience and increase consumer awareness of nutrition. One example is Healthy Shelf, an interactive nutritional label system that allows consumers to change serving sizes and compare items (figure 4). While Healthy Shelf focuses on general nutrition facts and information, some applications are specialized for people with certain chronic illnesses. The Nutrastick system is a portable scanning device that delivers positive and negative feedback about the product with a green or red light respectively, indicating to the consumer that the particular

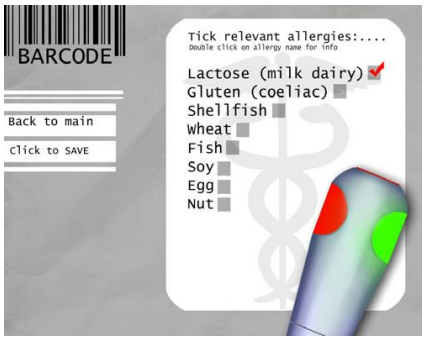


Figure 5. Nutrastick allows the user to see if products contain allergens.

Figure 6. Grocery hunter gives kids a fun learning experience with well-known cartoon

product will fit their specialized diets (figure 5). For younger audiences, the Grocery Hunter game is a mobile system that encourages kids to explore the grocery store and find healthy foods based upon given clues (figure 6). In a similar vein, there are too many calorie counters and diet trackers to count. Most recent developments on the mobile platform include Google Goggle and Red Laser. Both apps allow for the scanning of barcodes or specialized markers to access product information.

A medium that has become popular for communicating and encouraging growth of nutritional and fitness values is the video game [32]. An insurmountable amount of digital games that contribute to health or health education has saturated the market since obesity has been recognized as an epidemic. The internet is possibly the most effective and low-cost distribution channel, and hence has become a ground rich with health game resources. One such example is Fatworld, which utilizes the elements of accelerated time and an interweaving of nutritional, political, and economic simulation to education the user [28]. Console technology has coincidentally grown in tandem with the health craze; consoles such as the Wii or Xbox 360 with Kinect enable users to perform a range of movements in 3D space that were previously limited to button presses and analog toggles. Accompanying games such as Tennis for Wii, Dance Central, or Kinect Sports encourage users to be active instead of stationary while in front of the console. Along a similar line, Dance Dance Revolution, an arcade game that is now being offered for home entertainment systems as a set of foot-pads, has become renowned as a video game that unwittingly contributes to weight loss [33].

III. Proposed Solution

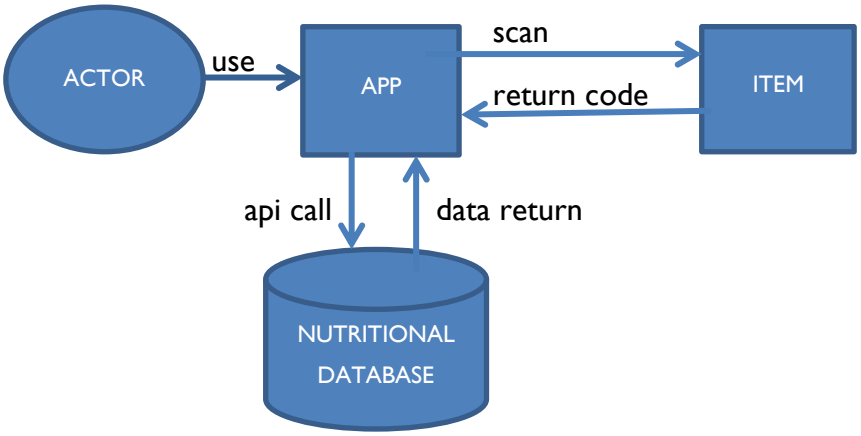
A. Solution

The solution that I propose is an educational tool that would be used in the grocery store environment. The format will be an interactive game-like application, which aims to educate consumers in three respects: first, how each nutrient in an individual item contributes to the diet; second, how to balance the diet as a whole using the nutritional facts provided by each item; and finally, to enable the shopper to identify healthful options using the layout of the grocery store

B. Specific Proposed Deliverable

1. Technical

The final deliverable will be a proof of concept prototype which will be deployed on the Motorola Xoom equipped with Android OS. The application will accept barcode input from grocery items that are scanned by the consumer. The item will then return data which will provide information for an API call to a nutritional database, which will then return data on the item to the application. Two implementation methods I am currently considering are Adobe Flash or Java. In order to obtain the scans of the items, XZing and Scanlife for Android or Actionscript methods which call on video and image processing will be used. Finally, the database will either be hardcoded using selective grocery items, or an online database such as FatSecret which provides a REST API are two options that I will consider as I continue to iterate on my design.



2. Design

The design of this prototype can be broken up into three main sections that fit with the goals of the project. The first section will present the nutritional information of the item just scanned in an interactive format that allows the user to explore what each nutritional component contributes to their diet. If the user chooses to purchase the item, the nutritional information of one serving is then added to the second section, which depicts the user's health status. The user's health status starts in a neutral position (all stats such as vitamins and minerals, or fats and sugars are set to zero). This status will be visualized as several measures of nutritional intake as recommended by the USDA. As a serving of each food is added to the player's stats, they can begin to see the aggregated effect that the food has on their health. Items can be removed from the list if the consumer decides not to purchase the said item.

In order to encourage users to invest more in "healthier" sections of the grocery store, the system will visualize the grocery store using the metaphor of a terrain. Game-like incentives, which are separate from the player's health, act as a motivator for the player to visit the healthier sections of the

grocery store. For instance, the vegetables and fruits section may look like an orchard or garden, while the snack isle is represented with a sand pit. Visiting certain sections delivers abstracted "rewards" from the system, such as an increase in points or the granting of certain "powers". This visualization, however, is not set in stone. As the player continues to scan items, the terrain will continue to evolve to fit the user's selections. For example, if the user purchases a wide selection of meat, the dairy section may begin to look less appealing by evolving from an inviting farmland to a dilapidated shack.

3. Impact

The value of this artifact is that it makes the consumer aware of the nutritional composition of their purchases and how it affects their diet with two distinct methods. The first is that the artifact draws on the nutritional relations between foods. While many people hold a dichotomous view on certain foods or nutrients as either "good" or "bad", most of these foods and nutrients can contribute positively to a healthy diet in moderation. For instance, while many people are informed by media to avoid fats, fat is a necessary part of a diet. When the right fats are consumed (such as Omega-3's) there are definite health benefits.

The second distinct method is the utilization of the shopping environment's spatial layout as a way to educate the consumer. Each section in a grocery store already has its definitive characteristics that result from the nature of the foods and their required storage methods. By relating certain nutritional qualities to the different segments of the grocery store, the consumer can learn to relate general features to each branch. This provides an easy framework that the shopper can follow even if they are not able to recall details such as the significance of certain nutrients.

4. User Scenario

Andy W. has been struggling with maintaining his weight since he started working three months ago. Determined to lose the extra fifteen that he has gained (and to keep it off), Andy decided to change his diet and exercise habits. On his usual shopping trip, he decides to use the tablet application provided by the local grocery store. He turns on the device, and enters his name and demographic information as he slowly pushes his way into the humming throng of the produce section. He notes that he starts off with all health statistics set at zero. As he walks through the section, he picks up some carrot sticks, baby spinach, chard, and broccoli. He recognizes that his statistics increase positively, and he feels motivated as he approaches the fruits. He picks up a couple of apples, and reaches for the caramel dip that he is usually so fond of. He spots that the contribution to his health is detrimental, especially due to the excess refined sugar that the dip contains. However, his health points do not drop significantly, so he decides to purchase the caramel dip.

Andy passes through the bakery to pick up some whole-grain breads, and then heads towards the meat section of the grocery store. He notices that the map is evolving; the snack isles that were once represented by a barren desert have now been replaced by a quicksand pool. He makes a mental note to avoid draining his health points in that section, and puts some lean ground turkey and shrimp into his cart. As the proteins are added to his cart, he notices that the bright farm that symbolized the dairy section began to dim. He grabs his usual dozen of eggs, and sees now that the additional protein has turned the once-shining farm fields into a worn cabin on a dry prairie. He proudly bypasses the beers, snacks, and frozen food isles, which are looking rather bleak on the game map. When he completes his shopping trip, his receipts display the final health statistics of his dietary choices.

C. Timetable with Significant Milestones

October 12, 2011	Papermock up complete, playtesting started
October 19, 2011	Playtesting continues, new edited papermock-up passed through to Nitsche
October 26, 2011	Playtesting complete, final paper mock-up done, game design being solidifed
November 2, 2011	Game design complete, implementation of simple click-through play started
November 23, 2011	Click-through game complete, playtesting started
December 7, 2011	Playtesting complete, Start adding functionalities over winter break (tackle barcode scanning issue)
January 18, 2012	Deadline for barcode and scanning issues. Secondary playtesting begun.
Februrary 8, 2012	Playtesting complete. Feedback being incorporated into game.
February 29, 2012	Final game iteration ready for feedback. First draft of 25-50 page writeup due
March 8, 2012	Final playtesting complete, results incorporated into 25-50 page deliverable Final draft due of 25-50 page writeup Website first draft due
March 14, 2011	Documentation website complete Writeup complete Project Presentation begun
March 26, 2012	Initial Format Check* Project Presentation final draft due
April 2, 2012	Project Defense*

* Following the currently projected dates on graduate admission website (http://www.gradadmiss.gatech.edu/thesis/thesisdeadlines.php)

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