The Insulators Proposal

How Might We

How might we address students' unhealthy eating habits at Georgia Tech Dining Halls

Background

From 2009 to 2012, an average of 41.6% of college students were considered to be obese [1]. This large scale of obesity in universities is mostly contributed to the ingestion of low-quality foods such as fast foods [1]. The freshman 15 is more than just a college rumor, it is a real phenomenon [2]. While studies do show that students gain on average only about 5-9 pounds of weight their freshman year, many unhealthy dietary habits also begin to develop. Late night meals, energy drinks, skipping meals, and unhealthy snack foods are only some of the poor eating choices that college students make [2]. Over the past few years, college campuses, including Georgia Tech, have attempted to improve the quality of food, as seen by new programs, such as Simple Servings, and menus [3]. Georgia Tech also encourages the usage of calorie-monitoring applications, such as MyFitnessPal, Samsung Health, and FitBit [4]. However, these applications have not shown any signs of solving the obesity problem because they often confuse users with a a large amount of user input and a high level of complexity [5]. Although many other technical products in the United States are moving towards a low-user input requirement, health applications have done very little in the recent years to advance, with the only notable change being the introduction of activity trackers [6]. While these trackers may improve one's lifestyle by monitoring the activity completed, they do not monitor intake of calories, or the quality of the calories taken in. With the high prevalence of obesity in the United States, an efficient solution needs to be created. If obesity rates go unchanged, or increase, then it can lead to major health conditions including type II diabetes, higher heart rate, an increased chance of heart attack, and a higher chance to require cardiac surgery or liposuction [7]. If obese students continue on this path, they are expected to be much more of a health burden at age 50 than their parents will be [7]. Overweight college students are only one of three major stakeholders to this problem; they represent the population of people who are at risk and want to change with a minimal amount of work that is streamlined into their everyday life. The second major stakeholder are health-concerned students and athletes, who want to be able to control their calorie intake through the use of a user-friendly application. The final stakeholder are health specialists, like doctors and nutritionists, who want to use the application for their patients, in

order to easily administer a healthier diet, and to see the benefits of eating healthy in a patient's daily life.

External Advisors

Our three external advisors will be Dr. Holton, Amber Thompson, and Thad Starner. Dr. Holton is a M.D. in Stamps Health Center on Georgia Tech's campus. He will provide the team with his expertise regarding health concerns on campus including but not limited to diabetes and obesity. Also, Dr. Holton will help the team better understand the scope of our project, providing statistics for the Georgia Tech student population. Amber Thompson is a nutritionist for Georgia Tech's Dining Services. Ms. Thompson will be the group's main contact with GT dining services and will help the team access nutritional information for foods in the dining halls. Also, she will assist the team in any questions about building a balanced diet for the GT student population. Thad Starner is a Georgia Tech professor with a passion for wearable technology like Google Glass. Dr. Starner will be the group's main advisor for the Google Glass section of our project. Dr. Starner has years of experience with the device and his expertise will help the team better understand the capabilities of Google Glass.

Project Goals

1. Scope:
   Our project is targeted primarily towards Georgia Tech students.
2. Rationale:
   We chose GT students because of their close proximity to the dining halls, limited dining choices and the similarity in dietary options which also makes communicating with our target group easier and defines our goals and and expected impact for the project. By targeting GT Students we will also have access to the school's dining hall databases. This will also let us use the dining hall's records of their food consumption and inventory. Lastly, dining hall food is repeated in a cycle which allows us room correcting any mistakes we have and continue to test for the next cycle.

3. Checkpoints
   Our project has 3 main checkpoints that we wish to achieve by the end of the year
   - Have a working smartphone application
   - Have a working Google Glass application
   - Have achieved a 95% level of accuracy with our data
4. Impact

We hope to promote a healthier diet, emphasize the importance of controlling their food intake and lifestyle for the students of Georgia Tech using our application.

Objectives

1. *Prototype for smartphone application*

The first step in our project is to create a prototype smartphone application. The primary function of this prototype will be to recognize food from a photograph and then bring up the nutritional information for the food. In order to completely define this function, we must first create a design or storyboard. The storyboard will serve as the basis for the prototype's function. Everything we will want to implement will be written in the storyboard. The storyboard will be the first step and also an ongoing development as the group comes up with ideas during this first objective. At the present moment, our team has decided the prototype requires two main functions, A) recognize food and B) bring up the nutritional information of the food. There will be no user interface in our prototype. The app will be as bare bones as possible and only have enough features to accomplish the stated two functions.

After the design is complete, the next step will be actually creating the application. The main person responsible with this task will be our programmer, Chuanbo. Chuanbo created an app for the Inventure prize that is very similar to the app we are trying to create now. The primary difference is that Chuanbo's application was focused on recognizing objects to assist the blind, whereas our application is meant to recognize food specifications. The app works by using image recognition technology with canny edge detection. The image recognition technology will use a database of personally collected images to recognize the different foods. The process of creation will involve Chuanbo working through the storyboard and consulting with the team on any design issues or problems that may arise. The creation process for this smartphone prototype should not take as long as creating an application from scratch because of Chuanbo's preexisting app.

Testing will be the very last step in our first objective of creating a prototype cell phone app. The testing process will be tasked to each member of the group but Chuanbo as he is the creator. Testing will be done using a scientific approach. Approximately 3 foods will be chosen and they will each be tested 10 times. The testing process will involve taking pictures of the food at different angles and seeing if it accesses the correct nutritional information. In order for testing to deemed successful, a 95% accuracy must be found for each food. If this accuracy cannot be established then the team will return to the creation and design steps to determine whether or not the idea is still feasible. At this point, the team will have an idea whether the next two objectives will be feasible and whether the team is ready to move forward.

2. *Smartphone User Interface*

Our project revolves around making it easier for individuals to maintain a healthy lifestyle and keep track of their diet. To make this possible it is mandatory to provide an easy to navigate, yet comprehensive user interface. The user interface is extremely essential and will provide complete, unrestricted access to our application's features. We plan to start working on the user interface as soon as the prototype is fully tested and operational for 50 test cases.

The primary objective of the user interface is to minimize user input while using the application. When a user takes a picture of a food item using their smartphone, the nutritional details should be displayed instantly, achieving our goal of having a functional prototype for the smartphone. The user however is not a developer and so the information must be presented in a very simple manner. In order to do this, the application's function would include asking the user whether that food item should be added to their diet to prevent any miscalculation with diet charts caused due to errors in automation. Once confirmed through verbal confirmation, the application would notify the user that the item has been added to their diet chart.

The calorie intake, based on food consumption, can be calculated on a daily basis using a simple addition algorithm which would offer users the convenience of using this application without increasing their own effort or having to input unnecessary details as required by other fitness applications. The nutritional information for each food would be provided through a specific database, which can be expanded over time. For our initial test trials, we will be using the food located in Georgia Tech dining halls, which are displayed each day with an accompanying nutritional fact label, which was checked by the United States Food and Drug Administration. We also need to take into consideration that the nutritional information presented to the user by the app will be approximate and not exact since portion sizes may vary.

Creating the user interface will begin as an initial plan, but will eventually evolve into a case by case project. It is impossible to plan for every feature that a user will need at the very beginning of the user interface design process. In order to ensure the user interface works well, the group will need to constantly test it within the group and among any interested students. Creating the user interface will be a process of creating the initial design and then tweaking and adding any features as the need arises.

This user interface interface portion of our project will be the most time consuming. In order for the user interface to be deemed completed, the app will be tested by a group of Georgia Tech student testers. If the testers give positive feedback, the group will be able to declare the user interface design completed and ready for use by the general users.

3. Google Glass Interface

The Google Glass version of our application would have the same basic functions as the smartphone application, however the advantage of this interface would be that the it will capitalize on the Google Glass' ability to be worn and would therefore require almost no user input. The Glass' camera would be utilized by the application to click a picture of the food item in its line of sight. Image processing software would then analyze the picture and provide nutritional information in a concise yet effective manner, based on previously provided pictures in the database. Each food has eight different images associated with it, each from a different angle. The application would initially determine the colors present in the food, such as green for a Granny Smith apple. These colors would then be searched in the database, to find any similar pictures. The application then determines the shape of the food, and cross-references it with the images that fit within the image parameters. Finally, the program checks several different angles of the food to make sure the correct one was chosen, before retrieving the nutritional data.

Once the food has correctly been identified, Google Glass will display the nutritional data, and the user may either verbally confirm the selection or ignore the display, indicating that Google Glass has indeed chosen the correct food, and that the application should add the nutritional data to the daily calorie count. In order to promote healthy living, it has been discussed that our application should warn a user if they are exceeded the standard calorie intake, 2,400kcal per day for men and 1,800kcal for women [7], by flashing the screen red three times before stating what value is exceeded, such as fat, carbohydrates, calories, sugars, protein, and sodium. The user may choose to ignore this warning by simply grabbing the food, which would immediately turn off the warning.

Naturally, as a back up, the application will have a manual version. This includes manually turning on the app and taking a photo, which Google Glass would then analyze. The nutritional data would be displayed as normal, and added to the calorie count. To close the high calorie warning, the user may tap the side of Glass, a common action used by the Glass interface.

A very important function of the user interface for the Glass is to maintain clarity while still providing all the required details on its screen because of its small size. For this to work, users must be able to clearly identify the data that is presented by Glass, and they must appeal to the layout of the program, otherwise the app will not be favored by the general populace. For identifiable data, the information must be large enough to read easily, but it must also be organized into an effective manner. For example, the nutritional data for each food can be organized into several slides, each with one or two pieces of data. To ensure that our program seems appealing, we will survey certain students through a blind study, comparing current nutritional applications with our application. In order to receive a large participation in this

study, we will be using screenshots of either application, rather than using Google Glass or smartphones to determine appeal.

The algorithms run in the background will be identical for the Glass and the Smartphone application since the result to be computed and displayed is the same but through different media. The purpose of Google Glass in this project is just to provide users with a lower degree of input, requiring much less dedication and time from the user.

Budget

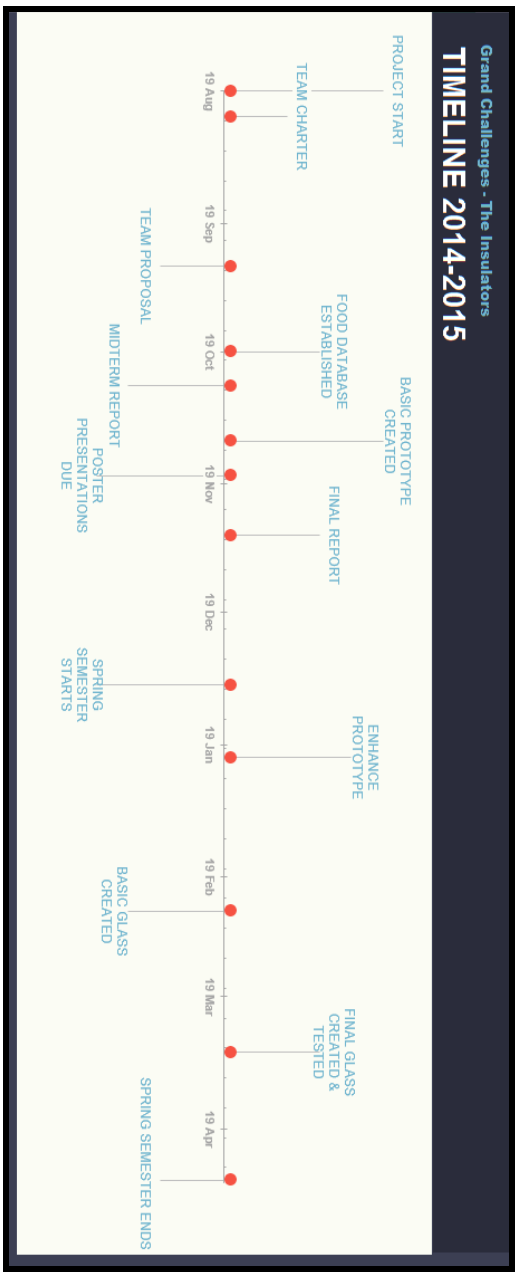
Objectives for all the items

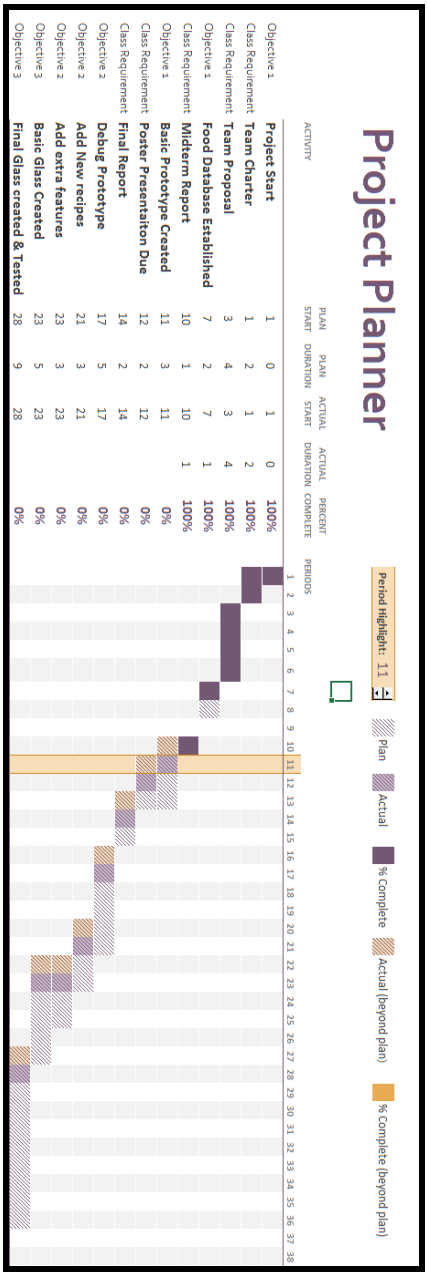
Objective	**Semester**	**Item**	**Purchased**	**Need**	
Google Glass Interface (Objective 3)	Fall 2013	Google Glass	$1,700		
Smartphone Prototype (Objective 1)	Fall 2014	Dining Database		$0	
Smartphone Prototype (Objective 2)	Fall 2014	Software (Estimate)		$200	
	Fall 2013 - Spring 2015	Travel		$100	
	Fall 2014 - Spring 2015	Conferences (Estimate)		$500	
	Fall 2013 - Spring 2015	Miscellaneous		$200	
		Total	$1,700	$1,300	$3,000.00

Our software and conference estimated figures are highly estimated and will most likely be reduced by a large percentage. Currently, we are not expecting to go to any conferences, but we would like to speak with our advisors, and the faculty of Grand Challenges regarding this opportunity. We know that last semester, Dr. Wynens mentioned our project to some of his friends in Japan, and they were very interested. In addition, we believe that we have the

sufficient software to develop this program, seeing as how our programmer, Chuanbo Pan, has created a similar smartphone program before, and will just need to adjust his program and enhance it for our application. Then, the only work that needs to be done is the transfer of the feed from smartphone to Google Glass UI, the implementation of a manual input function for when the food recognised is not accurate or not available in the database. The manual input would also aid in choosing partially eaten meals or portion sizes. Finally, the miscellaneous section of the budget covers any and all extraneous funds that we had not anticipated, and will completely cover our team, should an issue arise.

Timeline





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