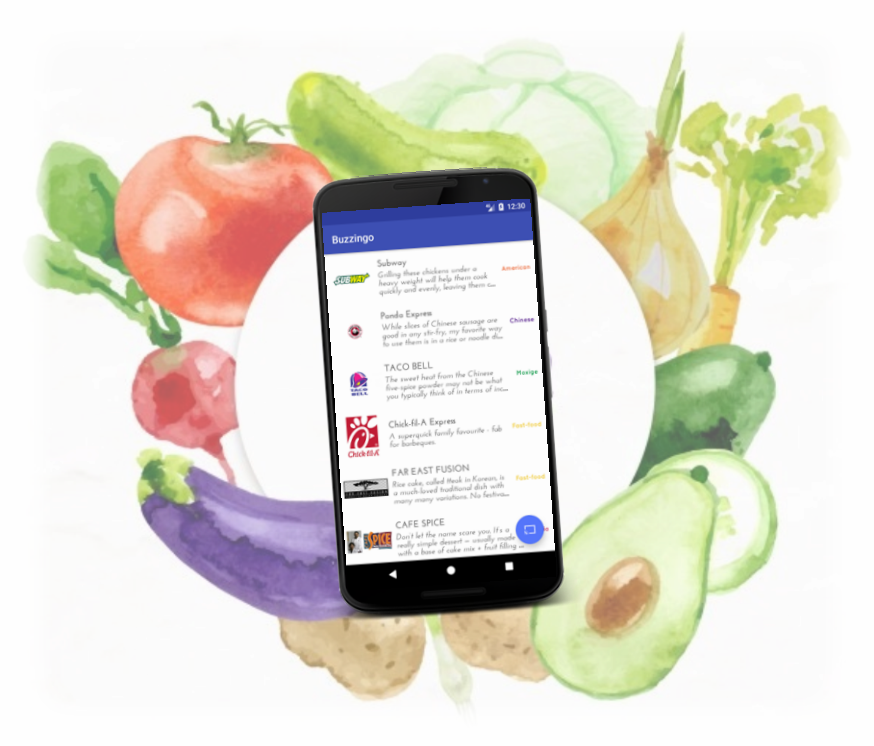
Buzzingo Meal

Your dining assistant and nutrition monitor

at Georgia Tech



CS 6365 Project Final Report

2017 Spring

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1. Motivation

Where should I go for lunch today? What should I get? How many eating places are there on campus, and what foods are they offering? As Georgia Tech students, we've all been having such questions from time to time. Maintaining three regular meals a day is not easy for college students. Healthful eating is even more difficult. However, a regular and healthy dietary habit is so important that it is key to keeping you energetic and surviving a long, busy, and sometimes stressful day.

So what's making dining on campus complex? One fact we observe is that although we spend almost half of our days at school during weekdays, the majority of us are not fully aware of all the dining places on campus. During a survey we conducted, we found that only 19.5% of the 87 students we surveyed, including both graduate and undergraduate students, knew the 19 campus restaurants we listed. When it comes to food trucks, things become more even more complex since these vendors have changing schedules. Most students reported during the survey that it was difficult to plan ahead of time due to the inconvenience of looking up the food truck schedules, and they basically just went there whenever they spotted a truck they were interested in. A second issue we identified is that for the four main community restaurants (dining halls), it is not easy to keep up with their daily menus, which stops students from making fully informed decisions. Besides these two issues of lacking fully integrated, accessible dining information, there is also an issue in terms of nutrition contents. It has never been an easy job to keep track of the calories and nutrients you take in at school without knowing much about the food that's been served to you, hence making diet management even more difficult for students. One last issue we observed, which also makes the campus dining problem special from general meal planning, is that Georgia Tech students are busy. Our school life is occupied by all kinds of stuff. Classes, homeworks, projects, club meetings, hanging out with friends, part-time jobs, research, and internships don't leave us a ton of downtime to plan our meals. Think about it: you might be running from class to class, and simply grab a donut, a

piece of pizza or something else fast but unhealthy for lunch. You might be eating at the same few places throughout the semester because you don't want to spend time to check out (or simply just don't know about) other eating places on campus. You might be busy working on your projects and often skip meals. Later on, you find yourself hungry and unenergetic that you end up grazing on snacks every few hours and taking in excessive calories unconsciously. The unique nature of school life and campus dining makes it desirable to have some source of well-integrated and easily accessible dietary information available to Georgia Tech students.

At present, there is some limited dining information for community restaurants on the GT dining services website. There is also some food information available to the public provided by individual commercial restaurants. However, such online information is not integrated but rather scattered and in inconsistent forms. It is also inconvenient to search online and navigate among different websites whenever you want to look up some food information. In a nutshell, we find it valuable to build a dining and nutrition App for members of the Georgia Tech community.

2. Objective

Motivated by the abovementioned four issues, we developed a multi-platform application named 'Buzzingo Meal' to tackle the problems and improve campus dining experience. The name Buzzingo comes from Buzz and Bingo with our hope that this App could bring the GT community a pleasant surprise. There are four main objectives we want to achieve.

1) First of all, we want to make real-time menus and food information accessible to GT students, faculty and staff for all dining places across the campus.
2) Second, we want to include precise locations for campus restaurants with easy navigation via Google Maps.
3) Third, we want to provide detailed nutrition facts for the listed foods.
4) Finally, we want to help students better manage their diet by providing effective food nutrition profiling, and useful little tools such as daily calorie and essential nutrient calculator.

The key objectives and associated functional modules are outlined in Figure 1.

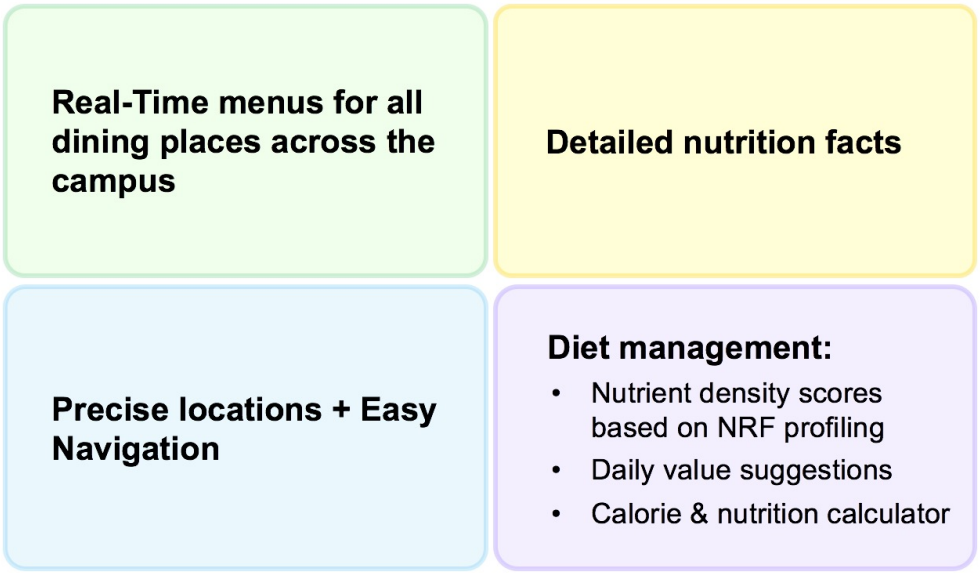


Figure 1. Four modules for App design

3. Research and App Design

During our design phases, we did some research and collected information via different Approaches.

First, we studied popular dietary and nutrition Apps on Google Play and Apple Store. We found that generally, food and nutrition Apps could be divided into two categories: food-centered and vendor-specific. For the first category, you can search for nutrition facts for a certain food/ingredient, get recommended receipts for healthy diet, record the food you eat, and track your dietary intake. Following is a list of selected high-rating Apps of this type on Google Play:

Healthy Diet Plans:
https://play.google.com/store/Apps/details?id=com.techiestalk.dietplans

Calories in food:
https://play.google.com/store/Apps/details?id=com.food.calories

MyPlate Calorie Tracker:

https://play.google.com/store/Apps/details?id=com.livestrong.tracker

Calorie Counter – MyFitnessPal:
https://play.google.com/store/Apps/details?id=com.myfitnesspal.android

Calorie Counter & Diet Tracker
https://play.google.com/store/Apps/details?id=com.sparkpeople.androidtracker

MyNetDiary Calorie Counter:
https://play.google.com/store/Apps/details?id=com.fourtechnologies.mynetdiary.ad

However, most such Apps require users to search the matching food in the database and add it to your daily meals in order to calculate the dietary intake. Also, the information is quite general. (This is understandable since there are numerous foods from different vendors/restaurants out there such that it is mission impossible to create an App capable of encompassing all specific food information.) Hence, they are neither convenient enough for students to use nor precise enough for our purposes. Fortunately, there are only a limited number of dining places and foods they provide in our case. This enables us to create an application which could provide information of food served on campus as complete and precise as possible.

The second type of Apps are those created by schools, restaurants or third party suppliers to provide food information for specific groups of users. Unfortunately, currently Georgia Tech has no such Apps available. There are also some limitations we noticed during our testing. One typical feature of many of such Apps is that they have been integrated into a big school/organization's portal App, hence making it only a small part of a big App with relatively limited functionalities. The dining tab is sometimes even hard to spot at first sight. Also, some of them are integrated into the portal by embedding the dining service webpages into it. Embedded webpages often result in awful display/layout on different devices. Secondly, only a limited number of them come with nutrition facts. Finally, many such Apps only provide food menus for (school) dining halls with no or very limited information on retail restaurants. By surveying our potential users, we found they were also very interested in getting food

information of commercial restaurants. Providing such information would be of great help if students want to have more eating options or to know about what are available to them.

During our checking and testing of Apps in this catalog, we found some good designs in line with our requirements. We took a few good examples as references during our design, integrated and extended their features, and created new functionalities to better serve our purposes. Examples of such Apps include:

Eats - USC Dining Hall:
https://play.google.com/store/Apps/details?id=com.blackbirdstudios.usceats&hl=en
Carnegie Mellon University Dining Services
https://play.google.com/store/Apps/details?id=com.nutritionaddition.nutrition_cmu&hl=en
UI Dining
https://play.google.com/store/Apps/details?id=edu.uillinois.aits.uidining&hl=en#details-reviews

The second approach we took was using survey. we surveyed our potential users – Georgia Tech students -- to better understand their requirements. We did that by including a set of features we proposed with checkboxes in our survey, as well as text boxes for them to write down their suggestions. By doing that, we collected some valuable information. Then we also looked into user reviews of popular dietary and nutrition Apps on Google Play and Apple Store to collect useful user feedbacks, requirements, suggestions, and features people would generally be interested in for a dining App. We also paid great attention to user complaints among the reviews, and took notes of pitfalls we wanted to avoid for our own App design.

Finally, we checked App design guidelines from designers from Google Play and Apple Store [1][2][3]. They provided some good guidance and tips, especially from the aspects of user interface and usability.

4. Project Scope

There are two key parts in our project scope: 1) data and contents; 2) web and mobile applications.

4.1 Data and Contents

Our application aims at providing useful information and tools for GT users. Hence, the data and contents play a significant role in our design.

A. Data Sources

1) Location:

   Precise GPS data for dining locations is available to us via the Georgia Tech Dining API on GTDevHub. We also implemented the Google Maps API for navigation and other map features.

2) Menu Information

   Menu information for community restaurants (dining halls) is available on Georgia Tech dining services website. The menus are updated weekly. We wrote Python scripts to crawl and scrap the menu information from the webpages.

   Menus information for retail restaurants, food trucks and their schedules is also available online. Unfortunately, such information is scattered and unformatted. We also spent some time scraping and parsing such data using python scripts. Finally, we populated the data into our database.

3) Nutrition Facts

   Nutrition facts for foods served at community restaurants are listed on multiple GT dining services webpages, and hence can be scrapped and processed using Python scripts. For other restaurants and food trucks, we obtained required data via APIs and open source databases including US Department of Agriculture (USDA) Food Composition database, Nutritionix API, and CalorieKing's API.

B. Data Analysis

With nutrition data in hand, we are able to provide tables of nutrition contents within our App. However, we figured nutrition facts provided detailed information on individual nutrient, they are not good at providing a big picture of the total nutrient package of a certain food. Also, there is a whole lot of information in the table, which may be too complex to read within a short time. Truth is, when people look at the nutrition facts, they tend to focus only on total calories per unit food, and at most contents of a few nutrients to avoid. However, total calories do not reflect the true nutrition values of a certain food. Meanwhile, instead of low-carb or low calorie diet, we want to encourage more balanced diet among college students. Hence, we tried to find a simple but effective approach to best reflect the nutrient quality of certain food. Hence, we profiled each food based on their nutrition contents using the Nutrient Rich Food (NRF) Indexing method [3][4] which is based on the algorithm below:

$$\mathbf{NRF9.3 = \Sigma_{i=9ENC}(\%DV/100kcal) - \Sigma_{i=3LIM}(\%DV/100kcal)}$$

The calculation matrices for this algorithm are provided in Figure 2. It basically takes the unweighted sum of the nutrition densities of 9 nutrients to encourage, and subtract those of 3 nutrients to limit, based on their percentages of suggested daily values. Since the indices have a wide range from negative values to positive values, and do not make much sense to people without much knowledge of NRF values. We normalized the values, broke down the range and assigned each of the restaurant food a score from 1 to 10 based on its NRF index. Using this scoring method, we provided a simple measurement that everyone could tell its meaning at a glance, and hence could encourage students build healthier diets by getting the most nutrition from per calorie.

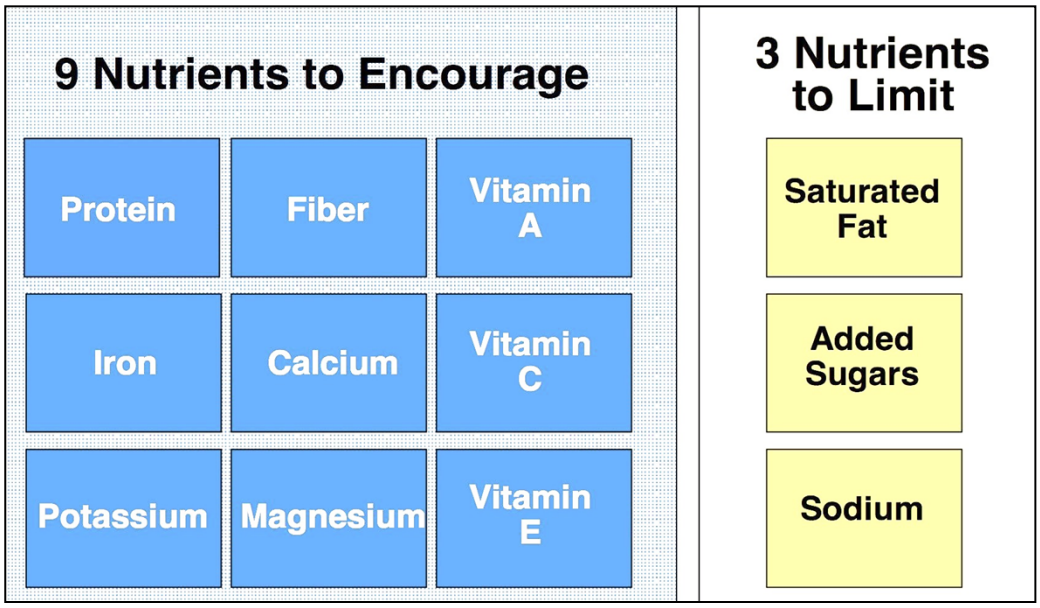


Figure 2. NRF 9.3 matrices

4.2 Web and Mobile Applications

With all the data and contents ready, we proceeded to build the web and mobile applications. Due to the time limitation and the scope of our work, the web application is relatively simple, and mainly acts as the visualization and an interactive interface with our backend database. The focus of our work is mainly on building the mobile App. The architecture and functionalities of the two applications will be discussed in detail in later sections.

5. Implementation

5.2 Overall Project Architecture

The architecture of our product is illustrated in Figure 3. We used the Amazon Web Server at the backend, and used local SQLite sync with Firebase. We have a website and the Android App as front ends for our application. We built the Web application with RESTful API to allow communication between the web-based client and server that employs representational state transfer (REST) constraints. Other APIs we used included Nutritionix API, CalorieKing's API, and

USDA NDA API for food and nutrition data, Georgia Tech Dining API and Google Maps API for dining location and other map and navigation features.

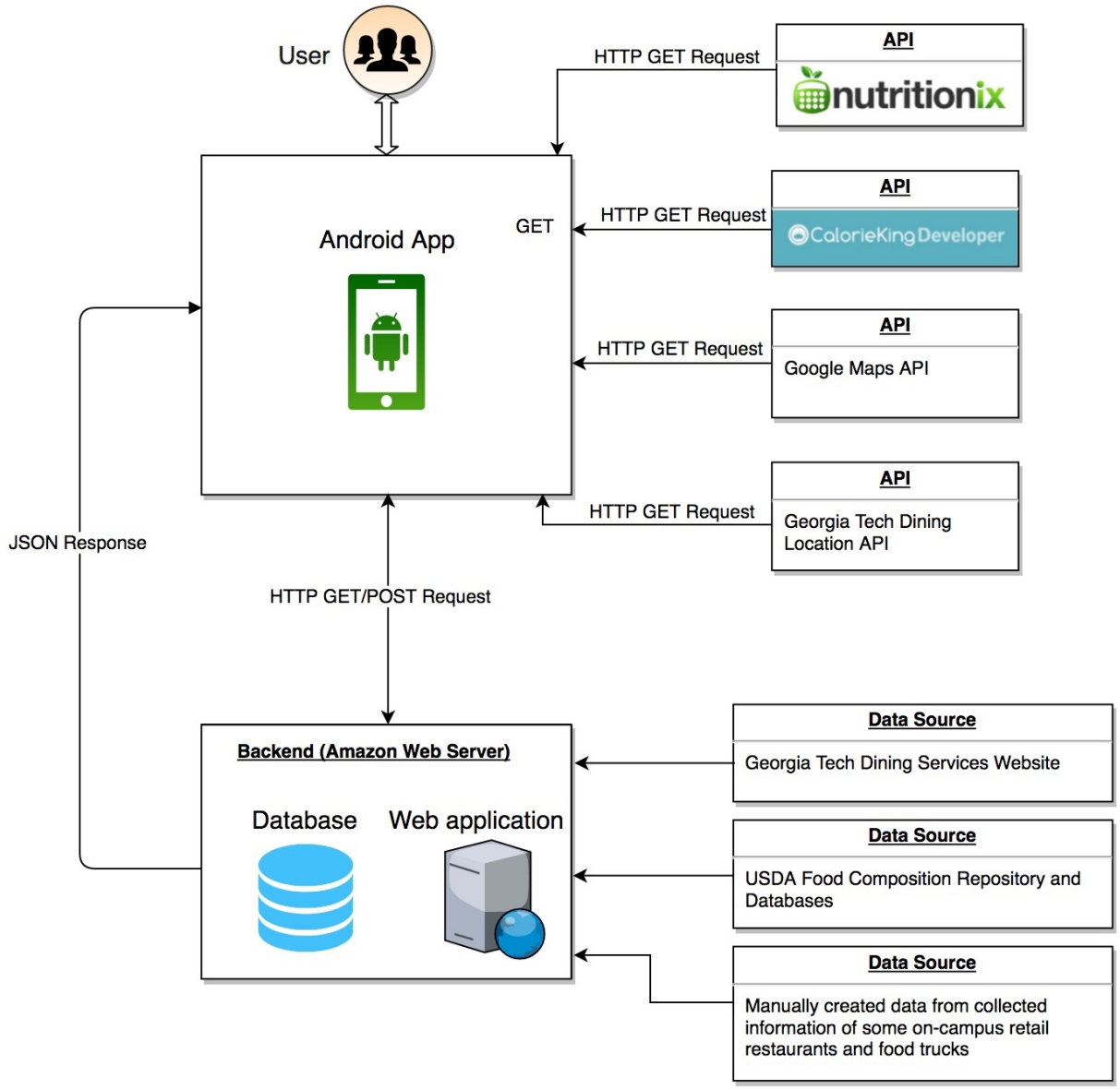


Figure.3 Architecture of the *Buzz*ingo Meal Android application

5.3 Technology Overview

In this project, we used Python to craw source the data and contents. The web server and application with RESTful API was built using Python with Flask framework. The client end is a mobile App with Android 7.0 Nougat. The technology overview is provided in Table 1.

Table 1. Project Technology Overview

Module	Techniques	Tools
Data & Contents	Web crawling and scraping	Python (*Urllib + BeautifulSoup; Selenium + Phantomjs)*
Backend	Web server & application with RESTful API	Python + Flask
Client End (Mobile)	Android application	Android 7.0 Nougat

5.4 Web Platform Architecture

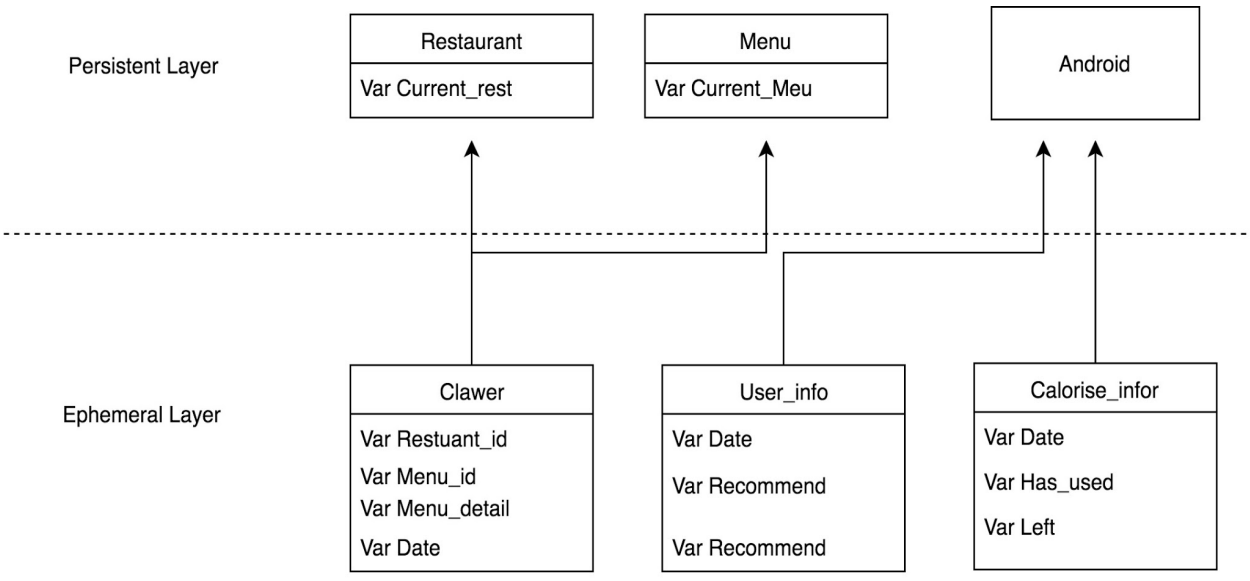
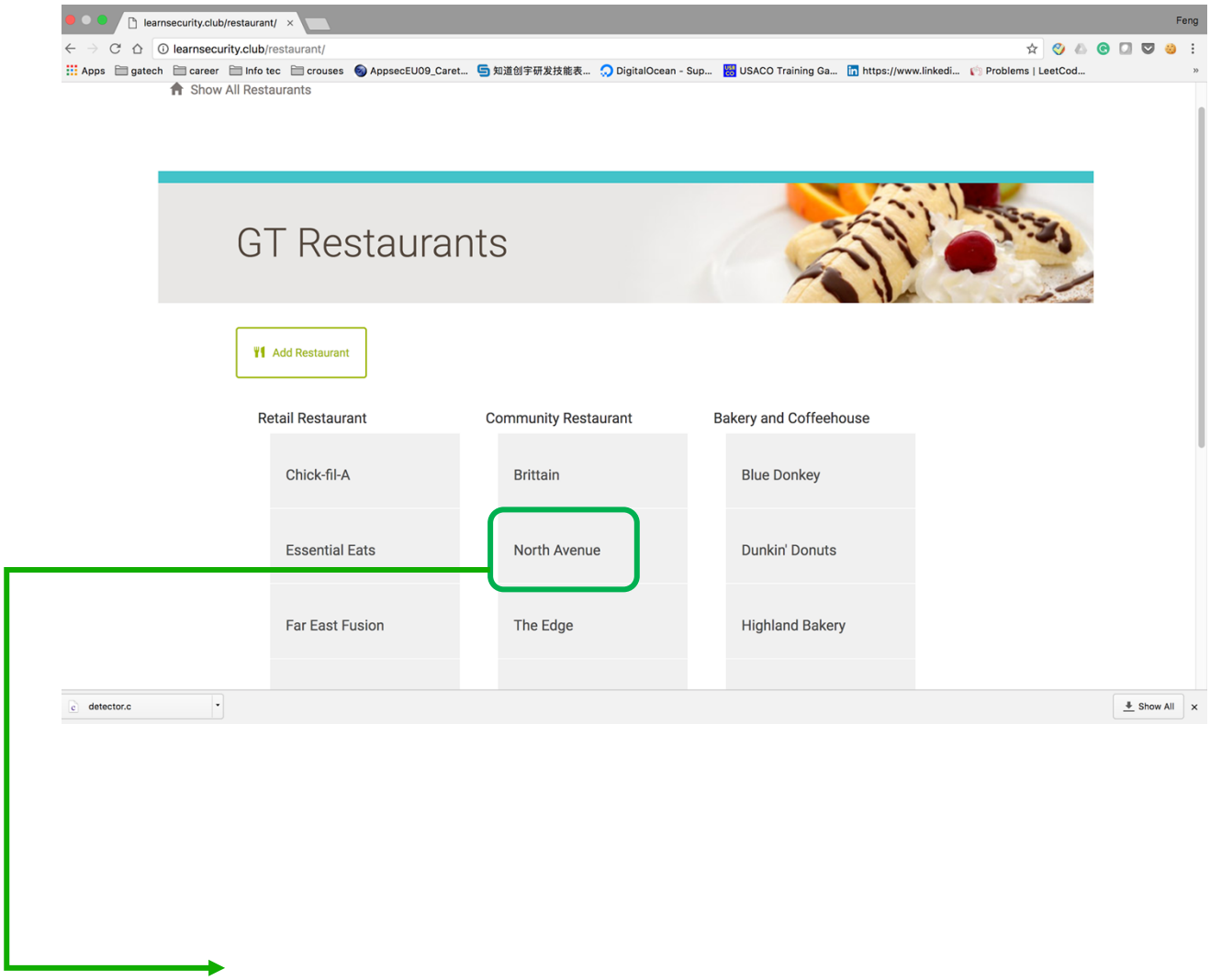


Figure 4. Web App Architecture

The implementation of the web platform follows the workflow as described in Figure 4. The web App was developed using Python with Flask framework, and can be separated conceptually into a persistent layer (where data is maintained between views) and an ephemeral layer (where data such as typed password are stored). Users are able to see the restaurants and associated information. They can also use the RESTful API to get the data from the backend. The web application also manages claw sourcing the data from various sources, and querying different APIs to obtain data. The layout of the web App is presented in Figure 5.



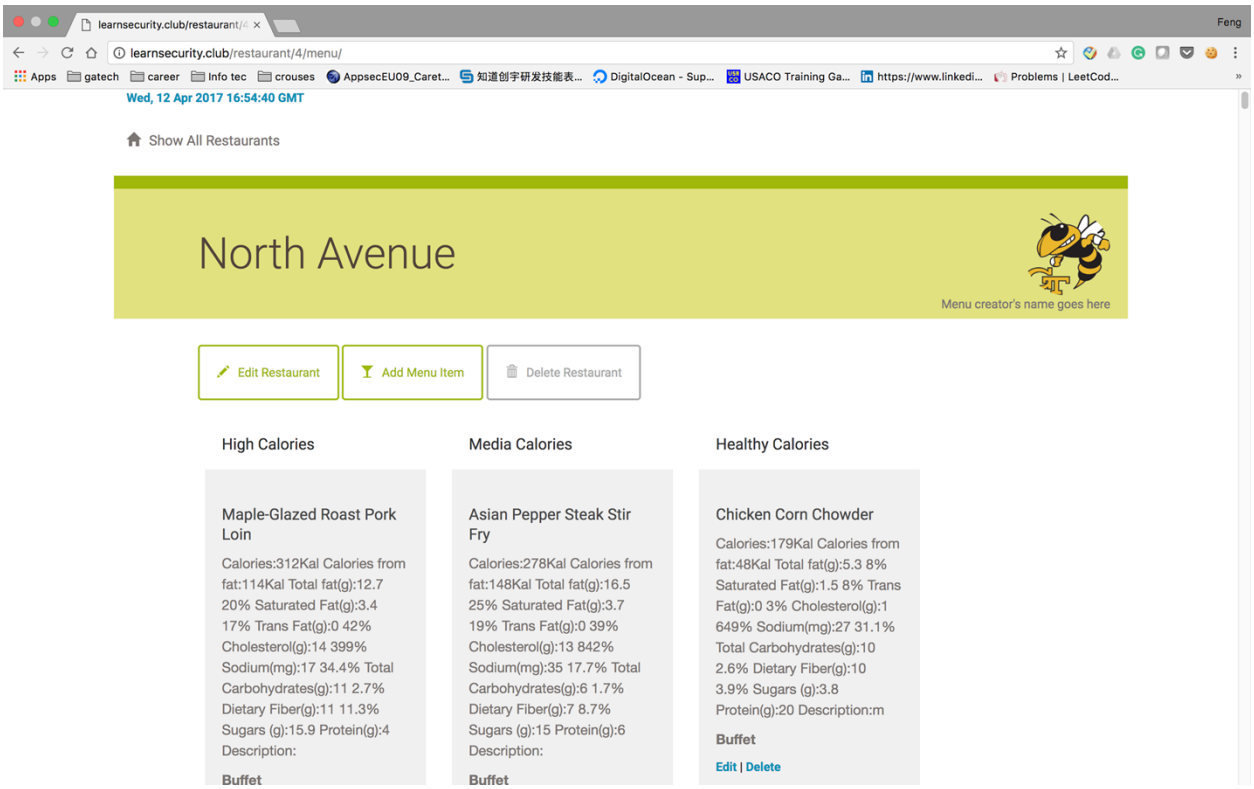


Figure 5. Web application presentation

5.5 Android Architecture

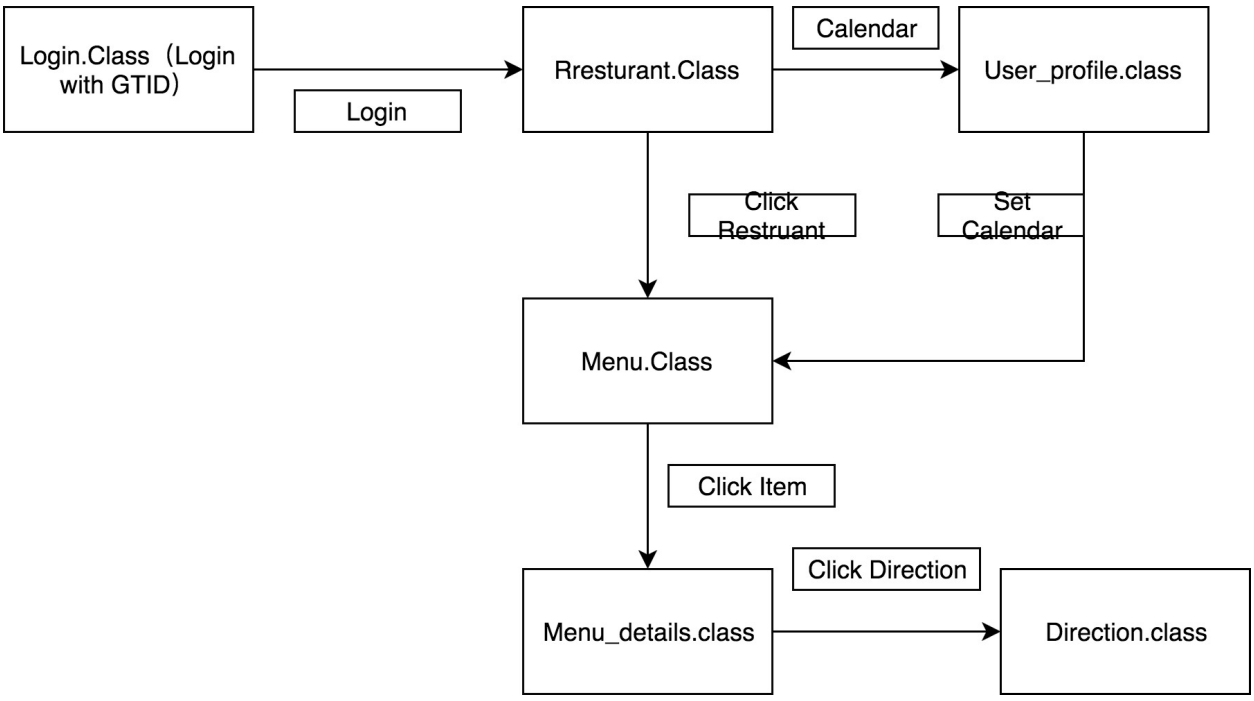
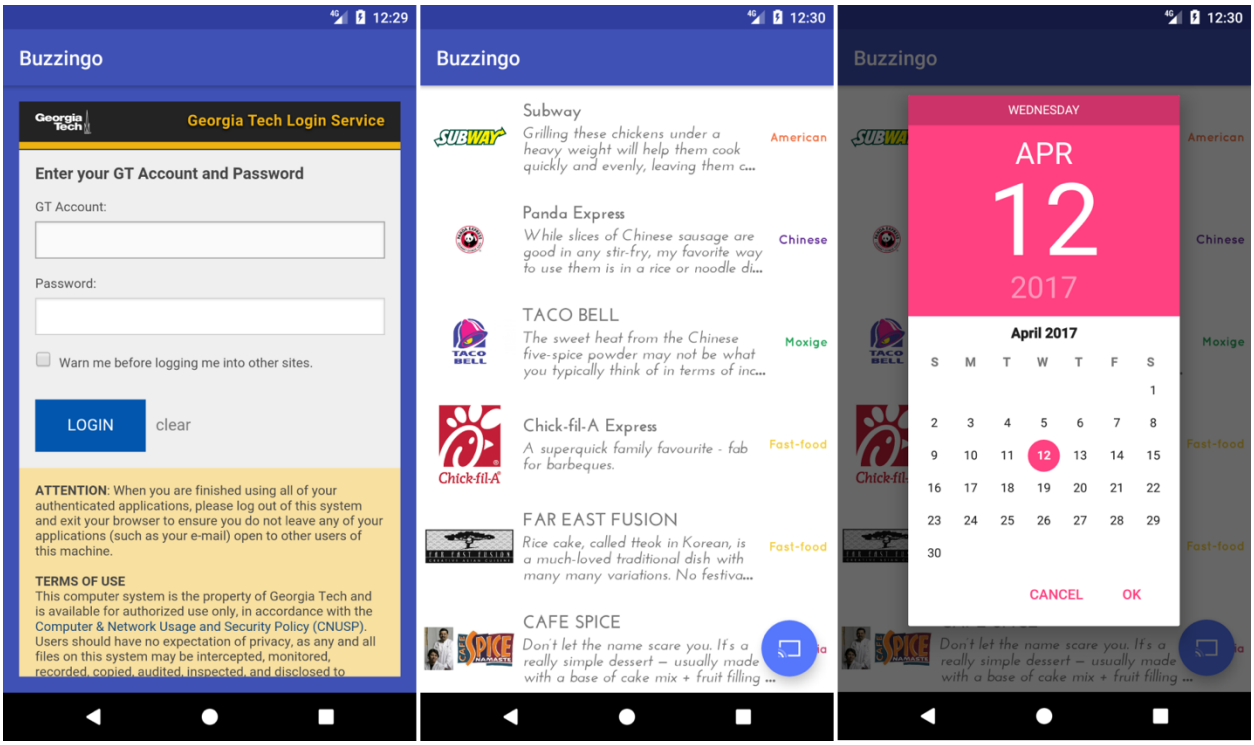
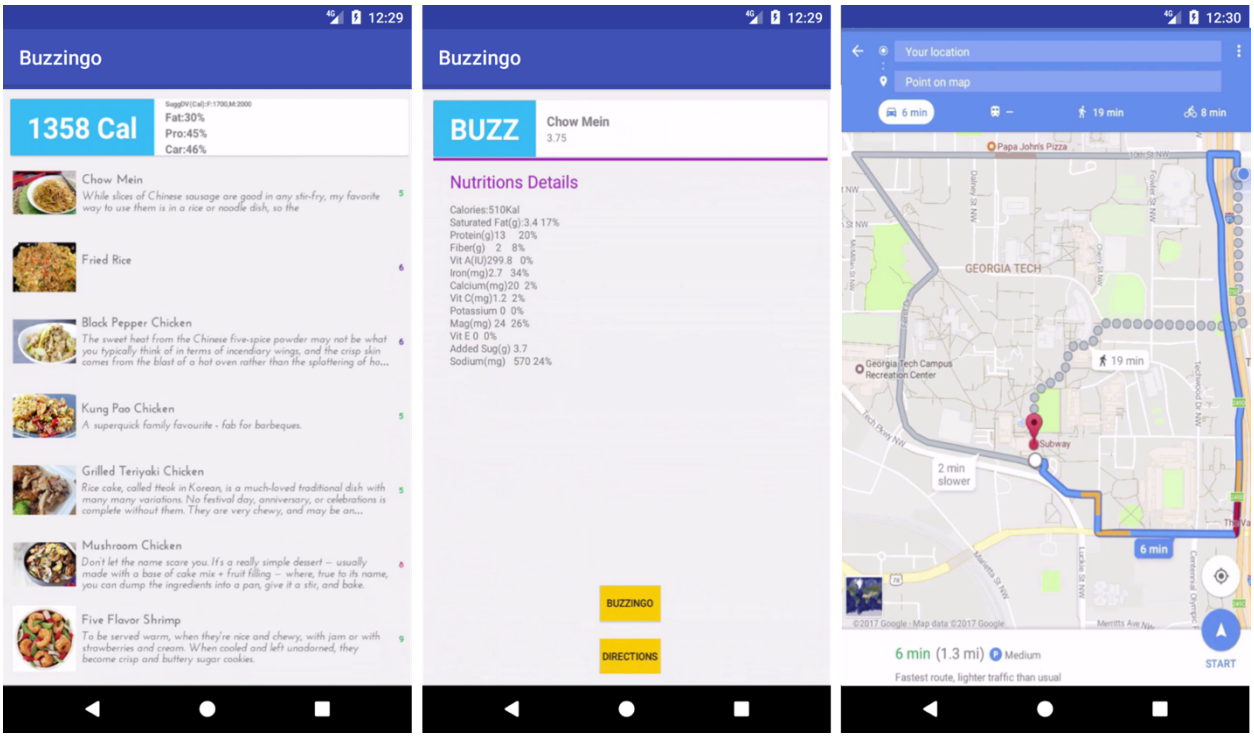


Figure 6. Android Architecture of Buzzingo Meal

The architecture of the Buzzingo Meal Android App is illustrated in Figure 6. A sample user case is presented in Figure 7. When you, the user, open the Buzzingo Meal App, you will be presented with a login screen (Figure 7A), and will be required to provide your GT user name and password associated with it. Currently, the target users of this App are GT students, faculty and staff. We require login to enable future extension/integration of more user specific features and display of information associated with your account. After you sign in, you will be presented with a list of campus restaurants and dining places (Figure 7B) with brief descriptions and their food types (Chinese, Mexican, American, buffet, etc.). The NRF scores are also displayed at the right-hand size of each food. You can click on them to check the details. You can also open the calendar (Figure 7C) to choose the date of which you want to display the menus. Currently, we only store data for the current week and the week before, since historical data is not of much use in our case. The database will be updated every Friday when the weekly menus for the next week are available online. When you click on the restaurant name, you will be brought to a new screen (Figure 7D) with a list of foods provided by that vendor. There is also a bar with your daily cumulative calorie and nutrition intakes displayed on the top. Suggested daily dietary intakes are also provided. You can check the details of each food by clicking on them. Detailed nutrition facts will be displayed (Figure 7E) with additional special features such as vegetarian, gluten free, dairy free, etc., as well as its price. You can add the calorie and nutrient values to your daily dietary calculator based on the amount by clicking on the 'BUZZINGO' button. If you are interested in this food, and decide to go there but need navigation, you can simply click on the 'DIRECTION' button, which will bring up the Google Maps, parse your start and destination location data into the map and help your find the path to go there.



(A) (B) (C)



(D) (E) (F)

Figure 7. Android App presentation

6. APIs

- Google Maps API [6] -- With the Google Maps Android API, you can add maps based on Google Maps data to your application. The API automatically handles access to Google Maps servers, data downloading, map display, and response to map gestures. You can also use API calls to add markers, polygons, and overlays to a basic map, and to change the user's view of a particular map area.
- USDA NDB API [7] -- United States Department of Agriculture provides a large repository of food composite data, and a database for of nutrients and their values in various portions for a specific food, common grocery products, and menu items from chained restaurants. The data elements returned in the API request match those in the Reports component of the NDB search application.
- Nutritionix API [8] – The Nutritionix API provides a robust search engine, which comes with real-time access to 713K foods, autocomplete Endpoint, and UPC Scanning; the free version provides nutrition information on 120K restaurant menu Items, 572K branded grocery products, and entire USDA common foods.
- CalorieKing's API [9] – CalorieKing's JSON API makes development quick and easy. Developers could be benefit from their proprietary search. It provides extensive coverage of fast-food chains and restaurants. It's also continually updated to meet the needs of health professionals and consumers alike.
- Georgia Tech Dining API [10] – This API allows you to access the information about the dining locations inside and around the Georgia Tech main campus at Atlanta, GA.

7. Testing and Evaluation

Unit tests have been performed at module level to test different functionalities as our App development proceeded. We also fully tested the App after integration was complete. We tested our App based on four key criteria:

1). Completeness and Workability

We tested the App to ensure the successful implementation of each functionality. We also ensured each module is working well and the whole App is complete and well integrated.

2). Accuracy and Up-to-Date

We checked the information displayed on the App against original data to ensure accuracy and good match. We also checked the App to make sure the data is up-to-date.

3). Database Integrity

We tested and optimized the relational database design to ensure data integrity, accuracy, and eliminate redundancy.

4). User Friendly

We asked other GT students to test our App and provide suggestions. We modified our design based on their feedbacks.

8. Project Deliverables

Within this package, we have included:

- One (1) package od project source codes
- Two (2) live demo of the application
- One (1) project final report
- One (1) PowerPoint for final presentation

9. Thoughts on Future Work

- Personal Dietary Diary

  Currently, our App does not come with personal dietary profiling feature. However, with the daily dietary intake data the App is able to collect, we shall be able to build users' dietary diaries. To implement this functionality, we should fist enable users to input data of their other meals eating off-campus. Also, Nutritionix API and CalorieKing's API could be used for querying nutrition facts for specified food.

- 'Like' Counts

  Another feature that could be added onto the app is a 'Like' button. The database would record how many each food item gets, and display that next to the NRF score. The number of 'Like's might help users find the food that many people recommend.

- Notify Me

  The 'Notify Me' feature would be useful for keeping up with certain food truck schedules and changing menus of community restaurants. If you mark a dish/food truck as "Notify Me". Once it's available, the App will notify you.

- Further Data Analysis

  Currently, every week we would display more 1,800 records of food information in this App. Using the data we parsed, we can actually perform some data analysis on restaurant-wise food nutrition analysis, student eating patterns analysis, nutrition intake profiling of the student body, etc.

References

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[3] User Interface Guidelines | Android Developers: https://developer.android.com/guide/practices/ui_guidelines/index.html

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