College Health and Dining Application

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This paper discusses the development process regarding a group of four Augustana College seniors' research. The project is a mobile app for Android built in Android Studio called Augustana Health and Dining. This application will improve the dining experience at Augustana College, as well as provide additional health metrics for personal use and to promote healthier lifestyles. The app features the menus of the various dining areas on campus, with calories, allergens, and other important food information. It also includes a profile section that will display campus meal credits, in addition to a calorie counting metric that can be used to track calories consumed, in order to display this information to users so they can make more informed choices on their meals and health.

1 INTRODUCTION

For the this research project, the plan is to create a College Dining and Health mobile application. The goal was to create an app to polish development skills, as well as give back to the college in a place the college could improve in. This app will strive to provide a useful user experience entailing a concise view of the Augustana Gerber Center dining menu that provides a variety of features, such as a calorie counter.

With the ever increasing presence of technology in our lives and its mostly helpful features, the dining center at Augustana was identified as a place that could also make use of these benefits. Given the immense use of smartphones, especially in the younger demographics, an app would be easy to access and simple to use, fostering a reason to develop an app and a user base [23]. The hope is to provide integration with the official college database that handle meal swipes and campus cash, to provide this information to students at a moment's notice, outside of having to visit a campus food vendor. If this is unavailable, the plan is to at least set up a separate proxy database to demonstrate these features. To do

this, the developers will implement MongoDB, as it provides an alternative to SQL that promotes ease of use and more options given MongoDB is a non-relational database. Although official meal swipes may be unavailable, a system that involves the user entering in their individual meal plan when first launching the app can provide a work-around. Based on this input, the app will be able to track and remove swipes from an internal counter when students use the app, providing a relatively simple method for students to keep track of their meal swipes. If the college sees utility in this app-based approach to dining, they might adopt the app or something similar in the near future. Given the group's experience with Android is significantly more than iOS, the development of this app will be in Android Studio for Android. One thing to note; however, that a large portion of the student body at many colleges uses Apple products that run on the iOS operating system. This means there may not have as large of a user population as desired unless there is a change in development space, or the school or another development group create a version for iOS. Compared to other food and dining apps, this app stands out for its specificity rooted in its attention to college dining centers. While many other apps need to account for foods of all different types, our app focuses exclusively on campus supplied meals, which reduces the complexity necessary to manage the app, as well as allows for a curated experience specifically for college students. Rather than have to account for a multitude of different meals, college's rotating dining menu limits the amount of variation in foods available at one time, allowing for a more manageable menu. The app's relative simplicity also allows for easier usage and adoption, so users can easily pick up the app and do what they need, rather than have to jump through the hoops that come with an app designed for a much broader purpose.

This paper will be organized into multiple sections, starting with the analysis of various other food diet apps in section two, Related Work. The third section will discuss motivations for developing the app as well as objectives in its creation. The fourth section will describe the framework for the app, its development environment, and the multiple features the app is planned to have. Section five will discuss the novelty of this project and its intellectual merit. Section six will handle results of the project and utility gained from the creation of the app. Finally, section seven will provide a discussion of the app's development, utility, and potential for future development.

2   RELATED WORK

While creating an app specifically for the college dining experience, many apps have been created for food and health-related purposes. Given the app's secondary focus on calorie metrics and health, surveying existing apps and previous approaches to curtailing the dining experience and promoting health will be helpful. Another important aspect to consider when designing an app is a user engagement, and how many people one can expect to use an app [19]. Research has been done to study usage metrics and user experiences and opinions regarding mobile app usage, particularly in the health and diet app sector, which pertains to the app's health features. According to one study, "over half... of mobile phone users had downloaded a health-related mobile app;" this points to a reasonable estimate of people that will consider this app for themselves, giving the app purpose and usage [15]. Even with high user engagement, the overall utility and benefit of an app also needs to be considered and measured in some qualitative and quantitative sense. Numerous studies have been conducted to determine the effectiveness of food and diet apps on personal behavior. Although the app that is the subject of this paper is not particularly a "dieting" app, its features such as the calorie counter can help facilitate these use cases for users inclined to do so. According to a study conducted by researchers at Brigham Young University, over half of the respondents felt the use of a nutrition app increased their motivation to eat healthy [28]. Another review of research from 2006 to 2016 regarding app usage in weight loss and diet plans also found that these kinds of apps did provide benefits for achieving these health goals, particularly when combined with other intervention techniques [20]. In a separate study conducted in 2016, more results were found that supported the notion

that apps were moderately helpful in the context of improving diets [21]. An app called Healthy Shopping connected a smartphone app with a bar code reader and a shopping cart, to allow shoppers to scan items as they shopped to determine their nutritional value. The study based on the app usage found that purchases on average included healthier food options [2]. Given the app's target audience is college students, analysis of college students' opinions regarding food apps specifically is useful. One study found that through analyzing various factors, there was a positive indication regarding college students' perceived usefulness and perceived ease of use of health apps [?]. Given this information, the team deduced that an app such as this would likely find an engaged user base. When creating an app, one must also consider how current apps are perceived, to try and find ways to improve. Comparing user reviews is one approach researchers have done. While the study did not specifically regard reviews, one study was conducted on the interaction between diet/diary apps and social media. It was found that the usage of social media in coordination with these types of apps promoted food interest [25]. The proposed review system for the app would function similarly to social media in this study, in that having one's opinions heard and being able to see others would result in further engagement and usage of the app. Another study from 2016 analyzed the characteristics of various health-based mobile apps and their ability to positively influence healthier food choices. It was found that there are currently some apps that fulfill this goal, but some can improve concerning user customization and nutritional information [6]. Working with dietitians provides another angle at which to approach health-based mobile app development. Researchers at the University of Maryland found that when designing food tracking apps in coordination with dietitians, these apps can be beneficial for those trying to diet. Additionally, customization was found to be a very important factor in the success of these apps [16]. A study involving another health app called SmartAPPetite was found to help promote healthy food consumption when specialized messages relaying nutritional information and encouragement were provided to users [7]. A different study conducted in 2014 regarding health mobile app usage demonstrated a few things. They found that reminders, goal setting, and tracking were features beneficial to app users[14]. One challenging aspect of this project is the variety of foods that need to be cataloged for tracking purposes. One study attempted to solve this problem on a larger scale than one college's dining center, through image recognition software on restaurant foods [24]. This approach could make the process of tracking calories easier for users, and therefore encourage it. This approach is unnecessary for the College Health and Dining app; however, as the dining center operates on a rotating menu of pre-selected items that would already be available in the database and in the app to quickly add to one's list of meals to be tracked, with the calories already determined and attached. While it will take some time to implement each menu item into the app's database, once there it will likely stay the same for an extended period of time, reducing the amount of upkeep needed. One study conducted regarding the utility of a smartphone app called Recaller that uses food pictures for dietary recall found that the app was easy to use [12]. Considering Recaller required users to take pictures, the College Dining app should be even easier, as pictures are not required for custom input meals, and meals provided by the college will already have images attached to them within the app. This further ease of use likely points to this app having the potential to be used more because of this.

The product is an Android phone software created to help college students navigate their dining center more quickly and increase their understanding of where different food items are situated and how many calories they have so that they can eat a nutritious diet. Students could generate alerts for themselves to remind them to eat on time, and it would allow them to upload their daily diet plan and give them an indication of the calorie count. Furthermore, people could just consult the menu on their phone to determine whether or not they wanted to visit the Gerber Center. The app will also show Allergens on various food items so that pupils are aware of them ahead of time. The findings would be displayed in a profile section, which would include information such as the user's specific food plan and calorie count.

Users can check for information regarding each food category, such as Bella Luna or Global Fusion. In a nutshell, the app will include daily menu information as well as customer evaluations and ratings provided by other users.

This app will be especially helpful to college students who visit the campus regularly, but it will also be beneficial to anyone unfamiliar with the campus, such as new students and guests. Most college campuses have an online menu, however, the app would add features that the website lacks. It would provide more thorough search possibilities based on the services the user is looking for, as well as the ability for users to review food items and get a customized diet plan. Furthermore, while most of this information is available on numerous websites, such as the college's website, this would bring it all together in one convenient area.

This application will provide available resources at the disposal of the user, and could be used by other schools too. With the basic code layout that the team would be using, it would be simple to take out the Augustana configurations that will be implemented, then a different school could use it to benefit their students. There could also be instances where this application could be framed to have multiple schools on the same app. Alongside Moodle and Handshake, it could be programmed to make it so that schools all around the country could have access to creating a section. That, however, would require a lot of time and effort.

For the product that is trying to be created, there have been apps that are parts of what is trying to be accomplish. One that has some of the same goals as the app, ShopWell. Their android app page states to accomplish "personalized nutrition scores when you create a Food Profile with your dietary goals, health concerns, allergies, and dislikes. Simply scan any item to see quick nutritional information and learn how it matches your needs – not an average. Discover products that are a better match for you. Create lists of your favorite finds and share them with family and friends. It's that easy." This approach is limited to supermarkets or grocery stores. While it is a useful app to look at, there would have to be hard coded items from the meal options into the app.

3 MOTIVATIONS AND OBJECTIVES

The motivation for choosing this project came from multiple places. The group desired to create an app, as it was believed this would be the most effective way to demonstrate the ability to create an app. The reason why the team chose a dining and health app because there was the potential need for it on campus. It also allows the opportunity of giving back to the school. At one point during development, the dining menu was not present on the Augustana website. The current menu has a QR code to share with others, a list of dining area menus, a search feature, and filters for allergies and options for certain dietary needs such as vegetarian. While there is one present on the website, it only provided food names and places, and the app would expand upon this by adding more information such as a photo and calories. The website restructured the dining section recently, and the menu is now hidden in a "dining calendar" page that is not even linked on the main "dining" page. Although Augustana offers the menu on the website, an app allows an even simpler, and more customizable, way to access the same information. Based on student anecdotes, many typically cannot find the menu, as it is currently placed within an odd section of the website, or do not want to bother searching that long. An app provides a very quick one-click method to get to the dining menu, whereas a website takes slightly more navigation; this minimal extra effort may be enough to stop some people from using the Dining Center. An app provides a sense of personal connection, furthered by the inclusion of personal meal choices and logs, which incentivizes users to continue to use the app, and subsequently the Dining Center. Creating an app that readily and concisely displays the menu information would benefit students in ease of access and by providing helpful information, with less hoops to jump through and less time searching the website. Although the website currently includes a fair amount of information, the group believe an image of the food being served would give a greater understanding of

what one would like to eat, as far as appetites and appeals are concerned. Some students might not know what to expect when getting a meal at their colleges dining center, and this would help alleviate this concern. The plan was to also incorporate a calorie counter within the app, based on each item from the dining center. Each food item would have an attached estimated calorie count, as well as potential allergens. The allergen notifier would assist people with allergies in finding something they can eat. The calorie counter is an integral part of the design, as it can promote a healthier lifestyle and help people track what they eat. The team also planned to integrate an "add your own meal" feature. This is to allow users to incorporate calories and meals outside of the college dining center food items, in order to gain a more accurate view of their calorie consumption, as plenty of people do not only eat at the college dining Center. This also gives the app more viability, not limiting it only to college dining, so users older than sophomores (who typically have less or reduced meal plans) can still find benefits of using the app. The plan is to integrate a time-based chart that would be displayed to show various data points such as daily calorie totals or weekly averages. These could be used in creating diets, as well as help in deciding what to eat in the many dining places. Another reason it was decided to create a dining app was to hopefully allow students to acquire access to their current meal swipes without having to go to a campus vendor. Currently, to find your amount of swipes, you have to go to a place on campus to swipe your card. It would greatly benefit students, especially those with meal plans that need to be budgeted weekly if they could check their swipes anytime and anywhere at their convenience. Finding out you do not have enough swipes for the remaining time period in a meal plan schedule is a potentially annoying problem, and this information should be available at all times. The group was not sure if this information is available to obtain, given the assumption that it is linked to official Augustana servers that would require extra security. Additionally, this could provide data metrics for Augustana and the students themselves on eating habits and food consumption. While the school can likely tell how much of which kind of food is eaten based on inventory, a digital record on a per person basis could be beneficial and reveal new information, although this may be a privacy concern unless an opt-out of data collection feature is implemented. With the review feature, it is considered many people, particularly new students, might want an extra opinion on what to eat at the Gerber Center. User reviews would allow students to give a rating for each individual food item, which would then be aggregated to allow for a decent consensus on the quality of a particular food. Giving the ability to rate food items could also drive user engagement, creating a more robust environment of users within the app. People would be more likely to use the app if they felt they could make their opinions about the food known.

There was an idea to create this app and have incentives for the users to get more engagement and spark more involvement with the app. This idea was scrapped because the idea was for this to be a quality of life for the students and want the interactions to be more genuine. From the Journal of Economic Perspectives, it states that "Because the standard incentive effect is gone in the long run (we define the long run as after the incentives are removed), effort will be lower than it was before extrinsic incentives were offered" [8]. After making an incentive in any case, the value of the app will decline because the user will no longer find a use for the app without an incentive motivating them.

One challenge to be examined with the development of this app is handling different people's body and health standards, and how calorie counting could affect them. One study examined people looking for weight loss, and found that calorie counting was not favored by them [22]. Another facet of this discussion involves eating disorders and personal body image, and how this could potentially impact mental health, in both positive and negative ways. Seeing calorie numbers could help some people in achieving their goals, but they also could discourage others and make them feel worse overall. A certain balance in design and appearance of the app's features must be found throughout development in order to help prevent negative experiences.

The team tried implementation of different databases and at first the developers implemented the use of MongoDB, a NoSQL database, NoSQL databases have become a popular alternative to traditional SQL databases, especially in the scenario where extremely large scale of data needed to be managed. The adoption of NoSQL solutions is called for theoretical and technical supports on evaluation of the solutions, comparison with SQL solutions and optimization of NoSQL solutions. [30]. The collaborators of this project realized that the population they aim to serve is only a limited amount and Augustana College being a small college only has a population of 2500 – 3000 students, will do just fine with an app that has a relational database. However, for the purpose of learning and to look ahead in the future the developer team decided to implement MongoDB as their first database.

MongoDB database holds a set of collections. A collection has no predefined schema like tables, and stores data as BSON documents (binary encoded JSON like objects) [26]. Using a non-relational database, such as MongoDB, for development of a forum, allows the structure to be specific to each user, thus each user has the possibility to organize its forum in a unique way. Thus, using a non-relational database, the static structure in which a forum contains subforums, the subforums contain discussions and discussions contain comments, is not mandatory to meet. A subforum may contain another subforum, which may contain another subforum, which contains another subforum and so on. There is also the possibility of attaching discussions directly to a forum, without the need to create a subforum for opening a new discussion. [9]

After testing their software using MongoDB, the developers decided to try a new database in order to improve the app and keep the intended user population. They found MySQL to be the ideal option. MySQL provided seamless connectivity, rapid development, and round-the-clock uptime and data security, among other benefits. MySQL is a database server that operates on a wide range of operating systems. It runs on a number of operating systems, including Linux, Solaris, and Windows. It's an excellent choice for projects that must work across multiple platforms, particularly online apps. MySQL is part of the popular LAMP (Linux Apache MySQL PHP) server stack, which is widely used for online application development all over the world. C, C++, PHP, PERL, JAVA, Python, and other programming languages are supported by MySql. MySQL is the most secure and reliable database management system available, and it's used by well-known web applications such as WordPress, Drupal, Joomla, Facebook, and Twitter. Passwords secure data, and the good news is that these passwords are stored in encrypted form, which means they can't be broken by these powerful encryption techniques. The Dining App's initial scaffolding featured an id, a name, meal swipes, a calorie goal, and a time stamp. Later, the team recognized that a user id was required so that existing user data could be updated. The id was designated as the primary key, while the email was designated as the index key.
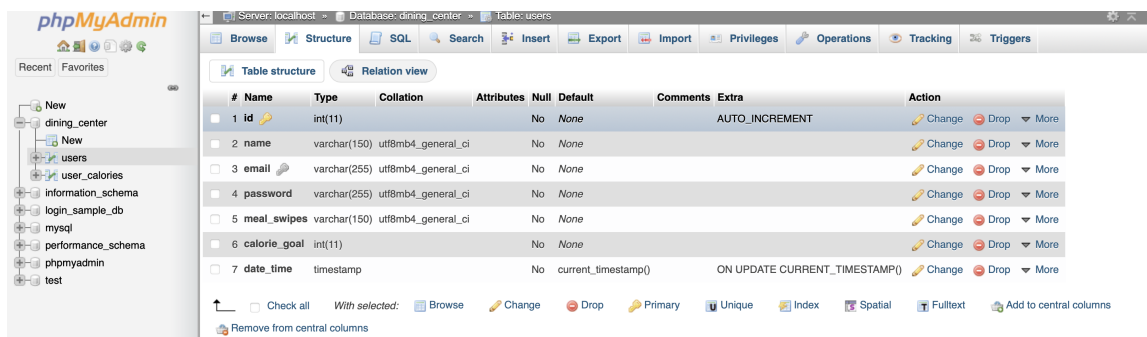
Fig. 1. The database which uses SQL to store and track data.

This is where we can see an overview of the database—the existing tables, a link to create a table, the tabs to the Database view subpages, and some special operations that we might do on this database in order to generate documentation and statistics. [5]

The biggest benefit of NOSQL databases is that, unlike relational databases, they can effectively manage unstructured data such as documents, e-mail, multimedia, and social media. The common features of NOSQL databases can be summarized as high scalability and reliability, very simple data model, very simple (primitive) query language, lack of mechanism for handling and managing data consistency and integrity constraints maintenance [18]

4 FRAMEWORK

When discussing what potential ideas were available for this project, it was evident that the goal was to get something that would benefit the college communities, but that could also potentially be extended to benefit other communities as well as visitors of any given college. Eventually, there was a common problem that could be solved. Here at Augustana, the CSL is the abbreviation given for the primary dining center, and the biggest mystery kept by the CSL on a daily basis is what was on the menu for the day. Of course, right at the entrance, there is a TV displaying the menu, but what the team found is that many students were rather irritated when they arrived at the CSL just to find out there is nothing good on the menu. This is where phase one of the project idea comes in. For phase one, the plan is to have the daily menu displayed for all different stations within the CSL. This would allow students to pre-plan their breakfast, lunch, and dinner plans all at once as well as be able to check the menu at any time they please.

What was quickly realized is that this feature would only help Augustana students, but the goal was to have this help as many people as possible seeing as it would be a public app. This led to phase two of the project idea which is the incorporation of health tracking features. What does it mean to have health tracking features? Specifically, the thought would be to make a design which is very beneficial to fuse the menu ideas with ideas revolving around health. There is a few ideas to support this including a calorie tracker for each food item that you could then add to your daily total as a means of keeping track of how many calories you eat in a period of time. This is a substantial feature to include for the health-conscious students as well as students who do not usually concern themselves with their physical health will have an easy means to start getting into calorie tracking. On top of this, the plan is to include nutritional information about each food item so students can eat fearlessly even with the most severe food allergies [4]. Itemized below is a full list of planned features of the College Health and Dining app:

- Images of the food items being served to help students gauge their interest in what is currently being served.
- Food items are organized on a per-station basis to allow students to quickly view what their preferred stations have to offer.
- Nutritional information is readily displayed to assist students with certain dietary needs such as allergens, vegetarian diets, and other special needs in determining what they would like to eat.
- Estimated calorie information for each meal item, to allow students to plan their consumption with a focus on personal health, allowing the monitoring of their diets.
- A built-in calorie/health metric based on student height, weight, and other characteristics to attempt to help decide meal options and to track their current health in this regard.
- For students with meal plans: access to the number of swipes they currently have available to them in their meal plan, be it a weekly budget plan or a per-term lump sum of swipes; this information is not currently available unless a student physically goes to a campus food vendor and swipes their card.

- A visual displaying meals they have added to their daily meals, which could track calorie averages, high points, and low points to help monitor health and consumption.
- A display of a meal swipes usage log on a time basis, allowing for the planning and management of the usage of meal swipes over longer periods.
- An alert display for various things determined by the college/dining center staff is to be shown. Examples include: if a certain food item were to run out, a certain station being closed, a change in hours for particular days, new food options available, limited capacity, among others.
- A profile page that compiles the various information metrics, such as available meal swipes, student health metrics, modifiable allergen/dietary needs, a chart/calendar displaying the usage of meal swipes, and which foods were consumed.
- An "add your own" meal option, to account for meals/calories outside of the college dining center services, to incorporate them into your calorie counts and health metrics.
- A section for FAQ/links to the college's website for questions and concerns regarding the dining experience not covered by the app.
- A review system on a per food basis to help students determine which foods they are most likely to enjoy based on cumulative user feedback.
- A search feature to allow for finding desired food items and their availability

Nailing the framework for this app is essential to us because only if it is easy to implement, use, and maintain would this app see impact beyond the walls of small colleges such as Augustana [11].

5 INTELLECTUAL MERIT

Mobile applications have become a powerful and profitable way to communicate as the number of people owning mobile devices grows rapidly around the world. Because innovation in this industry moves at breakneck pace, it's critical for colleges to stay current on new technologies in order to get the most out of this powerful problem-solving tool. According to surveys, well-designed mobile apps are significantly faster and more resourceful to create than webpages for the same platforms. In contrast to webpages, which often use web servers, mobile apps typically keep their data locally on the mobile device itself. A mobile app provides an unrestricted user experience and functionality, allowing you to expand the range of services available to your clients that may not be available on your website. The College Dining App app would allow college students to choose their meal plan from the convenience of their dorm room. Developing this software in a collaborative environment would allow the group to get experience working in a group while also allowing individuals to succeed in their own fields. The belief is that because this project is a one-of-a-kind concept, it could help organizations around campus in terms of assisting current and prospective students. This app will provide us with essential information and experience for future project design and operation, as well as help us understand the limitations of app creation. The project will be completed by all students, who will gain cutting-edge app development skills and knowledge. The current initiative, which focuses on the dining center's food, can highlight how healthy college dining center's food is, allowing students to eat healthy even when under the stress of ongoing classes. The team can't afford to create a mobile application that blends in with thousands of others or deviates from its objective in this competitive industry. The best mobile app developer for the team will be able to:

- Help the team's application stand out from the competition by exposing it to a large audience.
- Combine an easy-to-use user interface with a visually appealing design that complements the college's name.

- Conduct extensive meaningful testing to guarantee that our app works flawlessly across a wide range of operating systems, devices, and software versions.
- Transform our vision into a useful final product.
- Create an ambient User Experience and User Interface, or UX and UI — in other words, the team will make an app which is easy to engage with and looks desirable.

The framework should strive to build an app that take into account the unique characteristics of the mobile environment from the start [13]. Furthermore, it will manage the development time in such a way that it is as short as possible without compromising the application's quality. The belief is that it is critical to seek alignment between the activities of the application development life cycle and their own or relevant components of the mobile context, as well as an agile approach to managing the application development process. With the development of the app, there are certain areas that the team are focusing on in particular. Since there have already been thousands of weight-watching apps that are currently on the market, that is not going to be the selling point of this app. The intent is on helping every student on campus in some way. The vision that going forward is during the orientation for Augustana and potentially any school. The advisors of the students would advise them to download this app to get important information with a click of a finger.

6 RESULTS

The goal of this project was to gain skills in Android app development, alongside improving the student's time and resources at Augustana College. This project proved to be a tall task to be developed in fourteen weeks, however. The combination of learning how to code an application in Android Studio, alongside no prior knowledge of app design, proved to be a huge impediment in the group's way. What the team found out, is that coding in Java in Android Studio proved to be more time-efficient, because trying to learn a new coding language like Kotlin, was not included in the time parameters. What was best was splitting the work into different areas that could be focused on for the group. One student focused on the framework of the app, another student helped create the database that helps keep all of the information of the users safe and stored, another student was tasked with finding out how to import the data from the school into the app, and the last student was tasked with designing the pages that are used to display said data. With that laid out, the team got to work on their respective areas. Once the framework and the design of the pages were complete, it was time to merge the two. Which proved to be more difficult than was previously thought. The main problem that was discovered was that there are a lot of there are connection issues when trying to connect the two. One workaround is that a new project was created and implemented those changes together once all of the pages were done.

The photos in Figures 2, 3, and 4 are shown to be the basis of the app. It has the main login page to accept users within the database. The next picture shown is the home screen of the app. This is what the user can navigate to, to switch between the different areas of the dining hall. Also at the bottom, there are the alerts, which are there to show if the dining hall is closing early or some other changes occur. The last picture is the basis of all of the pages that are currently available. It has a way to get back to the home screen, a list to display what is in the rotation of the day, and displays an image of the food and the calorie amount that it is. If someone were to select that option, it would add that amount into the daily intake of calories and display it for the user.

One of the app's primary features is the alerts system, which will be used for a variety of purposes. The dining center, if need be, would have the ability to push alerts and notifications to users in case of certain situations, such as
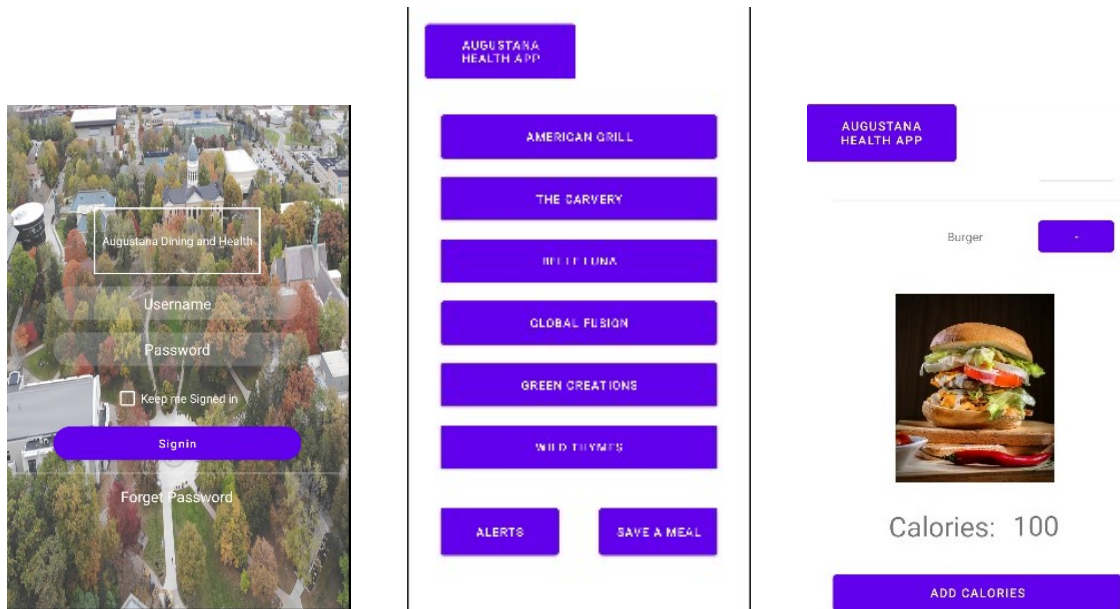
Fig. 2. The current login screen for the app, able to log in through the username and password.

Fig. 3. The main screen of the app. The team went with a simple design to ensure that it was easy to use and not a lot of distractions present in the app.

Fig. 4. One of the six screen that the user can navigate to, to show what is in that specific area and what they can choose from. It has a calorie counter at the bottom to add that specific item's calories to your daily calorie intake.

a menu change or closure. The alerts were also designed with another purpose in mind, that is to promote healthy behaviors. Based on user input and choices, the app could be set up to send push notifications and such to remind users of certain things. Examples include reminding users to drink water in specific time increments, or to consider going to grab a meal if one has not done so in a certain amount of time. This would promote usage of the campus dining facilities, while also helping students remember to care for themselves. A study of obese adult women found that push notifications from an app provided a noticeable increase in benefits from the weight loss study they were involved in [10]. Although the College Dining App was not designed as a fitness app, the concept of push notifications has been demonstrated to assist in achieving goals related to them, and this shows that the dining app's push notifications would also likely spur improvements in students' lives.

Then was the implementation of the database into the application, the finest database for establishing a mobile app or updating an existing one is the right database. The mobile app database indicates whether or not your app is capable of supporting many users (old and new) as well as frequent maintenance and updates. We chose a relational database because of this. MySQL is a very fast, robust, relational database management system (RDBMS). A database enables you to efficiently store, search, sort, and retrieve data. The MySQL server controls access to your data to ensure that multiple users can work with it concurrently, to provide fast access to it, and to ensure that only authorized users can obtain access. Hence MySQL is a multiuser, multithreaded server. It uses Structured Query Language (SQL), the standard database query language worldwide.[27]

While working with the database, the team noticed how fast, cost-effective, and portable it is. After utilizing MySQL, the team realizes and agrees that MySQL is the best option for this application. The libmysqld embedded server library makes MySQL Server suitable for a vastly expanded realm of applications. By using this library, developers can embed MySQL Server into various applications and electronics devices, where the end user has no knowledge of there actually being an underlying database. Embedded MySQL Server is ideal for use behind the scenes in Internet appliances, public kiosks, turnkey hardware/software combination units, high performance Internet servers, self- contained databases distributed on CD-ROM, and so on.[17]

7 DISCUSSION

Future work that could be accomplished on this app would be upkeep on the app so that it could be supported later. Also with future work, if this were to keep being developed, it could be given to other schools and universities to help them with this issue as well. Another concern that the group had that could be addressed later, is the consensus of where everything was laid out. Maybe others in the school may have better suggestions and could be implemented into the application. Overall, this project made the students working on it more aware of the time, effort, and resources needed to make a functioning Android app, but also an application that people will like. A future project that could occur with this app, could be applying it to a Google App Engine. A study with the Google App Engine shows that one could write a server-side application on top of Google's scalable infrastructure [29]. This would allow the creator accessibility to all of Google features.

One area left for future work is the development of an iOS version of the app. Given Augustana's student population's high usage of iOS, porting the app to the App Store to allow iOS users access to the app would be a large step forward. This would allow for many more users, increasing the app's effectiveness, as well as increase the usage population to help in identifying and notifying the developers about important features that are necessary. This expansion would also result in an increase in bug reports, allowing for a more robust development environment where more problems are identified and later solved. Given the high usage of iOS across the college student demographic, expanding to iOS will also allow the app's framework to be generalized to other schools or institutions in a much easier manner as well.

Another area left for future work is the implementation of the school's meal swipe database with the app. Due to time constraints and the current plans of the Dining Center, our app was unable to be connected to Augustana's official databases. The app will instead use a proxy system, in that upon registration, users will manually input their current meal plan, and the app will automatically deduct meal swipes when appropriate. The app will display the swipe counts in a visible and accessible manner, allowing for the user to easily check their swipes when they need to, as the app's creation was motivated by this particular feature. The app will also feature a way to modify a user's meal plan, in case they change or upgrade theirs during a given school semester. While there are concerns this could lead to potential misalignment between users' displayed meal swipes/plans and their actual swipe counts and meal plans, allowing for users to easily adjust their plans within the app should hopefully mitigate these issues.

The group collectively thought at the beginning of the development that building an Android application would have been a breeze. Then shortly after starting, it seemed to be a bigger task then was expected. The table below shows the time that it took to accomplish those goals. The actual time taken with the plus after the amount of hours, represents that there would be time taken and needed to perfect what the team is trying to accomplish. From [1] states that with all of the fixes that are necessary for a app to be functional, the time taken is going to be great.

Overall, the general thought behind the app was to improve the time efficiency that it took for students wondering what the dining hall was serving, or a way for students to take care of their bodies if they wanted to. Everything that the app has to offer is up to the user, which makes it so they have an enjoyable time at campus.

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