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CS 522 - FSP Deliverable #1 - Report

Interview Clients

The purpose of the project is to support university students with dietary restrictions in efficiently navigating the menus and physical spaces of food halls; as it now stands, confidently locating safe food options is a challenge. With a particular interest in UIC students and the university's United Table in Student Center East, to better understand the ways in which those with dietary restrictions go about searching for food, a series of six interviews were conducted with an emphasis on the "what, how, and why".

The interviewees intentionally consisted of young-adult UIC students from a variety of countries with dietary restrictions who frequently use UIC's dining services, as they are the target user group. Among the six, two were female and four were male. The age range started at 28 years old and ended at 35 years old. All six interviewees happened to be graduate students studying Computer Science and/or related fields. In terms of ethnicities and countries of origin, two were South Asian while the others were from Brazil, Peru, Germany, and the United States.

For a full list of the questions asked during the interviews, a discussion guide has been provided as supplementary material. Within it are a series of key demographic, warm-up, and main questions intended to identify the interviewees' dietary restrictions, what they intend to do at the United Table, how they go about doing so, and why they choose to do so in the way they do. Examples of warm-up questions include, "What are your dietary restrictions?", "Can you tell us about websites/apps/social media you use to know about the dining hall?", and "How much time do you spend inside the dining hall looking for preferable food options?". Examples of main questions are "Can you walk me through the thought process you used to choose what to eat there?" and "Can you think of a time you were particularly frustrated at finding what to eat?".

With reasons ranging from religious beliefs to allergic reactions, the dietary restrictions identified by the participants were no pork, no spicy food, no mutton, no red meat, no monosodium glutamate, no processed food, and no animal products. The frequency at which the participants visit the United Table ranges from three times a month to daily, and their reasons for visiting are for convenience and variety. Most participants rarely use the online menu to determine what foods they can eat, as it requires the selection of too many links and there are no images provided with the food names, making it difficult to map and locate them in the actual space. For a first-timer, the space is overwhelming. To learn about the ingredients, the students ask the workers directly, but they rarely provide helpful answers. To ask a worker or to read the scarce signs available, they have to wait in very long lines only to discover they cannot eat the meal in front of them. In addition, no information is provided in regards to cross-contamination.

Current Interface

To locate the menu of the United Table, one must use the website for UIC's Dining Services. There is a drop down in which the user selects the date and the specific restaurant of interest which, in this case, is "United Table at SCE". The following is a link to the webpage: https://dineoncampus.com/UIC/whats-on-the-menu. Three tabs are provided: breakfast, lunch, and dinner. When one of the tabs is selected, there will be a lengthy list of available options that requires the use of a scroll bar. To reduce the number of options present, there is a drop down for filtering. The filters provided are Vegetarian, Vegan, Balanced U, How Good Friendly, How Good Good, How Good Great, and How Good Best. For each menu item listed, there is the name, portion size, calories, and nutritional information. When the nutritional information button is selected, the window that appears also displays the ingredients. If the item is Balanced, Vegan, or Vegetarian, for example, a circular symbol will be placed next to the item name. A search bar is also provided which will inform the user of the dates in which their item of interest will be served.

According to the participants, pulling up the menu using the website for UIC's Dining Services is inconvenient and time-consuming, as there are far too many links and buttons to press just to find the list of meals for that day. In addition, it is unclear what some of the filters mean without scrolling all the way to the bottom to see the legend. The filters in question are How Good Good, How Good Great, and How Good Best. If being used to find safe options that fall within the student's dietary restrictions, there is no way to, for example, determine if the meat listed is halal or not. Finally, while a student can use the menu to determine what they want in advance rather than trying to navigate the busy space of the dining hall, it does not provide images, so the student cannot determine which is their meal of interest. Regardless of the menu's existence, they will still have to wait in long lines to ask the workers which meal is which.

Designing a dedicated mobile app for students with dietary restrictions offers a host of advantages. Unlike the current web interface, which is deemed cumbersome and time-consuming, the app would provide a seamless and accessible platform for students to swiftly access vital information about dining options. With a user-friendly interface, intuitive filtering, and clear labeling, the app would address the current challenges of navigating the website. Moreover, it would allow students to specify their unique dietary needs, ensuring tailored meal recommendations that are mapped to physical space. By incorporating visual aids and real-time updates, the app would further empower students to make informed choices, significantly improving their dining experience. Overall, a dedicated mobile app holds the potential to revolutionize the dining experience for students with dietary restrictions, making it more convenient, personalized, and enjoyable.

To develop such an application, three design principles are at the center of the process. **Efficient solution**: planning the meal ahead of time and having a navigation recommendation available allow users to actualize their tasks with more certainty and less time. **Discoverability**: users will have enhanced filtering and labeling capabilities that will allow them to explore the

menu in a more comprehensive manner. **Mapping**: the online menu choices are directly mapped to the physical space of the restaurant.

Research

To the best of our knowledge, there is no paper that tackles the same or an analogous problem to the one we are trying to solve. However, aspects of it can be found in different papers. Therefore, the focus of this analysis will be twofold: understanding how different papers frame and tackle problems related to food consumption in the context of mobile solutions and what are the common solutions and challenges to navigation in indoor spaces.

Our goal is to integrate insights and findings from those papers to compose a well grounded solution.

Food Literacy while Shopping: Motivating Informed Food Purchasing Behaviour with a Situated Gameful App

This was a paper accepted at CHI 2020 that proposes a gamified mobile application to support food literacy while shopping. The main goal of the paper is to support holistic eating patterns that not only focus on calorie intake, but considers what constitutes sustainable healthy eating patterns.

As the work points out, unhealthy eating patterns are commonly fed by low food literacy, which means that the lack of knowledge has direct impacts on dietary choices. The assumption that the paper is built on is that information can empower users to make informed food choices.

Gamification was the means used by the authors to deliver the information. By gamifying the whole grocery shopping experience, users were able to receive constant feedback about their progress towards proposed goals. Also the users could scan products' bar codes to have immediate access to nutritional information and support to interpret their values. Moreover, the application was organized to reflect the typical isles of a typical market and as the users navigate them, information about the types of food found there are shown.

The authors compared their solution (PBGA) with an application by Public Health Canada (MFG) in a three-week field study involving 24 participants, where they were randomly assigned to either of the applications. By comparison their solution managed to encourage more variety and balance when selecting foods in stores and helped users moderate their intake of ultra-processed food.

A number of takeaways from this paper will be integrated into our project. First of all the MFG application is more successful than PBGA with regards to the pre-planning stages of grocery shopping. Even though our solution does not involve grocery shopping, the importance of planning can be extrapolated to the decision making process that takes place at food halls. Therefore, to combine the best characteristics of PBGA and MFG and better encourage variety

and balance, we want to support informed decision making before (MFG) and during (PBGA) the “shopping” process.

A second crucial aspect of this paper is their use of a top-down view of a common supermarket layout to support user navigation. The successful use of a top-down approach encourages us to simplify the use of navigation tools, leveraging the simplicity of our selected dining space, while still delivering an effective navigation.

Additionally, the authors highlight how dietary requirements are highly personal and can greatly vary from person to person. With that in mind their application offers personalized dietary planning according to one’s nutritional needs. It seems evident that a solution of similar nature should be offered in our solution, where users can account for multiple dietary restrictions and combine preferences in their planning process.

Finally, it is made clear that by exposing users to adequate food recommendations through time, can increase food literacy and cause lifelong impacts. That being said, educating the user by providing detailed information about dishes seems to be an important aspect of our solution.

Navigation Based Application with Augmented Reality and Accessibility

This paper was presented at CHI 2020 and it tackles the problem of supporting indoor accessibility through adaptive applications for navigation. That is accomplished by using augmented reality (AR) paired with interactive visual elements and auditive instructions.

The authors use an AR Cloud to create a digital twin of the physical environment, so there can be a mapping between the users’ position in the real world to the digital one. With that it is possible to provide real-time instructions to guide the users based on their motion and position. The instructions are given visually but also made accessible to blind people through auditive instructions and haptic feedback.

Users can use their voices to ask for directions to a specific place inside the building without having to physically interact with the cellphone. Through a A* pathfinding algorithm the application is capable of directing the user step by step through AR elements.

Even though our solution does not fit a augmented reality approach given an easy task overloading risk for our users, this paper sheds light on the strong potential for navigation using mobile devices. A multi-modal interface, like the one presented in the paper (with audio and haptic feedback) seems to fit our needs to unburden users that will be concerned with grabbing and transporting foods and plates without needing to physically interact with the smartphone. The application could automatically detect when the user visited a station and give audible feedback to the user, for example.

In more practical terms, pathfinding algorithms like the A* employed in the paper can be used in our approach to calculate most efficient routes given the meal planning made by the user. This

solution fits our needs accordingly, since the selected dining space has a simple and relatively small layout.

Developing a Conversational Recommendation System for Navigating Limited Options

This work presents a guided multi-modal Conversational Recommendation System (CRS) and evaluates its performance using a constrained restaurant search application. The system's main feature is the ability to understand and respond to user preferences expressed in open-ended natural language critiques. The study involves a small-scale user study with highly engaged participants to assess the system's behavior during realistic user search journeys.

Conversational recommendation systems are ideal for finding the right restaurant within walking distance due to their ability to engage users in natural language conversations, allowing for the nuanced expression of preferences and context-specific requirements. These systems adapt to evolving user criteria, actively seek feedback, and provide justifications for their recommendations, which enhances user confidence in the suggested choices. Furthermore, they can consider real-time location data, making them well-suited for recommending nearby dining options, thus offering a user-friendly and context-aware solution to the complex task of restaurant selection.

This paper offers valuable insights for designing a mobile app aimed at efficiently navigating food halls based on dietary restrictions. Key takeaways include the implementation of conversational interfaces to engage users in natural language interactions, the inference of user preferences from text inputs to understand dietary restrictions, and the incorporation of scenario-based recommendations for various dining situations. Real-time location data can be integrated for proximity-based suggestions, and adaptive conversational strategies should adapt to changing user preferences. Providing visual information alongside text-based recommendations, ensuring privacy and ethical data handling, and regularly seeking explicit user feedback are crucial aspects of app design informed by this study.

Proposed Initial Interface Design

In developing our mobile app, we aim to provide users with a comprehensive tool for navigating food halls while considering their dietary restrictions. The app will prioritize user-centric design principles. Interactive nutritional labels will enable users to access detailed information easily.

To provide personalized food recommendations based on dietary preferences, we will use User Profiles that allow users to create detailed profiles where they can input their dietary restrictions, preferences and allergies, including options for common dietary restrictions such as gluten-free, vegan, vegetarian, lactose-intolerant, or specific medical conditions like diabetes or celiac disease. Additionally, we will incorporate Meal Planning that allows users to plan their meals for the day within the app.

Client interviews provided some great insights that are as follows:

- **Mobile App Features:** Participants barely or not at all use the online menu available for the UIC dining hall. **Enforces the need for a better way to navigate menus in dining spaces like the UIC dining hall.** Some participants suggested that a mobile app could be beneficial for navigating the dining hall more efficiently. They proposed features like saving favorite items for future reference and checking food availability on different days.The interviewees also mentioned some useful tips for the application such as saving a preferable food option in the application and getting a notification automatically if it is available on any other day they go to the dining hall.
- **Dietary Information**: Users rely on information about ingredients and dietary restrictions when choosing their meals. Many participants mentioned there is no proper labeling or tags to check for dietary-restricted food. Oftentimes, even if the tags are available, they are difficult to locate. Often, the people at the food stations are unaware of the ingredients when being asked. This highlighted the importance of having a well-structured menu or clear food labels to help them locate suitable options quickly.. **Thus, a requirement arises for interaction between human and computer to properly navigate dietary restrictions.**
- **Navigation Support:** People going there for the first time struggle the most, navigating the dining hall and finding food. This is a major concern, as many people get discouraged by the overwhelming amount of food options and find it difficult to navigate through it. **There should be an easier way to navigate the dining hall for both regular people and those who do not go there as often.**
- **Allergen Awareness:** Some students expressed concerns unsure about the cross-contamination of food at the dining hall and about the ingredients list for each item. These information are not as transparent or are not easier to locate, which makes students unsure if they should try a food item or not. **The interface takes into consideration these factors.**
- **Calorie Information:** The calorie count is also not properly locatable, which is one of the few important concerns of the students. **The interface makes it easier for students to find this.**

The **Efficient Food Hall Navigator** is an Android mobile application designed to assist users in efficiently navigating food halls based on their specific dietary restrictions. Developed using Java within the Android Studio IDE, this app focuses on providing personalized recommendations and detailed information about food vendors. It employs SQLite for local data storage, managing user preferences, dietary restrictions, and favorite vendors. While a backend server is optional, technologies like Node.js with Express or Django could be integrated for advanced functionalities. The app's user interface is meticulously designed using Figma, ensuring an intuitive and seamless experience for inputting dietary preferences. Integration with the Google Maps API facilitates precise mapping and navigation services. Additionally, Firebase Authentication ensures secure user access, while optional push notifications can offer updates and personalized offers. This comprehensive technical approach aims to create a robust and user-friendly solution for efficient food hall navigation.

Initial sketches

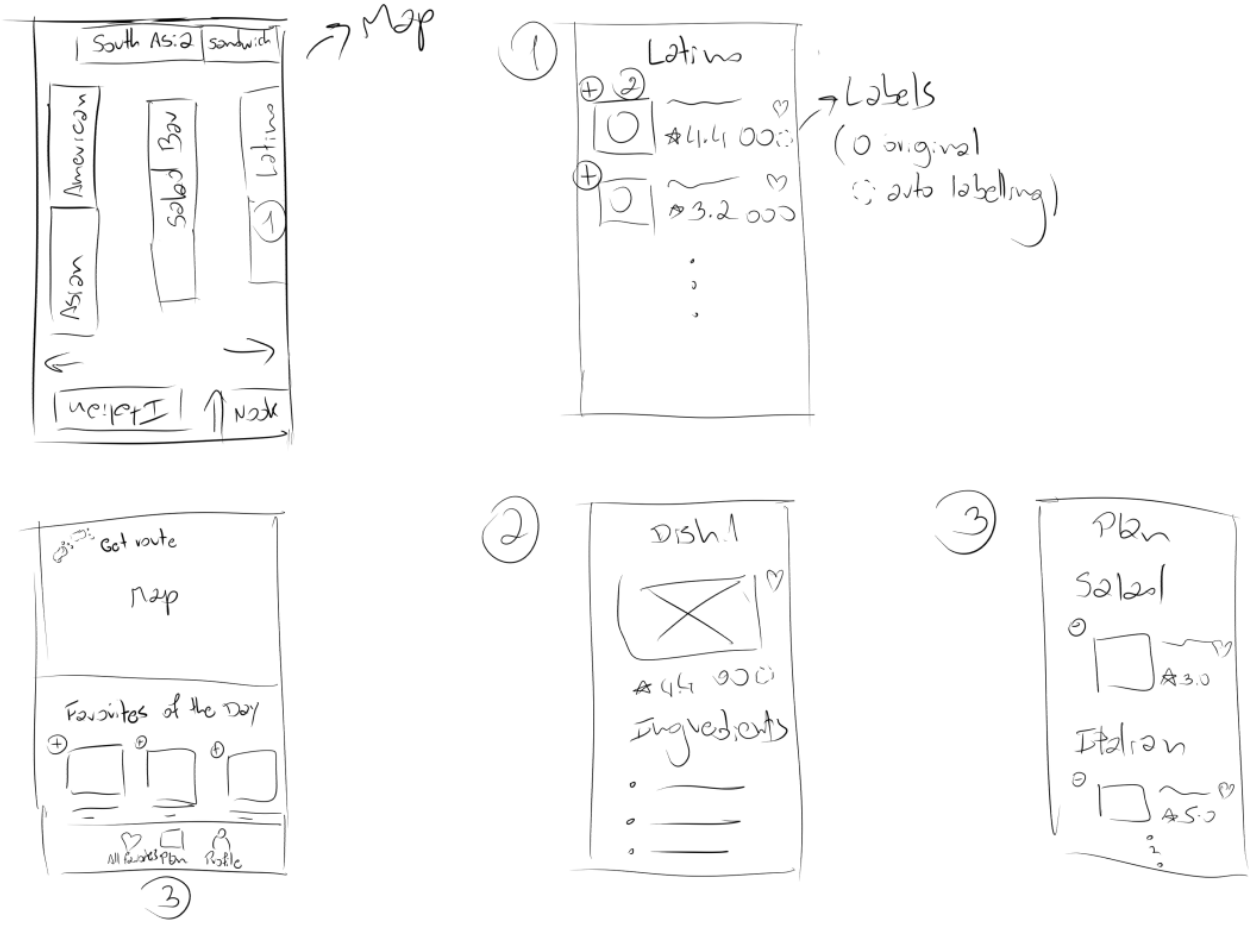

Figure 1. Brainstorm sketches

Figure 1 contains the initial sketches of the main screens and functionalities of our application. It is important to highlight that the sketches were created during a brainstorming session and are meant to represent the final state of the interface. The ideas were further refined to create a more polished version using Figma.

Final Sketches

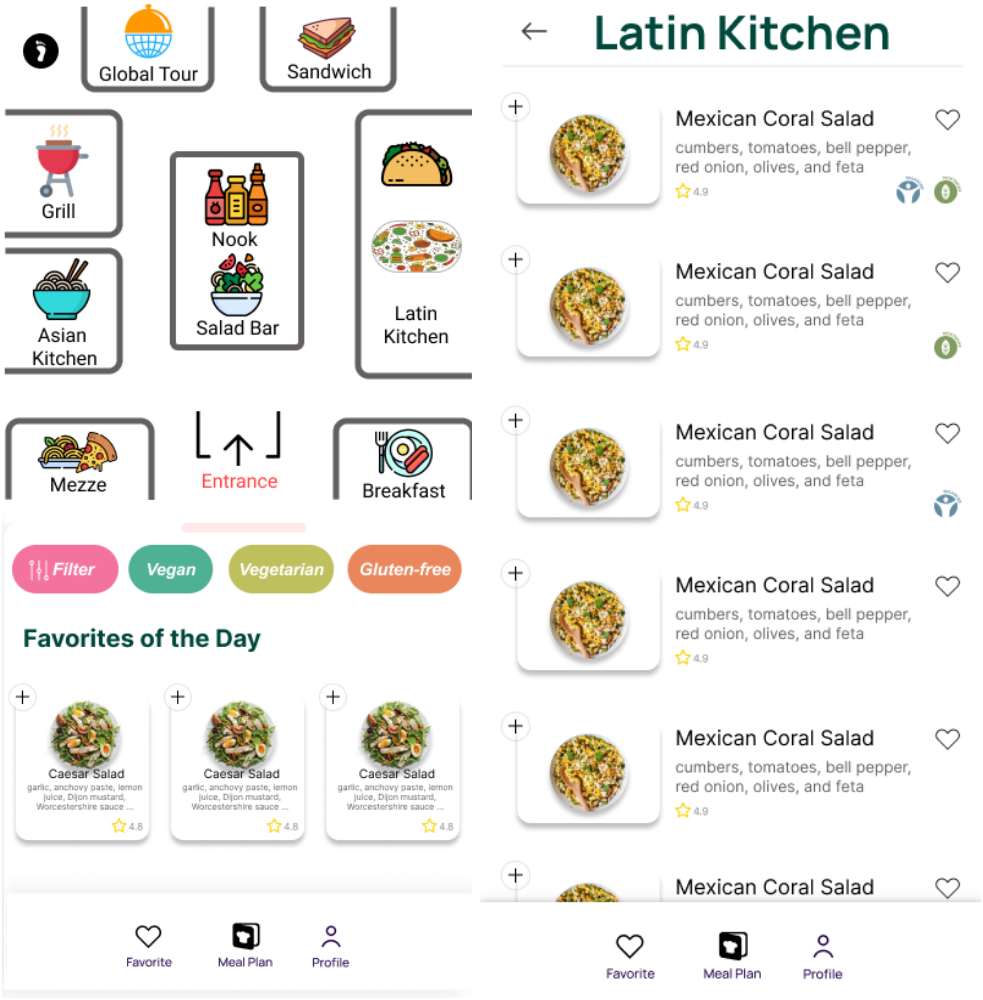

Figure 2. Home screen and Latin Kitchen menu

Figure 2 illustrates the home screen and the Latin Kitchen menu. The home screen contains the map of the dinning hall, where each isle can be clicked to show more details. On the bottom the user can specify predefined dietary restrictions or tailor custom filters according to specific needs, so the whole system is updated to hide non-desired options (increasing safety).

Having all the food options displayed on a map increases discoverability, since there is no need to explore different menus. As a collateral effect each dish is automatically mapped to a position in space.

On the Latin Kitchen menu it is possible to see the dishes available on that day and quickly add them to the meal plan. To illustrate each dish has a picture (automatically downloaded from the internet) to help the user map the dish to the real world. Next to the dish there are extra labels provided by the dinning or derived by the system using the ingredients.

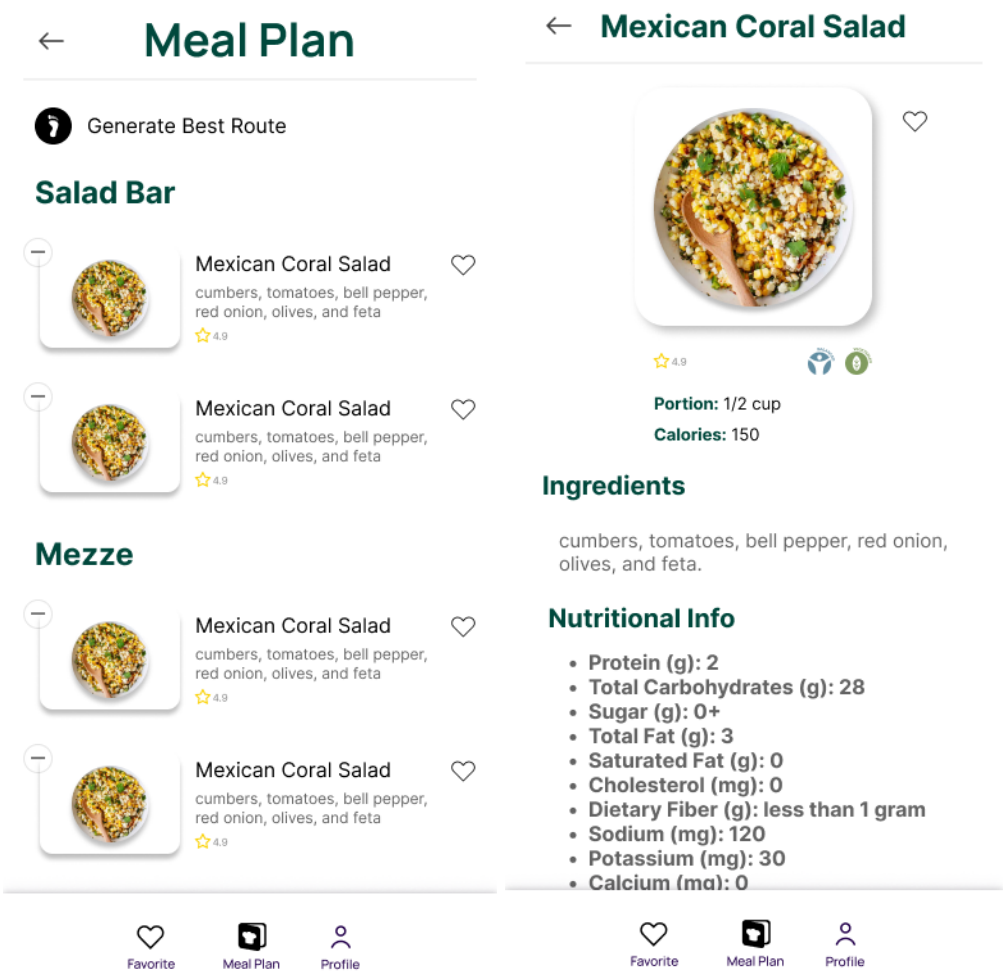

Figure 3. Meal Plan screen and closer look at dish

Figure 3 illustrates the meal plan developed by the user including dishes from different isles. Based on the isles included on the meal plan, the user can click on “Generate Best Route” and get the most efficient order to visit the stations. Finally, by clicking on a specific dish the user can go to a different screen that includes a more detailed description of ingredients and nutritional information.

The idea is that all planning activities should be done before entering the dinning hall and the only functionalities used inside the restaurant should be the meal plan with the choices and the pre-generated best route, supporting ease of use and comfort.

Student Name: _Gustavo Moreira
Contribution:
Reading and writing about the first two papers for the research section. Partially designing figma sketches. Brainstorming solutions and paper sketching. Writing about sketches and explaining HCI principles behind them. Creating questions for interviews. Recruiting participants and conducting interviews.

Student Name: _Kazi Omar____
Contribution:
Wrote the “proposed initial interface design” section. Created the map layout on figma. Recruited and interviewed participants. Helped brainstorming sketches. Evaluated results of the interviews.

Student Name: _Shanghao Li___
Contribution:
Interview questions. One research paper. Initial design: home page. How research and interview impact our study. Technical solution.

Student Name: _Farah Kamleh__
Contribution:
Evaluated the data collected from the target user interviews in order to understand what they do in the dining hall (locate food with their dietary restrictions in mind), how they go about navigating the menu and space, and why they use the method that they do. In terms of the report, described the problem, target users, participant demographics, questions asked, and participant pain points. Lastly, described the current interface and the problems identified by the participants.