CMSC 20370 GP4

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Project Description

Our project focuses on students with dietary restrictions and allergies at the University of Chicago. Currently, it can be difficult or unreliable to figure out how to comply with dietary restrictions when eating in the dining hall. Menu information is currently available online, as well as on tablets in the dining halls, but not in easily searchable formats. Our project aims to help students at UChicago who are eating in the dining halls to better discover which foods they can and cannot eat at a given meal. Our system supports a wide array of dietary restrictions and all allergies, allowing students with these restrictions to find food they can eat. Non-exhaustive examples of students in this user group includes students following a vegetarian, vegan, or pescatarian diet, and students who cannot eat gluten or are allergic to other specific foods such as peanuts. Our solution provides students with easily-accessible information about meals in the dining hall, empowering them to have more knowledge and peace of mind about what they eat.

Requirements Summary

- Support for dietary restrictions/allergies: Our system needs to support a broad range of dietary restrictions, as well as any allergens, not just a limited list of the most common allergies. Users should be able to personalize our system so that workarounds are not necessary.
- Accuracy of food suggestions: In order to accommodate particularly severe allergies as well as strict dietary restrictions, and to ensure user trust, foods marked as appropriate for a user must fit in with their specified dietary restrictions, and any uncertainties or potential for cross-contamination be clearly expressed.
- Efficient and simple: Our system must be usable and practical for students on the go; identifying compatible foods should require minimal effort and time by users.
- Sides in dining hall: Our system should distinguish between the different dishes offered at a given station. Currently sides are grouped with their entree in the Bon Appetit filters, making it harder to find sides that conform with dietary restrictions even if the entree does not.
- Filtering: Our system should make it straightforward to filter by the dietary restriction or allergen, and readily surface the foods that can be eaten without having to manually read through all menu items.
- Enjoyable: Our system should provide a satisfying user experience that users wish to come back to and actually enjoy using.
- Accessible: Our system should meet a basic level of accessibility, and in particular should not require a high level of technical literacy.

Evaluation techniques

We conducted 7 in-person interviews with target users recruited from our initial target user research survey. 3 target users evaluated our medium fidelity prototype, and 4 target users evaluated our high fidelity prototype. 4 peers also evaluated our medium fidelity prototype during the in-class session, however we prioritized feedback from our target users when considering design changes.

During the interviews, we had users interact with the app and we asked them to narrate the experience. We asked them to complete a series of tasks which included setting up a profile, editing a profile, and researching a meal. When relevant, we asked follow-up questions to clarify the nuances of a dietary restriction, a habit, or an interaction with the app.

We chose to conduct user research in this way so that our target users could give better feedback based on the actual experience of using the app, and so that we could see firsthand how someone would use the app and any pitfalls they might run into.

The strongest trends in the data were target users' desire of feedback to build trust that the system was taking their restrictions into account, and target users' desire to be able to see full ingredients lists in order to confirm that trust. Providing ingredients lists also conforms with target users' habits, as many currently look at full ingredients lists before consuming a dish.

	Medium-Fidelity Prototype Testers							**High-Fidelity Prototype Testers**			
	Target Users			**Classmates**				**Target Users**			
	P3	P9	P13	P15	P16	P17	P18	P14	P10	P11	P8
Info fatigue concerns					X	X	X				
Wanted ingredients list	X	X	X	X				X	X	X	X
Signifiers confusion	X	X	X	X	X	X	X				
Wants recommendation system				X		X		X			
Liked the UI's simplicity					X		X				
Importance of trust feedback	X	X	X					X	X	X	X
Would use system	X	X	X	n/a	n/a	n/a	n/a	X	X	X	X
Preferred filtration to QR	X	X	X	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 1: Data coding of user interview results.

Future evaluations

If we had more time, we would have like to do a field deployment of the app. We would have recruited target users and tracked their dining hall experience on days in which they used our app and on days that they didn't. On days they didn't use the app, users would log the amount of time they spent on Bon Appetit's site, and we would ask them to self-report the amount of time they spent choosing food (time spent between walking in the dining hall and sitting down with a plate of food). On days with our app, we would gather data on time spent on the app and ask for similar self-reporting of time spent selecting food in the dining hall. Then, we would compare the time spent to see the effectiveness of our app. This field deployment would also allow us to learn more about when users use our app (is it before a meal? during a meal? the day before a meal?), which would help inform future iterations of the app. We would also ask users to log their success at finding meals on each day, and fill out a survey on the accuracy of the app with respect to adhering to their restrictions and matching the food actually being served over time.

Medium Fidelity Prototype Revisions

Personalization

Our target users had a history of lacking trust in the Bon Appetit system, and we found that users wanted high amounts of feedback from our system to confirm that the system was taking into account their dietary restrictions when categorizing dishes. Based on suggestions from target users, we added a personalized message to the app's home page which states the user's name and which lists their dietary restrictions. This feedback will also give users a chance to review their inputted restrictions, serving as a back-up chance for users to realize mistakes or overlooked restrictions in their profile.

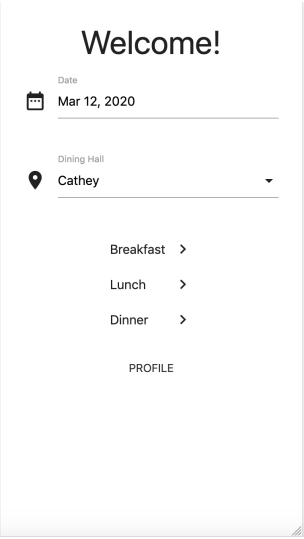

Figure 1: The medium fidelity prototype, which lacked a personalized home page.

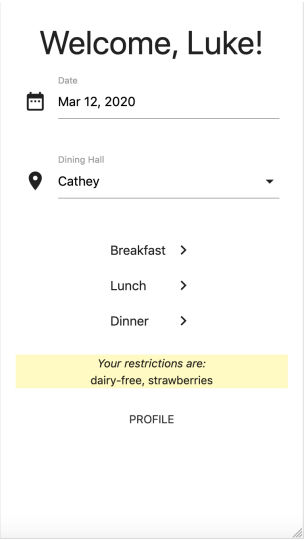

Figure 2: The high fidelity prototype, which includes a user's name and their restrictions.

Filtration-based system

In our previous design phase, we tested a QR-based system and a web-filtration system with our target users. Users overwhelmingly expressed that, while the QR system would be helpful, the web-based filtration system would be much more helpful for them to use, as many of our target users have to plan their meals before going to the dining hall. The filtration system gives users the flexibility to research a meal either beforehand or on the fly, which allows us to accomodate the diverse ways that our target users aproach dining hall meals: some prefer to plan ahead, some prefer to figure out what to eat once they've arrived in the dining hall. One feature of the QR-code system that our final design keeps is the idea of organizing dishes by station, which is how the dining hall itself is laid out, allowing users to find desired foods efficiently.

Fig. 4 shows an early prototype of the QR scanner system, while Fig. 3 shows the welcome page of the final prototype that allows users to see all dining halls at once, rather than necessitating them to physically be at a station to get information like in the QR code design. As P3, who always plans their meals ahead of time, said, "the QR code is not accessible all the time," which would limit the usefulness of the app for them as it would clash with their preferred manner of navigating the dining hall.

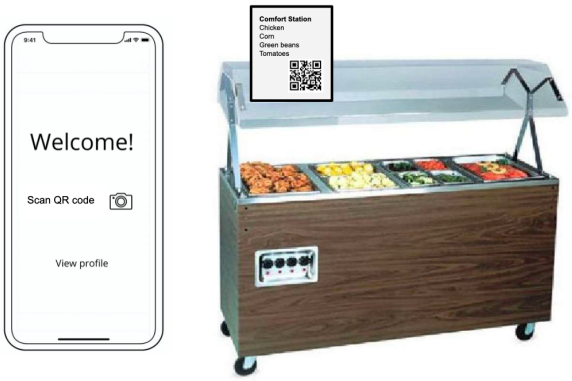

Figure 3: QR code station scanner design, which we abandoned after target users said that a filtration system would be more convenient.

Language of Compatibility

Several participants– both in class peer evaluations and our first phase of target user evaluators–expressed concerns about the word "compatible" when categorizing food items. To circumvent this confusion, we chose to eliminate this wording and to use only colors and symbols, encouraging users to engage with the app. All of our high fidelity user interviewees expressed that the meaning of the coloring was immediately clear to them after they looked into one dish in detail; it took about 15 seconds for them to teach themselves what the colors meant and then it was clear from there on out. Our rationale is that we wanted to prioritize information about the ingredients of a dish, but to minimize distracting information such as confusing labels that clutter the UI, per feedback from our peers and Professor Chetty during the in-class testing. Furthermore, the ambiguity of highlighting stations as yellow with a caution symbol if that station includes some but not all dishes that violate restriction(s), allows us to support two types of users: users with severe allergies for whom cross-contamination is a concern, as well as users who are in a rush and who don't want to have to cherry-pick dishes from different stations.

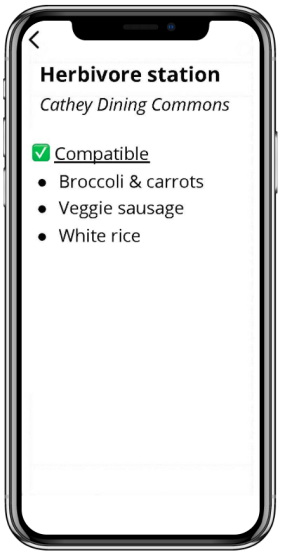

Figure 4: Medium fidelity prototype which used the term "compatible." Users found this language confusing.

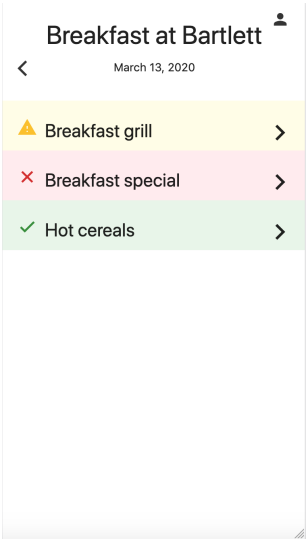

Figure 5: High fidelity prototype, which uses colors only rather than jargon as a signifier.

Highlighting violating ingredients

Fig. 8 demonstrates how the final prototype highlights ingredients that violate a user's restrictions. P10 remarked that "I like that I don't have to read through the ingredients; the app does that for me" when it highlights them. This strikes a balance between making ingredient lists visible to build user trust, and reducing the amount of information users have to scan through - their restrictions are brought to the forefront of their attention, and they can then choose whether to scrutinize the non-highlighted ingredients.

High Fidelity Prototype Revisions

Implemented design changes

Profile-editing ease

P11 and P13, who both keep kosher, expressed a desire for easier access to updating profile information. These users explained that there are different levels of adhering to a kosher diet, and that while they do not eat pork or shellfish, they alternate between following other kosher restrictions. Therefore, we added in an edit profile button to all pages when users are navigating through the app.

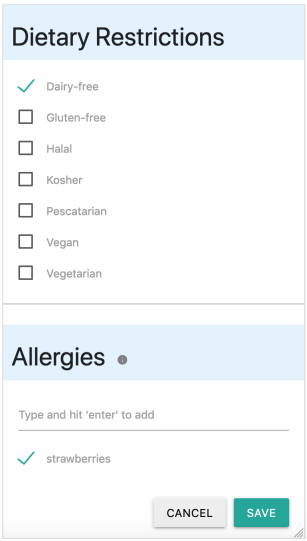

Figure 6: Profile-editing page of the high fidelity prototype, which includes the "edit user" option in the top right corner of menus (see Fig. 5) so that users can edit profile information from anywhere in the app.

Ingredients expansion

In our initial final prototype, we had designed a feature where, when users click on a dish, they can see a list of ingredients that violate their restrictions. If they wanted to, users could expand a box below the list of violations to see a full ingredients list. Users unanimously said that they would prefer to have the box already expanded, so we implemented this change.

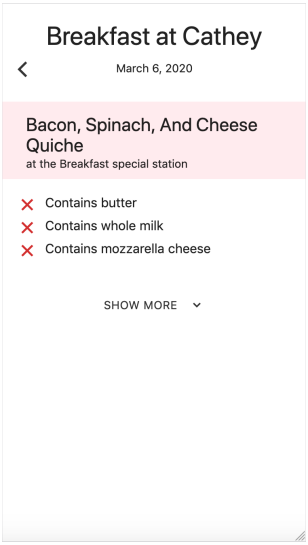

Figure 7: Original design of the high fidelity prototype, in which users had to click "show more" to see the full ingredients list after clicking on a dish. Users found this tedious and unnecessary.

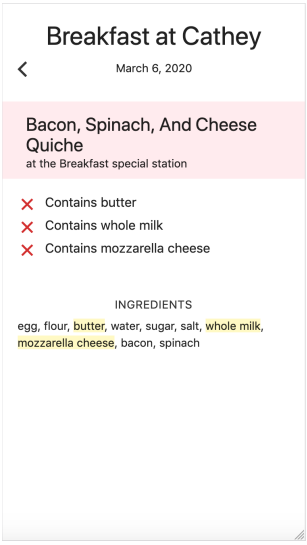

Figure 8: Redesigned high fidelity prototype, which automatically shows the ingredients list.

Un-implemented features

Recommendation page

Several participants expressed a preference for a page on the app that would recommend to them the best dining hall to eat at for each meal. We did not prioritize implementing this feature, as we found that the average meal consists of over 80% identical dishes across the 3 on-campus dining halls. However, a future version of the app would allow users to favorite dishes and to see a recommendation page that lists dining halls serving those dishes for a given meal.

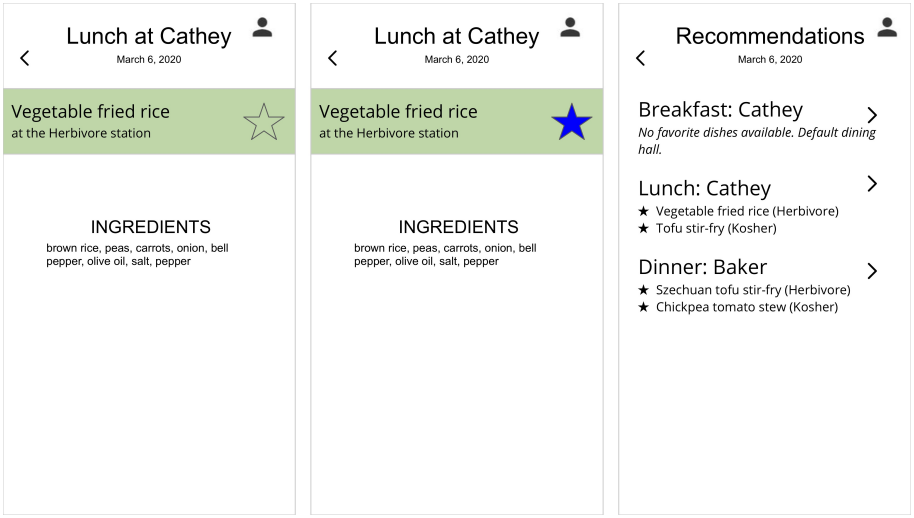

Figure 9: Updated dish page with a star icon to mark as a favorite. Recommendations page for the day based on favorite dishes, or default dining hall.

Web scraping

Currently, our high-fidelity prototype uses a Wizard of Oz method; we made JSON files of dining hall data for several days in March using manual scraping, and then put those files into the app's database. With more time, we would have implemented a backend web scraper that would have allowed us to scrape ingredient lists without our intervention.

Researched information

Some ingredients listed by Bon Appetit are incomplete: for example, a few weeks ago, "pie crust," without a further breakdown of ingredients, was listed as an ingredient for peach pie. In a production-ready version of our app, we would meet with dining staff and go over incomplete ingredients such as these. We would also research ingredients so that our app can provide information about whether ingredients were produced in a factory with danger of cross-contamination, which was a suggestion by P14, who has a severe peanut allergy.

Advanced identification

Ingredients for plant-based items often use the name of the ingredient that they are imitating in quotes. For example, a vegan butter substitute might be listed as *plant-based "butter."* Currently our application uses a keyword search to filter based on restrictions. Usage of words like butter, meat, or cheese with quotes is currently a loop-hole in our algorithm; our application will mark these ingredients as foods that violate vegan and vegetarian restrictions even if they are not. Target users overwhelmingly confirmed that they would rather receive a false negative from the system than a false positive from the system for safety reasons, which is why this bug was lower priority for us. Nevertheless, a future iteration of this app would fix this bug.

Conclusion

The field of dietary restrictions is a complex space in which accuracy, trust, and feedback are very important for users who are used to scrutinizing untrusted systems for their health and safety. We hope that our app will lend peace of mind, efficiency, and confidence to users for whom navigating the dining hall is usually a stressful experience.