Part 2: Food Waste in the Foodservice Industry

Team Eco-Eaters

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Project Description

Our problem space involves the issue of food waste in restaurants stemming from the customers, employees, and owners. Through the research we conducted for Part 1, we discovered that our users encompass a wide range of demographics. For example, the average age of a restaurant employee can range anywhere from 20-30 years old to 40+ (Zippia, 2021) and the age range of a customer can vary as well. This implies that we must be cognizant of the differences in technological understanding between our users. An older adult may have difficulty understanding a digital interface while a millennial would not have these issues. Keeping this in mind, we must design interfaces that are simplistic and intuitive. While the employees and managers could be trained in how to use the prototypes, the customers would not have this benefit. Therefore the prototypes targeted towards the customer need to be easily understandable. Our qualitative and quantitative research demonstrates that the main ways that food is wasted in restaurants is through customers wasting food and inventory inconsistencies. By addressing these problems we can both help the restaurants save money and achieve more environmentally sustainable habits. We plan on solving these issues through prototype models that can inform our users to do their best to help mitigate food waste, incentivize users through rewards programs, and provide them with a seamless process of taking inventory. These prototypes will help provide a solution that makes reducing food waste simple, cost-effective, and enjoyable.

Requirements Summary

Through the research that we conducted in part 1, we further refined our problem space and determined our usability goals. The requirements that our group chose to fulfill the expected goals and values of the service are meant to make sure that the solution that we discover is one that is ideal.

Functional

Our functional goals are to inform the users on how to manage food waste and to incentivize users to participate in food waste reduction measures. The major issues we determined from P1 include customer's lack of knowledge pertaining to food waste, customer's lack of incentive to mitigate food waste, and employee side misuse of ingredients. In our prototypes, we attempt to find solutions to each of these issues. By isolating sections of the problem space to a single solution each, we are able to discover more specific and applicable solutions.

Non-Functional

The non-functional requirements of our solutions are the usability goals that we had outlined in part 1. These goals were accessibility, speed, flexibility, transparency, and cost-effectiveness.

- Accessibility related to the ease with which users could access and use the implemented solution. Users would want to experience virtually no issues transferring over to our new method for the smoothest possible transition.
- Speed relates to the efficiency of the solution and how quickly the users can utilize the solution. We want the users to be able to use our solutions quickly so that they can be as efficient as possible with their time.
- Flexibility would be the way that any of our potential solutions would be able to respond to change. The solutions would need to be able to quickly adapt to any changes to a menu or inventory in a way that would not bother users.
- Transparency is the ability for users to see what the system is doing at all times and how it is beneficial. In our case, the solutions would need to be transparent so that both customers and employees would understand all the facets of the solutions.
- Cost-effectiveness is directly related to how expensive our solutions would be. Since it would be unlikely for restaurants to be able to utilize our solutions if they were exorbitantly expensive, our goal is to make them as cheap as possible so that we can emphasize the idea of our solutions helping to save money in the long run.

Design Space

Difficulty of Realization

From the mentioned requirements in the previous section, we thought that *accessibility* and *flexibility* would be the most difficult to realize. Although most of our solutions seem like they are pretty simple to implement, they rely on the fact that the restaurant owners have access to digital devices such as a printer, phone, or a tablet. Therefore, our solutions would exclude the population of users who do not have steady access to those devices, making it so that some of our prototypes would be harder to access for some of those users. Rather, our solutions focus more on the function requirement of *informing* the users on how to manage food waste and to provide easy alternatives and solutions to reduce food waste since the main source of food waste came from customers' lack of information, miscommunication, and food mishandling.

Design Alternatives

Going off of our implications discussed in P1, our group members each developed a couple of "How might we…" statements (Appendix 1) to find possible solutions to the problem of reducing food waste in the food industry. After developing a handful of those statements, we each shared our own ideas of possible solutions and picked out the best prototype ideas that could be a good solution to our problem space; some of the ideas included a to-go box dispenser, dine-in ordering mobile app, smart storage, and an employee guidelines flyer (Appendix 3 & 4). After having a full discussion on possible candidates and listing out pros and cons of those prototype ideas, our group decided that the most important solutions were an infographic flyer about food waste and food waste prevention measures on a napkin holder, an inventory tracking software that allows users to record inventory information by hand and then later transfer that information into a digital space, and a checklist menu designed to focus on customer-server-kitchen communication in order to minimize order error. However, after creating the rationale, user scenario, and a sketch of the checklist menu prototype, we realized that the

prototype might raise questions about the customer experience in a restaurant setting as well as the effectiveness of the menu prototype in actually decreasing the miscommunication with different stakeholders. Therefore, we decided to come up with a more interesting idea than the checklist menu prototype and replaced it with a new reward card prototype targeted towards restaurant dine-in customers where they can earn a sticker for a clean plate and reward them after a certain number of accumulated stickers.

      For our first prototype, we thought that the napkin holder infographic solution would be useful in food waste prevention occurring from the leftovers, because it raises food waste awareness and incentivizes the customers with a small reward for reading the infographic. For our second prototype, we thought that the inventory tracking software might be useful in preventing a large portion of food wastage that occurs in the ingredient inventory taking process since a lot of food wastage comes from the spoilage of ingredients. For our third prototype, the clean plate card, which essentially acts like a punch card, we thought it could be useful in encouraging customers to not waste food by finishing their meal or taking back the leftovers in a to-go box by using a reward system. Our prototypes target decreasing food waste stemming from the customers, employees, and the restaurant owners. They would inform the customers on food waste and increase their awareness as well as prevent food waste happening in the inventory due to ingredient spoilages.

Task Difficulty

Our solutions are designed to support our problem space, which is about the issues of food waste in the food industry stemming from the customers, employees, and owners. They focus on raising awareness around food waste happening in the food industry and encouraging the users to help prevent food waste in restaurants. For instance, the customers are now informed of facts around food waste and its effect on the environment and what they can do to help prevent food waste. Now, the customers can have an easier time being motivated to finish their plates or take the leftovers home. Also, the restaurant owners can have an easier time tracking down inventory with easier quantification of ingredient losses. However, for these tasks that do require user participation and motivation in general, the difficulty of the tasks remain the same in that it's up to the users to act on reducing food waste in the food industry.

Trade Offs

Since we discovered in Part 1 that the majority of food waste in restaurants happens via inventory issues and customers wasting food, we decided that these would be the areas that we focus on for our prototypes. In order to do this, however, we do have some tradeoffs. In terms of the inventory system these tradeoffs are cost, development and training time, and the complexity of the prototype. The inventory system that we designed will require both a website page and a mobile app. The website page is in charge of creating the inventory templates and holding onto the data that is scanned in from the app. The app handles the transfer of that data from handwritten to digital and also sends out a notification if the inventory sheet is unclear. The complexity of the system will mean that the programming costs and time will be somewhat high and then it will also take some time to teach the employees how to use the website and app effectively.

Thankfully, the other two prototypes do not suffer from these issues. The napkin holder infographic and the reward card are both relatively simple prototypes to deploy and would take a short amount of time to implement in any store. However, they do still have some drawbacks. The success of these two prototypes depend almost entirely on the

customer's actions. To help motivate the customers to follow the food waste management plans, we have instituted reward policies with both prototypes. By mentioning a special codeword to the server, you can receive a potential discount or free item. The codeword would be found at the bottom of the call to the action side of the napkin holder. The reward card is a basic reward card that would give you a free item for leaving no food waste behind (finishing your meal or getting a to-go box). The cost here would be that the restaurant would be offering free items as the motivation for the customers. This does slightly increase the costs of the two, otherwise, inexpensive items, but in the long run they have the potential for discouraging food waste and generating more business. The later one implying the concept of door-in-the-face from social psychology. In tandem, the three prototypes target the main problems that lead to food waste in restaurants and also target our three levels of stakeholders.

Prototype 1

Our prototype is an infographic flyer about food waste and food waste prevention measures that will be placed in a napkin holder at restaurant tables. The flyer will include a section at the bottom reading, "Be an Eco-Eater today!. Tell the server for a sweet surprise." In addition, the server will be instructed to invite customers to read the infographic before proceeding with taking their order.

Rationale

This prototype is helpful and useful because it can spread awareness to customers about food waste. According to our research from P1, about 10% of customers leave behind leftovers after their meal at Herban Fix, and up to 30% with the customers at Your Pie. Those numbers may seem small, but in perspective, roughly one billion tons of food go to waste every year according to the UN Environment Programme (UN Environment Programme). With this prototype, customers will be informed of the dangers of food waste and called to immediately act even with something as simple as asking for a to-go

box for their leftovers. In addition to informing customers, this prototype also encourages customers to participate in food waste reduction activities. Customers will be incentivized to read the infographic for a potential reward of a free item or discount in their bill. The placement of the prototype, which would be in a napkin holder on the customers' tables, would also help with the accessibility, transparency, and effectiveness of the prototype. In addition, the prototype is cost-effective enough to easily be implemented by any restaurant.

User Scenario

This user scenario involves both secondary (the server) and tertiary (the customer) stakeholders. This scenario places an emphasis on the role of the tertiary stakeholder in the food waste prevention process.

Josh and his friends just finished their soccer game and are looking for a place to eat. The group is very hungry. They decide to eat at Denny's, a local restaurant chain. Upon arriving, Josh and his friends plan on ordering a mountain of food. After combing over the menu, they are ready to make their order. When the server comes to take their order, they ask the group if they saw the infographic on the napkin holder. Josh and his friends say that they haven't and look it over. After reading it, Josh is astonished with the amount of food waste deriving from restaurants. Josh and his friends decide to be more mindful about the quantity of food they order and thus limit the amount of potential waste they would generate with their visit. If they are still hungry after their meal, they figure that they can just order additional sides.
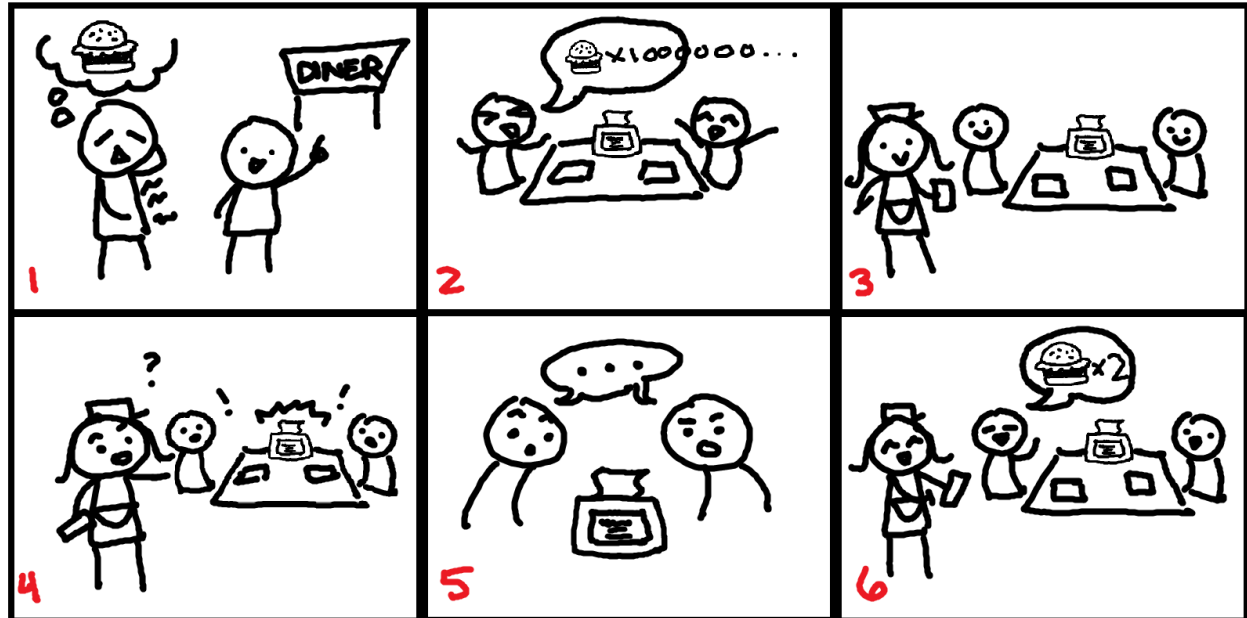
Sketch

i. Napkin Holder front side infographic

ii. Napkin Holder back side infographic

Storyboard

1) Josh and his friend are starving and decide to go to a diner.
2) Josh is excited to eat and expresses that he is going to order a massive amount of food.
3) A server comes by to take Josh and his friend's orders.
4) The server asks them if they have read the infographic on the napkin holder.
5) Josh and his friend take time to read the napkin holder infographic.
6) Josh changes his mind after reading the infographic and decides to order a more reasonable portion.

Evaluation Strategy

The functional requirements of this system is to inform users of food waste reduction policies and encourage them to take action right away. We are able to achieve these requirements by having the server invite customers to look at the napkin holder's infographic and disclose the potential for earning a reward hidden in the infographic. The customers in turn will read the infographic and mention to the server that they would like to be an eco-eater for a potential discount or free item. This can motivate the customer to act and take home their leftover food in a to-go box. We can evaluate the effectiveness of

this prototype by documenting the number of customers that participate in the discount / free item program. From there, we can further evaluate it by determining the amount of those customers who still leave food behind on their plate.

The napkin holders also meet some of our core usability goals that were mentioned previously. The goals it hits are accessibility, transparency, and cost-effectiveness. The information on the napkin holders will be easily accessible to all customers as there should be a napkin holder on every table. It will also be understandable as the facts and diction used on the napkin holders are not highly advanced jargon but rather information digestible by all groups of people. They are also transparent as our call-to-action is clearly printed on the back with what we expect the customers to do in order to help us. The customer is fully informed on what they can do and what steps the employees will take in conjunction with their own efforts. Most importantly, this idea is very cost-effective. Printing out and cutting the infographics out costs about $0.80 per copy at a local Staples. Considering that the average restaurant has about 25-30 napkin holders, the best possible purchase would be to buy about 50 copies of the infographic so that there are extras in case any need to be replaced. For the low price of around 40 dollars, the infographic could have a huge impact on how much money is saved through a reduction in food waste.

Prototype 2

The second prototype involves an inventory tracking software that allows users to record information by hand and then later transfer that information into a digital space. This is done by designing a system that allows for the customer to create a customer inventory tracking template, fill out the template by hand, and upload the template to an app via a photograph. This will consolidate inventory tracking documents into a single digital space. From there, this software will use the input data to analyze trends and make smart suggestions to the user. An example trend that can be found is average seasonal ingredient usage and losses.

Rationale

The results from our field research demonstrated that a large portion of food wastage can occur in the ingredient inventory taking process. For example, at Herban Fix a recurring issue was ordering too much of a certain ingredient which eventually caused spoilage. In addition, Herban Fix did not decide to utilize an inventory tracking program or software due to its complicated nature, they much preferred to utilize a more informal inventory taking process. This issue of complicated programs and software is enhanced by the fact that many of our primary users are generally older in age and have trouble working with technology (P1). Although the restaurants we interviewed did not participate in software based inventory tracking programs, they did see the benefit of them. Software based inventory tracking systems can be time efficient, can help quantify inventory losses, and can help discover trends in restaurant ingredients sales. For instance, a long term benefit of a software-based inventory tracker can be understanding which menu items sell better during which season. This information can help restaurants order a sufficient amount of food. When creating this prototype, we kept its ease of use, flexibility, and cost effectiveness into careful consideration. We designed this prototype to be inclusive to all demographics working within the restaurant industry. In addition, we attempted to keep the process of taking inventory relatively similar to common practices within restaurants already to aid the adoption of our prototype into the field.
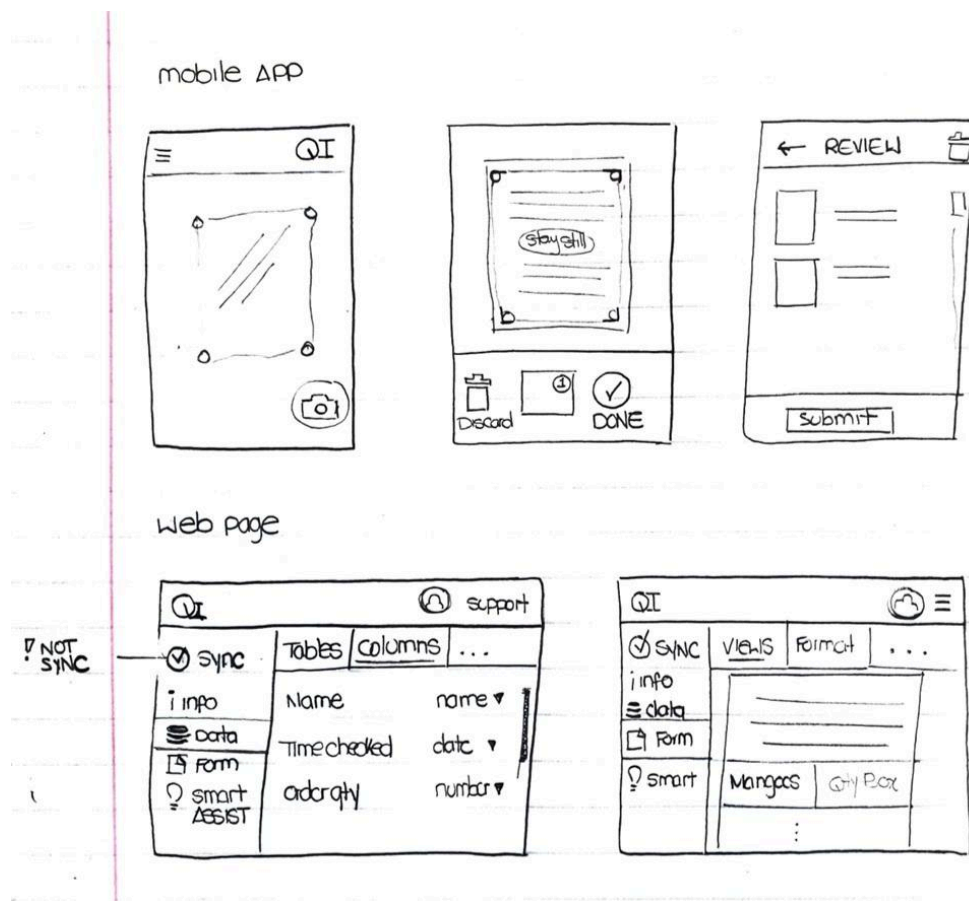
User Scenario

This user scenario focuses on the primary stakeholder. Particularly, the person that works directly with ingredient inventory, and whose actions determine most of the waste on the food preparation side of the restaurant.

Rachel looks at the calendar and sees it is Thursday - "time to prepare for the weekend" she thinks. She goes into her office and googles 'QuickInventory', a mobile and web-based application that allows her to create and store inventory tracking templates and relevant data. She logs in with her credentials and edits her saved 'for weekends'
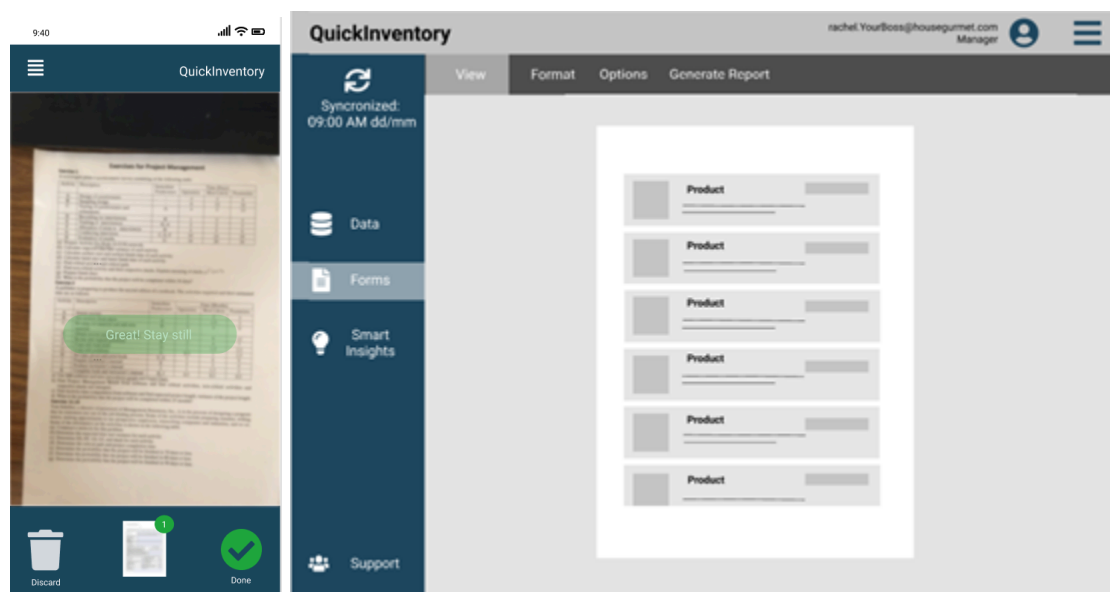
template to document some ingredients they had purchased earlier in the week. She adds a couple new entries on the template for peaches, strawberries and pineapples along with some fields watermarked 'qty per boxes'. Then, she saves these changes and proceeds to print the new template. Rachel goes to the kitchen, and hands Julia the inventory template. Nodding with her head, Julia receives the copy and starts her task on the cold storage. Once Julia is done, she looks over the template for completion and proceeds to launch the QuickInventory app on her phone. She directs her phone's camera as indicated by the app and proceeds to take and upload the picture. Noting no retake photo warning from the app, she takes the physical copy to Rachel's office. As Rachel receives the physical copy, she checks the QuickInventory website and proceeds to revise the updated charts and smart suggestions on the website.
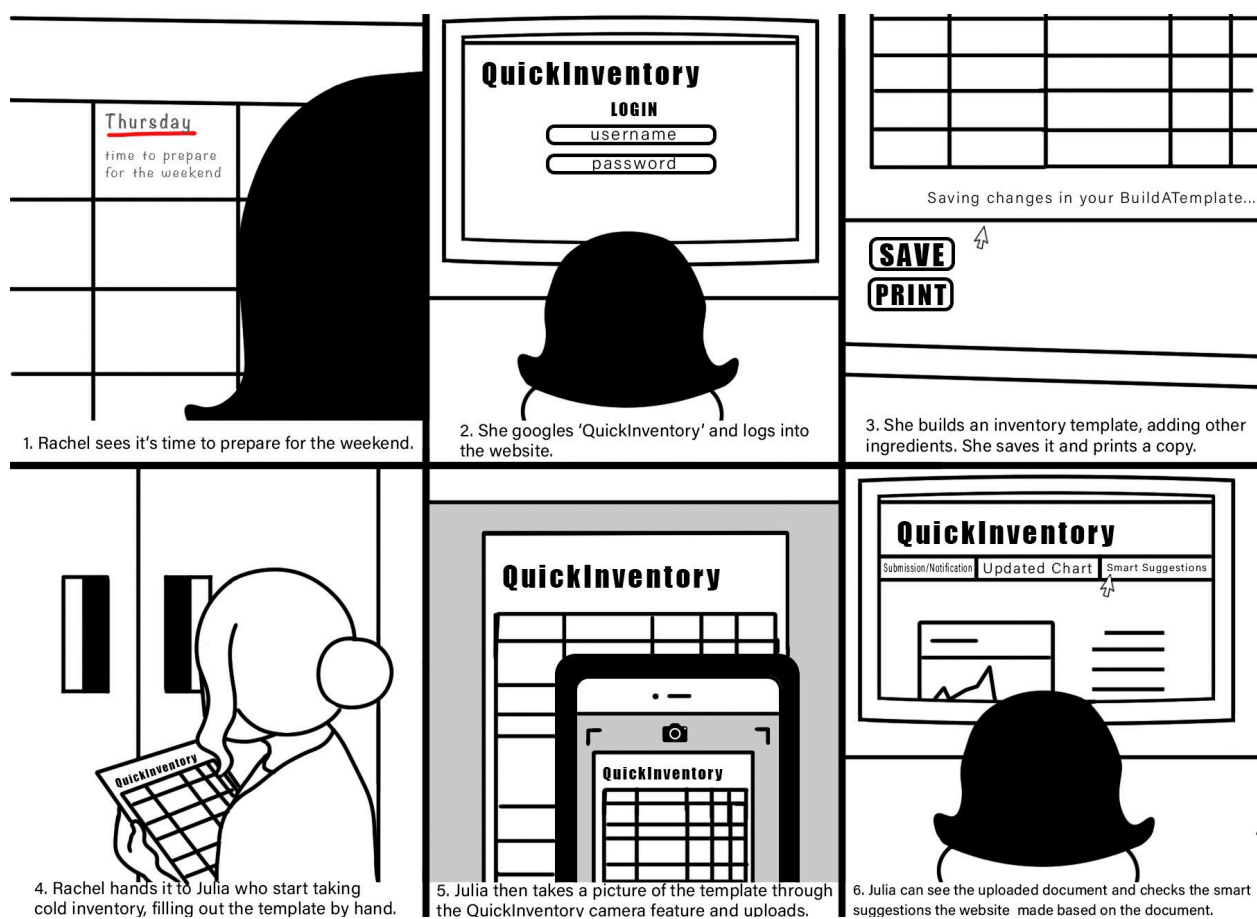
Sketch

i. Initial rough draft

ii. Formalized Sketch for mobile app and website, left and right respectively

Storyboard

1. Rachel sees it's time to prepare for the weekend.

2. She googles 'QuickInventory' and logs into the website.

3. She builds an inventory template, adding other ingredients. She saves it and prints a copy.

4. Rachel hands it to Julia who start taking cold inventory, filling out the template by hand.

5. Julia then takes a picture of the template through the QuickInventory camera feature and uploads.

6. Julia can see the uploaded document and checks the smart suggestions the website made based on the document.

Evaluation Strategy

The functional requirements pertaining to this prototype are to inform and aid primary and secondary users in methods to reduce food waste. We could evaluate the functional requirements of this prototype by keeping track of how many raw ingredients go to waste before use of the inventory software app compared to after using the app. Both trials would take place over a period of 4-8 weeks. The quantity of raw ingredients gone to waste can be measured by weight or by count of each number. A lower quantity of raw food waste after use of the app would indicate that the app is successful in reducing food waste by helping to better manage restaurant inventory. We can also monitor the cash flow statements in the weeks prior to the app being used and after. Since the app is also meant to suggest where purchasing may be necessary, by monitoring whether or not the app's prospective "big sellers" actually generate a larger revenue, then we know that the app is a success.

The usability goals that this prototype follows are flexibility, accessibility, and cost-effectiveness. The app is designed for all types of restaurants in the foodservice industry. It combines traditional methods, paper inventory checklist, with the modernity and convenience of a mobile application, making it flexible and accessible for users of different technological-literacy. Having an inventory software makes the inventory procedure quicker and more accurate, thus making it cost-effective.

Prototype 3

The third and final prototype is a rewards card targeted towards restaurant dine-in customers. Customers would be given a card with a total of 10 slots and can earn points given in the form of stickers. Customers can earn points by leaving the restaurant with a clean plate whether through eating the full meal or taking the leftovers home in a to-go box. Upon filling an entire card, customers are rewarded with a discount coupon or free item that can be used or obtained in the future.

Rationale

According to the survey of restaurant employees conducted in P1, customers not finishing their meals is the primary reason for food waste in the food service industry (64.7%). By providing an incentive to to not waste food, customers will be encouraged to find alternatives to throwing out food, whether it be ordering more reasonable portions or requesting a to-go box. Having a punch card given out dedicated to reducing food waste would also bring food waste as an issue to the attention of customers. Additionally, the rewards card would help customers to develop loyalty to the respective restaurant, encouraging them to come back in order to accumulate points. A rewards card would be easy to keep track of progress and can be easily stored and accessed through a wallet or purse. It is simple and inexpensive for restaurants to implement; the procedure of adding a point to a card can be done at the end of a meal, during payment. The punch card approach could also encourage behavioral change through positive reinforcement, helping people develop a habit of avoiding food waste. Overall, the "Clean Plate Card" equally benefits both the restaurant and consumer by offering a familiar, but new method to combat food waste.

User Scenario

Similar to the first user scenario, this scenario involves both secondary (the server) and tertiary (the customer) stakeholders. Again, this scenario places an emphasis on the role of the tertiary stakeholder in the food waste prevention process. A considerable amount of food waste can be prevented by preventing consumer waste.

Rick just got off of work and is looking for a place to eat. After contemplating his choices he decides to go to Kevin's Fried Chicken, a place that he has never been before. Rick arrives at the restaurant and soon after is taken to his seat. Rick ate a large lunch earlier in the day but still wants to get the full experience of the restaurant. Rick gives the server his order and begins to wait for his meal. At the table across from him, Rick notices the customers have little cards with what resembles stickers on them. Soon after, the

server returns with his food. Rick really enjoys the meal but unfortunately is unable to finish it. There is a small amount of food remaining and Rick decides that it is not worth it to take home. When the server returns with the bill, they ask if Rick would like a to-go box and mentions that their restaurant participates in a program called the "Clean Plate Card." The server explains that customers can earn points by leaving the restaurant with a clean plate. These points can be used for various benefits at the store such as discounted food or free items. A customer can earn points by either taking home the leftovers or finishing the meal at the restaurant. Incentivized by the reward program and delicious food, Rick asks for a to-go box and takes his food home. Rick plans to return to Kevin's Fried Chicken in the future!
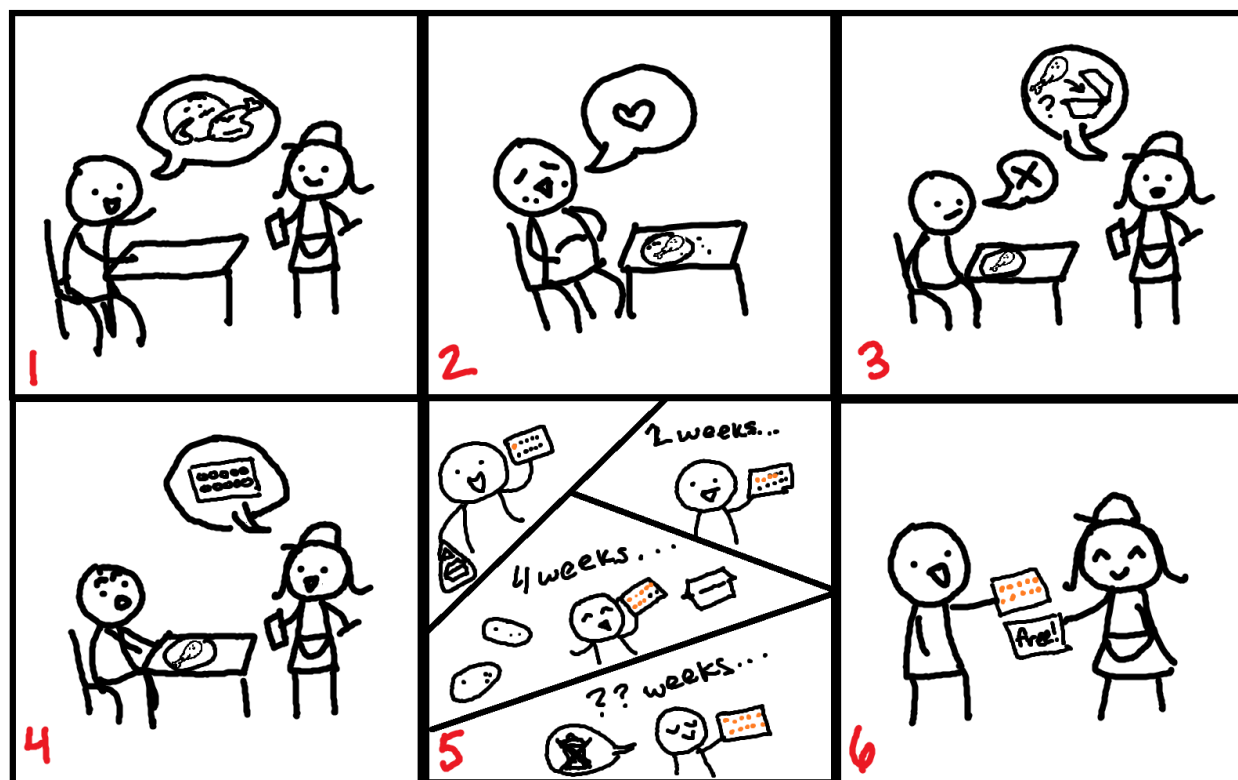
Sketch

i. Formalized front face of rewards card

i. Formalized backface of rewards card

Storyboard

1) Rick orders a whole fried chicken.

2) Rick is full and satisfied, but does not finish his meal. He leaves one chicken leg on his plate.

3) A server comes by asking Rick if he would like a to-go box for his leftovers. Rick declines.

4) The server notifies Rick of the Clean Plate Card and explains that for every finished plate or to-go box he requests, he gets one point on the card. With ten points, he can get a free fried chicken meal coupon.

5) Rick accepts the offer and goes home with the to-go box and a point on his Clean Plate Card. Over the course of the next few weeks, he accumulates enough points to earn the reward.

6) Rick shows the server his finished Clean Plate Card and she gives him a free fried chicken meal coupon.

Evaluation Strategy

This prototype solves the functional requirement of incentivizing users to participate in food waste reduction measures. Evaluating the effectiveness for this prototype could be done by keeping track of how many customers use the punch cards and how many points they have over the course of a few months. During initial implementation, customers should be notified of the new system through a server or a poster inside the restaurant. Gathering data on what percentage of customers take advantage of the system would allow us to determine whether or not it is effective in reducing food waste.

In accordance with the usability goals discussed in P1, this prototype is intended to be flexible, accessible, transparent, and cost-effective. Printing the cards on cardstock is cheap, with each paper being only a few cents to print and most office stores offering discounts to print in bulk. The process of adding points to a punch card is non-obstructive to the customer dining experience, as it is a quick add-on to the payment process at the end of dining. Therefore, the Clean Plate Card should be easy to implement across all

casual, dine-in restaurants. Punch cards are easily accessible, as they can fit in a wallet and can be conveniently accessed at the same time as a credit card. Finally, the purpose of the card is well-communicated, as points are earned through avoiding food waste by finishing all food or using a to-go box.

Design Assessments

Eco-Eaters	Napkin Holder	Inventory System	Reward Card
Functional Requirements (20%)	2 (20%) = .4	3 (20%) =.6	1 (20%) = .2
Innovative (15%)	2 (15%) =.3	3 (15%) = .45	1 (15%) = .15
Dev Cost (5%)	3 (5%) =.15	1 (5%) = .05	2 (5%) = .1
Dev Time (5%)	3 (5%) =.15	1 (5%) = .05	2 (5%) = .1
Dev Complexity (5%)	3 (5%) = .15	1 (5%) = .05	2 (5%) = .1
Accessibility (10%)	3 (10%) = .3	1 (10%) = .1	2 (10%) =.2
Speed (10%)	3 (10%) = .3	1 (10%) = .1	2 (10%) =.2
Flexibility (10%)	1 (10%) =.1	3 (10%) = .3	2 (10%) =.2
Cost-effectiveness (10%)	2 (10%) =.2	1 (10%) = .1	3 (10%) = .3
Transparency (10%)	3 (10%) = .3	1 (10%) = .1	2 (10%) =.2
Total	2.35	1.9	1.75

In order to adequately compare our prototypes to one another we decided that we would rank them from 1 to 3, with 1 being the worst and 3 being the best. As a group, we came up with a consensus for where each prototype placed in comparison to the other. We also took into consideration how important each of these overall topics were in the grand scope of things. We decided to give each category a percentage to represent the importance that it held in our overall assessment.

The non-functional requirements, or usability goals, were the largest and the most important category. These were things that were expected out of the prototypes and therefore a necessity for their design. Similarly, the functional requirements, which are outlined in the project description, were the next most important category as that was

what we needed the prototypes to be capable of. Finally we also took into consideration how innovative a solution was as well as how quickly the prototype could be developed.

The first prototype, the Napkin Holder, scored high in most of the usability goals. Most notably, it scored the highest in accessibility, speed, and transparency. The napkin holder sits on all dining tables, targeting customers who are dining in and relying on the common action of grabbing a napkin while dining. The infographic in the form of a napkin holder makes the information easily accessible to all dine-in guests, and information is relayed quickly. In comparison to the other prototypes, which require multiple steps to complete a given task, the napkin holder requires minimal steps to complete its goal, making it the most optimal prototype for speed. The purpose of the napkin holder is obvious, as the infographic contains information on the effects of food waste, on top of ways to combat the issue, making it the most transparent of the three prototypes. The Napkin Holder fulfills the functional requirement of bringing awareness to the issue of food waste in the food service industry.

Of all the prototypes, the Quick Inventory scored the lowest in most of the usability goals. However, we agreed that Quick Inventory excelled in flexibility. The Quick Inventory is intended to provide an easily customizable template creator and storage area for inventory information. Unlike the Napkin Holder and Clean Plate Card, which are additions to existing tasks in the food service industry, Quick Inventory is a solution to simplify another task and make the inventory information more streamlined and secure. It simplifies the task of taking inventory by allowing users to take inventory in a traditional, preferred way; pen, paper, and clipboard and eliminates the tedious task of copying data from paper to digital database. We also felt that it was the best fit for answering the functional requirements since it is the most direct at solving its portion. Along with this prototype being our most innovative one, it barely edged out the reward card for second place.

While the third prototype ranked last overall, the reward card ranked in the middle for all usability goals. It scored the highest in cost-efficiency due to its cheap cost and the

impact we have estimated it to have. Like the Napkin Holder, the Clean Plate Card is designed to blend in with the traditional dine-in experience, and shouldn't be complicated to implement. The goal is to make it easy for restaurants to implement the prototype by keeping the cost of doing so down. Even with the reward that will be given when the card is finished, the cost is still one of the lowest ones out of the three prototypes. Even with the additional cost of printing, business owners should see a large return on investment, as the card promotes business by encouraging customers to return for multiple visits. Although the reward card is seen to be in the middle of the pack for most of the design categories, it fell short in the functional requirements and how innovative the prototype was. Due to the importance we placed on these two categories, it ended up barely falling behind the Quick Inventory prototype.

Modifications Summary

The usability criteria we focused on in Part 1 remained the same in Part 2. In our design assessment we weighted each of our usability criteria the same at 10%. After receiving feedback from our poster session, we decided to reframe our cost-effectiveness usability goal to focus more on the cost to produce and focus less on the effectiveness for this report. We came to this conclusion because we cannot accurately determine its effectiveness without input from real world users. If we rated its effectiveness based on our own subjective opinions, our own bias can affect the results of this report. In addition to slightly altering our usability goals, we updated our functional requirements to not only inform users but also incentivize users to participate in food waste reduction activities. We determined that incentivizing users plays a large role in the overall acceptance and usage of our prototypes and food waste reduction policies in general.

Reflections & Limitations

Part 2 involved utilizing our information from Part 1 to create and explore possible solutions to the problems we discovered. This iteration of the project required us to synthesize the information obtained to understand our problem space more adequately. Given this new understanding, we were able to provide potential solutions to combat food waste within the food service industry. Our group found success utilizing synthesis and brainstorming methods such as Affinity Diagramming, Reframing, and SLICE and DICE. We found that these methods allowed us to not only visualize all of our ideas but also help us to categorize each idea. This in turn helped us realize the most important problems to solve. For example, our Affinity Diagram specifically helped us realize that one of the most important areas to reduce food waste is through the customer.

After determining the relevant problems to solve, we shifted our focus to determining which prototypes to create. We created an initial list of prototypes and eventually narrowed it down to a few of the most promising ideas (Appendix 2-4). It was very beneficial to do this as a group as it allowed for us to build off of each other's ideas. For example, the napkin holder prototype started out as a flyer to place within a napkin holder that just contained information. Another group member later suggested that we utilize a type of call to action to help aid the customer in participating in food waste reduction activities. Lastly, another group member suggested that we also include an incentive for customers to participate in the food waste reduction activities by having restaurants offer a discount or free item for participating. The process was similar for our other two prototypes. In addition, the incorporation of feedback from the poster session helped us further refine our prototypes and usability goals (Appendix 5).

In addition, our group found difficulty in innovating various aspects of the food service ecosystem. Food service is an industry that rarely has changed its core values over the past decades, an example of this being their value of customer service. Our group had to be careful to not design prototypes that would significantly alter the way a restaurant operates on both the front and back ends.

Our design synthesis and prototype generation activities were limited in how we could only conduct these activities in an online format. It would have been more beneficial to do these activities on physical surfaces instead of digital ones. Physical surfaces generally allow for easier digestion and visualization of large quantities of data. In addition, we were limited by our field research from P1. After synthesizing the data obtained from part 1, we realized a large quantity of food waste is derived from customer's actions. We would have benefitted from having personal interviews from customers about their experiences in restaurants and their involvement with food waste reduction.

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Appendix 1

"How might we…" statements

Jacob

- How might we Inform customers of the amount of food wasted?
- How might we Limit the amount of food wasted from over buying?

Rithvik

- How might we Limit the amount of server error?
- How might we inform secondary users of food waste prevention techniques?

Juan

- How might we design an easy to use mobile ingredient inventory application?

Roni

- How might we spread more awareness about food waste and its effects?
- How might we inventory checking and ordering quick and efficient for busy restaurants?

Deborah

- How might we make communication easier between servers and kitchen?
- How might we encourage customers to not throw away leftovers?

Hyeran

- How might we make the ordering process simpler for servers?

Appendix 2

Informal Affinity Diagram

Appendix 3

Prototype Idea Generation

Digital Napkin Holder (tertiary stakeholder - customer)
  a. Cycle through different food waste facts/food waste alternatives
  b. Solar or battery powered
  c. Bonus: light to indicate when napkins are low

To-go box dispenser (tertiary stakeholder - customer)
  d. Easy access to to-go boxes/bags would encourage guests to take food home instead of throwing out
  e. No need to wait for server
  f. Different sizes available
  g. Limit number per customer to reduce plastic waste

Dine-in ordering mobile or browser app (tertiary/secondary stakeholder - employee/customer)
  h. Allows for contact-less ordering
  i. Would eliminate the need for servers
  j. Reduces errors by servers from miscommunication/input mistakes
  k. Would allow guests to get food to table faster
  l. Easy access through qr code on phone
  m. Payment through phone available as well
  n. Quick dine in experience

Smart storage (secondary stakeholder - employee)
  o. baskets/storage containers with label on the outside
      i. Option to input ingredient name, quantity, expiration date
      ii. Employees can update number after taking out/putting in ingredient
  p. Contains built-in scale (?)
  q. Designed to preserve freshness
  r. Different types available for different kinds of ingredients (meat, produce, grains, etc.)
  s. Connect with a mobile app (?)

Inventory Tracking Software (secondary stakeholder - employee + primary stakeholder)
  t. Allows for easier quantification of ingredient losses
  u. Consolidate inventory tracking in one place
  v. Scanning templates into the computer
  w. Build Your Own Template using dropdown menus
  x. Click Print to create the template
  y. Record the information by hand in the template
  z. Notification if the handwriting is not clear

Appendix 4

Prototype Idea Generation

Appendix 5

Poster Session Poster