SMARTSCAN DESIGN PROJECT

...so we can all do our part to minimize food waste.

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INFM 480: Capstone

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December 14th, 2024

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Executive Summary

Food waste is a major problem in this country that creates many other problems like climate change, food shortages, world hunger, excessive animal agriculture, financial troubles, and health issues.

My research has led me to the conclusion that a large part of why so much food is thrown in the trash every day is because this fast-paced era we live in makes it extremely difficult for people to keep up with what foods they have at home. Being on the go all the time usually means excessive dining out, consuming fast foods, selecting processed foods when grocery shopping, and never finishing leftovers at home.

To assist with mitigating food waste, I searched for a solution that would not cost people a lot of money, would not need a large investment to design, and would not require a reinvention of the wheel in terms of technology. The project is a detailed introduction to that solution. It's called SmartScan.

SmartScan is a downloadable software application that is designed to allow users to upload their groceries and assign expiration dates to them based on what amount of time they want to give themselves to eat it. This design will be able to send out text notifications the phone numbers associated with the application about food items that are about to expire.

This project will show the justification for SmartScan in the sections with "needs finding" content such as interviews and literature around the topic of food waste and Smart refrigerators. The plan for this project is also detailed in this document and includes user scenarios and storyboards, a project proposal, a timeline, etc.

The design phase centers on the end users and focuses on ensuring SmartScan meets all the requirements to make navigating the application as seamless as possible.

Putting the technological template together in the form of prototypes is where you will begin to see SmartScan come alive. There are a total of three versions of the SmartScan prototype and each one was tested to see where improvements needed to be made.

Raw data was gathered and added to the appendices of this document for your viewing/listening pleasure.

Acknowledgements

Background

In furthering the search to find ways to better people's lives without requiring from them any financial investment in that regard, I thought about my life as a child and some of the struggles my mother had holding on to the money she earned while providing for me and my siblings. Next to the mortgage, food was probably her biggest expense, as we were a household of seven people. Our cupboards and refrigerator had to be packed to capacity, especially during summer months when school was out. We had no problem preparing simple meals for ourselves like PB&J, pouring a bowl of cereal, or boiling water to prepare boxed mac n' cheese, but fresh foods that were perishable often got pushed aside or ignored because they required cooking; they would sit in the refrigerator until my mother used them in dinner meals after she got home from work. The problem is, she often came home too tired to cook and would, instead, point us to the cold cuts in the fridge or give us money to buy a pizza. The fresh tomatoes, peppers, avocados, cabbage, strawberries, lemons, lettuce, spinach, and many other healthier foods, all with very limited shelf lives would spend another 24 hours untouched; with each passing day, their vibrant colors would slowly dim – their perfumed scents fading away and nutritional potency weaking. My mother took for granted that these foods would still be fresh when it came time to use them. Often too, she would simply put their existence in the back of her mind, while other of her priorities quieted the tick-tocking of the clocks imbedded in the lifespan of every perishable item. They were forgotten about. It should come as no surprise that by the time a decision was made to prepare a cooked meal, say, with a salad on the side, most of these perishable ingredients the recipes called for were now spoiled, rotten, and molded, and had to be tossed in the trash - more money had to be spent to replace them.

As I got older, the conditioning I underwent as a child in terms of how meals were chosen spilled over into my adult life. My habits had not changed, and, like my mother, I often forgot about the foods I had in the refrigerator. It was the same with my siblings. I soon learned this amnesia and other aforementioned bad habits around eating existed in the homes of friends and community members – it seemed this was a cultural issue and because of it, more time was spent in the middle aisles of grocery stores where the processed foods were than around the perimeter where the fresh foods were. I would say this is a major source of the obesity epidemic in this country and many of the diseases we now face, which impede our quality of life. I am not alone in this realization, though, and much of this country's population has become aware of the need to embrace healthier lifestyles. The desire to improve one's diet increases as they begin to see many loved ones dying at young ages and others barely clinging to life as they grapple with cardiovascular, neurological, and a host of other diseases brought on by poor food choices. But for those who have not been motivated by the pain felt in their hearts to eat better, they have certainly been motivated by the hole in their pockets; dining out instead of cooking at home and having to dispose of purchased groceries that have passed their expiration dates has added to the already troubling economic issue this nation faces, especially since individuals who are aware of harmful chemicals sprayed on produce and the genetic engineering of natural foods that compromise the nutritional integrities of them, choose organic and non-GMO items which come at exponentially higher costs.

The last point I'd like to make is this. There is a nationwide problem with food waste and spending too much money replacing foods that had to be discarded due to spoilage. Most of us are aware that climate change and food shortages have endangered human life on a global scale and while measures are being taken to mitigate this, it is important for the average person to

know how some of their behaviors add to the problem. Being careful not to let food go to waste is something we can all do to help the earth, which ultimately helps us.

Project Planning

Needs Finding

When thinking about my personal problem with food waste and then learning that a large portion of my community experienced the same thing, I wanted to see if this was occurring on an even larger scale. So, I started to look for information on the topic of food waste, not only in the U.S., but globally.

A website called ClimateScience has a section about food waste that informs us that thirty percent of food is wasted worldwide. This means, the average person wastes about six hundred fourteen kcal every single day, the equivalent of ten medium eggs and twenty-one large carrots. Per person……everyday! The land and water that had to be utilized to produce these foods through animal agriculture and farming, are also wasted because of this and contribute eight to ten percent of the earth's greenhouse gas emissions, (Food Waste, 2024). Moreover, if we reduced food waste by just fifty percent, it would greatly reduce the food shortage issues that leave much of the world's population hungry or starving, (Food Waste, 2024).

This problem of food waste extends to our financial situation as well. According to feedingamerica.org, this country wastes ninety-two billion pounds of food annually, which comes out to roughly $473 billion worth of food per year, (Fighting Food Waste, 2024). Food waste adds greatly to the economic problem in this country; rising prices on groceries make it even more imperative that we consume all that we buy and minimize the amounts that go into the trash.

Now, to dig a little deeper and for a more direct look into this issue, I chose a few individuals to conduct an interview with, whom I thought represent most Americans that waste food through forgetfulness and/or over shopping for groceries. They consisted of two different generations of adults with varying family structures, and they all gave reasons why they had to throw away food stored in their refrigerators. The full interview script is in the "**Project Proposal**" section of this document.

Results of the interview

After conducting and reviewing the notes from this interview it can be clearly seen why so many people end up wasting food and spending more money than they must on groceries. The biggest contributors of food waste among the interview participants were a lack of order, forgetting to consume leftovers and dining out instead, being unaware of the foods they have in their refrigerators, a lack of creativity regarding what to do with a food item after cutting it open, i.e. a half of a bell pepper or cucumber, and having limited visuals of items in the refrigerator due to over shopping and pushing existing foods to the back while storing new groceries. All these factors result in individuals having to discard foods, including products that were still fresh but, due to cross contamination of the spoiled ones, became unsafe to consume, adding to the food waste problem.

Success Measurement

In response to the problems uncovered during this interview, I came up with an application called SmartScan. This application will be downloadable to Smart phones and will allow users to scan the PLU codes of their perishable items or enter the item manually, set an expiration date for each of them, and upload the information to a database. SmartScan would then be able to send out notifications to the user reminding them within two days of the set expiration dates to eat the food(s).

That there are limits as to what my design will provide in terms of addressing some of the above issues is not lost on me. For instance, SmartScan will not assist shoppers with how to store food and it will not help shoppers plan meals. It will not make their refrigerators work better and it will not reward children for eating their fruits and veggies. But here's what it *will* do. SmartScan will help shoppers remember to eat their perishable foods before they spoil, which will eliminate the forgetful component that often leads to cross contamination of spoiled food to good food. It will provide increased confidence to shoppers about purchasing fresh foods and encourage them to spend more time around the perimeter of grocery stores and less time in the middle aisles, which will promote better health. SmartScan will help in deciding whether to dine out or prepare a meal at home, which could also help with saving money. And most importantly, SmartScan will help to significantly reduce the amount of food waste, which will not only help users avoid the guilt that comes from throwing food away, but by extension, it will help to slow down climate change and improve the food shortage problem that I briefly mentioned at the beginning of this document.

Project Proposal

To answer the call about finding a solution that would allow the average person to do their part to mitigate food waste, I have put together a project proposal.

SMARTSCAN DESIGN PROJECT PROPOSAL

Executive Summary

Based on Waste360.com, nationwide we toss 103 pounds of food in the trash per year due to spoilage alone. Furthermore, a "food waste" study showed that the average American will throw away four spoiled perishable items every week, and based on a survey issued by OnePoll, the "average American has about $102 worth of product in their fridge at any given time…. [and] ends up chucking out $53.81 worth of spoiled food a week from their fridge, or $2,798 every year," (Staff, W, 2023).

My design will answer the call of many Americans who must constantly make the hard decision to throw away groceries that spoiled in their refrigerators because they were not cooked, prepared, or eaten in a timely enough manner. This is due, in part, to a lack of proper organization and utilization of the appliance, and simple forgetfulness that the freshness of the foods is limited to a certain timeframe. This is a widescale dilemma that costs average citizens

sometimes hundreds of dollars a month and does no favors for the food shortage issue in this country. Families also sometimes suffer from foodborne illnesses due to the consumption of spoiled foods, particularly those that cannot afford to just toss expired groceries in the trash. But this new design will serve to mitigate all these issues.

The SmartScan design will be a digital application that can be downloaded to Smart phones, equipped with a PLU code reader. This will allow shoppers to scan their groceries, enter an expiration date and upload their grocery list to the application database. It will then send reminders to cook or eat foods when the assigned expiration date is near. So many Americans families can benefit from this application, saving themselves vast amounts of money to allocate elsewhere, and help minimize food waste.

Introduction

Most innovations in technology are derived from problems uncovered in everyday life among average individuals. From my assessment, these innovations give way to constant improvements and/or upgrades and forge ever expanding avenues down which passionate minds journey to pioneer fresh inventions, whose births owe a great debt to the revisions of pre-existing design models, all of which have improved the lives of everyday people.

This project seeks to stand on the shoulders of Smart Device innovators and provide further improvements in day-to-day life in terms of health and economics by designing a downloadable application from Smart phones called, SmartScan, that will allow grocery shoppers to keep track of expiration dates on perishable groceries. SmartScan will allow them to either scan the PLU code stickers on their perishable items or upload the information manually. Next, they would enter an expiration date of their choosing and then upload the list of all scanned items to the application database. The nearing of these dates would prompt the app to send out a notification via text message to the phone number associated with the account reminding the user to cook and/or consume the food. In this way, individuals can take better control of their eating habits by making more informed decisions around whether to dine out or prepare meals at home; the stress of "remembering" can be alleviated, as it has now been assigned to SmartScan.

Research Question and Hypothesis

Due to the food waste epidemic in this country and the amount of foodborne illness experienced by individuals who have consumed expired foods from their own refrigerators, what technological design can be rolled out to alleviate this issue?

This application has the potential to save consumers money that would be spent repurchasing groceries due to spoilage of already purchased products that have to be discarded and helps to prevent foodborne illnesses due to the consumption of expired foods.

Design Objectives:
- Downloadable to Smart Phones

- Allow users to scan PLU codes on products and set expiration dates
- Allow users to manually enter product information and set expiration dates
- Upload information to application database
- View information stored in database
- Track expiration dates of food and send out notifications within two days of product expiration
- Send notification to user when product has expired

Proposed Research Methodology

The target audience for the SmartScan application will be adults aged eighteen and up and will include families and adult members of different household types.

To conduct the research necessary around the issue of food waste to due spoilage, I have completed a literature review (see references). I have also conducted an interview with end-users to gain insight into their personal refrigeration practices to see if thet have led to food waste in their households.

For the interview, participant consent was granted.

The following describes the plan for the interview that was conducted to corroborate my claim that poor refrigeration practices contribute a great deal to food waste.

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Interview Setup:

This interview will be conducted using adult women (since no men were available for it) between the ages of 43 and 71 via a WhatsApp group discussion, each participant in the privacy of their own personal spaces. Since some may choose to have their cameras turned off, recorded audio will be the primary means of data collection and storage with some video recordings as a secondary mode of collection. This will be an open-ended semi-structured interview where participants will be encouraged to speak freely as they offer their responses and elaborations.

Intro & Participant Background:

Good day! As you all know, my name is Meah Hopkins, and I thank you for taking the time to meet with me today. First, I would like to know if I have everyone's permission to record this interview, as this will be my means of data collection and storage. And please be assured that you will not be asked to provide any personal information, and all the information you share will be protected and stored on my Android phone and will not be shared with any third-party solicitors. It will be strictly used for my research purposes and involving this project only. If there is anyone uncomfortable with being recorded, please understand that is ok, as your comfort throughout this process is paramount – just note that data collection will then be done via notetaking, which may prolong this interview. If I have everyone's permission to record, I want to extend my thanks, as this helps to better capture everything said here, significantly minimizing the chance that something pertinent will be missed. The purpose of this interview is to examine your refrigeration habits. But before we begin, I'd love for each of you to share some feedback as to how this research

may resonate with you and what you hope to see happen because of this study. I appreciate all your sharing, and without further ado, I'd like to commence with the interview. Everyone ok with that? Great!

Main Interview Questions:

1. Are you familiar with the issue of food waste? If so, what is your perspective on it?
2. What do you feel is the biggest contributor to food waste?
3. What are some ways you feel this problem can be solved?
4. Have any of you gotten sick from eating bad food? If so, how many times did it come from your own refrigerator?
5. What type of refrigerator do you have and how long have you had it?
6. Describe your food shopping experience. For instance, how much do you typically spend in one haul and about how many bags of perishable groceries do you leave with?
7. How is your grocery list compiled if you create one?
8. Do you prefer frozen foods to fresh foods? Why?
9. Does all the food purchased during a single haul usually fit easily in your refrigerator, or do you have to clean it out first? Expound on that, please.
10. How often do you clean out your refrigerator? When you do, how much food do you usually throw away, and why?
11. How do you feel when you have to get rid of food because it went bad in the refrigerator?
12. When do you usually learn that food has spoiled/expired in the refrigerator?
13. Describe how and where you place your perishables.
14. What kinds of practices do you implement to help you remember to eat food stored in the fridge? How has this affected your food waste?
15. Finally, what are wishes that you developed due to frustrations around having to throw food away?

In Closing:

Thank you for participating in this interview. Would any of you like a copy of this interview? Would you like to receive updates as to how this interview has impacted my project? Do you have anything else you would like to share? Thank you again for your time, and as a token of my appreciation, I'd like to offer you each a gift of $25. If you spend it on groceries, try not to let it go to waste! Have a great day!

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The following is the plan for the interview that will be conducted to test the initial design proposed.

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Setup:

This interview will be conducted using five adults between the ages of 18 and 71 via separate WhatsApp video calls, each participant in the privacy of their own personal spaces. This will be an open-ended unstructured interview where participants will be instructed to complete specific tasks involving scanning, manually entering, setting expiration dates, uploading, and viewing lists. They will be invited to speak freely as they offer their responses to questions. The purpose of the interview is to identify user perspectives, needs, and frustrations to help improve the design of SmartScan.

Intro & Participant Background:

Good day! As you all know, my name is Meah Hopkins, and I thank you for taking the time to meet with me today. First, I would like to know if I have everyone's permission to record this interview, as this will be my means of data collection and storage. And please be assured that you will not be asked to provide any personal information, and all the information you share will be protected and stored on my Android phone and will not be shared with any third-party solicitors. It will be strictly used for my research purposes and involving this project only. If there is anyone uncomfortable with being recorded, please understand that is ok, as your comfort throughout this process is paramount – just note that data collection will then be done via notetaking, which may prolong this interview. If I have everyone's permission to record, I want to extend my thanks, as this helps to better capture everything said here, significantly minimizing the chance that something pertinent will be missed. The purpose of this interview is to examine your refrigeration habits. But before we begin, I'd love for each of you to share some feedback as to how this research may resonate with you and what you hope to see happen because of this study. I appreciate all of your sharing, and without further ado, I'd like to commence with the interview. Everyone ok with that? Great!

TASKS:

1. User will download the app and create an account
2. User will sign in to the app
3. User will scan their groceries then assign expiration date
4. User will upload grocery list
5. User will manually enter items then assign expiration date
6. User will upload grocery list
7. User will view their stored lists
8. User will sign out

Main Interview Questions:

There will be no set questions for this interview. Users will be given specific tasks to complete (different combinations of the task list above) and will be asked general questions about how they felt as they navigate the application and what suggestions they have to improve the app.

In Closing:

Thank you for participating in this interview. Would any of you like a copy of this interview? Would you like to receive updates as to how this interview has impacted my project? Do you have anything else you would like to share? Thank you again for your time, and as a token of my appreciation, I'd like to offer you each a gift of $25. If you spend it on groceries, try not to let it go to waste! Have a great day!

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Proposed Data Collection Instrument

For data collection, a document analysis will be conducted to gather information from website articles containing information relative to this study.

List of website articles researched:

1. **Study Shows How Much Food Americans Waste Every Year**
   A new study examining the food waste habits of 2,000 Americans found average Americans discard four spoiled items from their fridge every week.

2. **Smart Appliances Promise Convenience and Innovation. But Is Your Privacy Worth the Price?**

   Manufacturers collect data every time you run your dryer and open your refrigerator, but most of them don't want to talk about it

3. **Smart Refrigerators: How They Work, What They Cost, and More**

As indicated above the interview will be conducted by way of a WhatsApp recorded video of a group discussion fueled by questions that will be posed to the participants and that will encourage the sharing of expanded thoughts on the matter at hand.

Notes will be taken during the interview, and the completed recording will be reviewed to analyze participant responses.

Project Planning Report Sample

PROJECT PLAN &
TIMELINE.pdf

Summation

This project design is one that I find myself becoming very passionate about and I hope to have much success with its design, but more importantly, I hope to see this design implemented in

Smart refrigerators nationwide in the not-too-distant future. I look forward to working on this project despite the challenges I am sure I will face along the way.

References

Just Energy. (2024, April 9). *Smart refrigerators: How they work, what they cost, and more*. https://justenergy.com/blog/smart-refrigerators

Staff, W. (2023, December 13). *Bosch studies how much food Americans waste every year*. Waste 360. https://www.waste360.com/food-waste/study-shows-how-much-food-americans-waste-every-year

Wroclawski, D. (n.d.). *Smart appliances promise convenience and innovation. but is your privacy worth the price?* Consumer Reports. https://www.consumerreports.org/electronics/privacy/smart-appliances-and-privacy-a1186358482

<div align="center">**END OF SMARSCAN PROJECT PROPOSAL**</div>

Project Deliverables

SmartScan will be carefully designed to ensure users can easily and successfully carry out various tasks.

- Downloadable Application

- PLU Code Reader

- Interactive component

- Database – store uploaded information

- Notifications via text alerts

- Chat Box - a ready assistant to users needing help with the application

<div align="center">**Project Scope**</div>

SmartScan is designed to be a user-friendly, downloadable, interactive application with the ability to store information about purchased grocery items. It will include a feature that sends out notifications to users via text alerts when items scanned and stored in the database are nearing their expiration dates.

The objective of this application is to be a tool for receiving reminders to cook or consume perishable grocery items so as not to waste food and money.

SmartScan is designed for mobile phones and delivers outputs to comfortably fit the screens of Androids, iPhones, and other Smart brands. The lettering and colors are easy on the eyes, and there is no useless information on the different pages to make it challenging to the user what he

or she should be focused on. The background objects and colors will be consistent with the theme of the application but will not distract from the information put forth.

Feedback is an important component of any application, so SmartScan will provide such feedback in the form of wording that confirms to the user the entry made (or button tapped) is valid, and/or navigate to the appropriate next page with clear options to choose what to do next or that the task has been completed. The choice to sign out of the account will also be a constant and displayed on every page upon signing in to the application.

SmartScan will be available in Play Stores on Smart phones and will include a PLU code reader and a database to store uploaded information. It will also give the option to manually enter the information.

Users will not have to be near their homes or refrigerated items to access the database or enter/edit information. Everywhere their Smart phone goes, so will SmartScan and all its features. See image in Figure 1 below.

Figure 1: Project Scope Statement

PROJECT SCOPE STATEMENT			
TITLE	SMARTSCAN - COMPATIBLE WITH SMART PHONES	**DATE**	10.29.2024
PROJECT MANAGER	Meah Hopkins		
PROJECT JUSTIFICATION	The SmartScan will be designed to be a user-friendly, downloadable application equipped with a database where information about scanned items will be stored and tracked based on expiration dates of items.		
PROJECT SCOPE DESCRIPTION	The SmartScan will be used as a feature of the downloadable application to send out notifications to users via text alert when items scanned and stored in the database are nearing their expiration dates.		
PROJECT OBJECTIVE	To create a tool that will remind users to consume perishable grocery items so as not to risk food and money waste.		
PROJECT REQUIREMENTS	• User-friendly downloadable application • PLU code reader for Smart Phones • Database to store uploaded item information		
IN SCOPE	• Remote access database from Smart devices • Enable data modifications • Allow notification preferences		

Project Timeline

The timeline for this project was created on a template from a web application called, SmartSheet, and was made to fit into an eight-week time window that was tracked using a color-coded status key.

The timeline was originally broken down to focus on a single aspect of the project and its subparts, per week. As the project got underway, however, some time windows needed to be extended or merged into others, as delays completing certain subtasks slowed the completion of the sections they were assigned to. Below are the parent sections of the timeline. See below figures 3(a)(b).

Figure 3(a): SmartScan Timeline

"SMART SCAN" - PROJECT PLAN/TIMELINE — smartsheet

Status		Task Name	Start Date	End Date	Remarks
1	Status Key				
2	🔴	Not Started			
3	🟡	On Hold			
4	🟢	In Progress			
5	🔵	Completed			
6					
7	🟢	**PROJECT PLANNING**	10. 16. 2024	10. 23. 2024	
8	🔵	Project Proposal			
9	🔵	Stakeholder's map			
10	🔵	Project Scope			
11	🟢	Project Timeline			Updated Weekly
12	🟢	Success Measurements			Have to redo
13					
14	🔵	**PROJECT DESIGN**	10. 24. 2024	10. 30. 2024	
15	🔵	User Task List			
16	🔵	Personas			
17	🔵	User Scenarios and Storyboards			
18	🔵	Site Structure			
19	🔵	Database Design			
20					
21	🟢	**PROTOTYPE DEVELOPMENT**	10. 31. 2024	11. 21. 2024	
22	🔵	Black & White Prototype			
23	🔵	Function Development			
24	🟢	Database Development			
25	🔵	Prototype Designs and Testing			
26					
27	🔵	**USABILITY TESTING**	11. 22. 2024	11. 27. 2024	
28	🔵	Interview w/ End-Users			
29	🔵	Usability Testing Report			

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Figure 3(b): SmartScan Timeline

Status		Task Name	Start Date	End Date	Remarks
30	🔵	Application Adjustments			
31					
32					
33	🟢	**DESIGN UPDATES & FINALIZATION**	11. 28. 2024	12. 4. 2024	
34	🟢	Prototype Final Release w/ User Help Docs			
35					
36	🔴	**CAPSTONE REPORT**	12. 5. 2024	12. 12. 2024	
37	🔴	Submit Capstone Report			

Problem declaration and Technical System design

Interview Summary and Analysis

Before asking the questions listed in the interview setup, I gave a brief description of the application design, SmartScan, and defined the purpose of it. I invited every participant to give some preliminary thoughts about it and explain whether they felt it would be a benefit to them. Every participant in the above interview loved the idea of having access to a mobile application that would help them remember to eat the foods they purchased before they go bad. Some of their reasons were that they have a habit of storing foods in the back of the refrigerator and thus forgetting about it, having a large family which makes it challenging to keep up with what foods they have, and that it would encourage meal prep (having a plan for the items they purchased).

In this section, I will break down the interview takeaways into sections (based on the questions asked) and provide key points made by the participants. These are what inspired the design of SmartScan. See appendices I and II for full interview and consent forms.

Perspective on food waste

All agreed that a great deal of food is wasted in the U.S., specifically, and it is a "huge issue." There was a contrast made between the U.S. and Trinidad that highlighted the differences in the value we place on food. While one of the participants was vacationing in Trinidad, a waiter serving her table at a restaurant asked to keep the leftovers her and her husband were going to have thrown away. She had never experienced that in the U.S., and neither did any of the other participants. They all routinely throw food away due to spoilage but have a true desire to stop. They understand the connection between food waste and money waste.

Biggest contributors to food waste

- Lack of order
- Leftovers get forgotten about
- Lack of creativity when it comes to using single ingredient leftovers, i.e. a cut open bell pepper
- Depth of refrigerator shelves and overall design of refrigerator makes forgetting easy; foods cannot be seen
- Existing foods get pushed aside or to the back when new groceries come home

Food sickness

- Suspicion around what's spoiled due to smell or taste; won't eat it
  - Will throw away immediately
  - Will delay discarding due to feelings around wasting
- "Best by" vs expiration dates create uncertainty about freshness of foods

Smart refrigerators

- Do not own due to cost
- Limited functionality around food waste prevention

Grocery haul experiences

- Shopping while hungry causes over shopping
- Budget dependent
- Usually, no plan or organization
- No consistency with appetite so selections are often different
- One empty nester experiences more consistency and less waste, but still throws away too much food
- Some foods are grown at home so can be preserved better by remaining on the vine until needed
- Purchasing frozen or fresh depends on what's in season
- Spends
  - Less than $100/day (married couple)
  - $130/day (for family of 5 with a garden; 40% are perishables)
  - $350/mo and 90% perishable (single bachelorette)

Grocery lists

- Only if meals are planned, otherwise no list
- May check for what is already at home before shopping, but often does not
- Sticks with household staples
- Compiled based on meals planned for the week, but no consistency

Fresh vs Frozen

- Fresh
  - Tastes better
  - Cost doesn't matter
  - If planning to prepare right away, but often deviates from plan after shopping is done
  - If in season
  - Depends on use
- Frozen
  - For smoothies
  - Picked at peak ripeness – taste better and nutrient dense
  - Meats if buying ahead of time – future meals
  - Depends on use

Refrigerator space

- Multi refrigerators in the house to accommodate amount of food stored
- No space – must clean out before storing newly purchased groceries

How often refrigerator is cleaned out / how much food is thrown away

- Twice per week - large quantity discarded
  - Leaking produce spilling onto other foods; must discard good and bad food as a result

- Once per month – always must discard
  - Refrigerator temp not optimal
    - Freezes leafy greens – cannot be eaten
    - Not keeping meats at low enough temperatures – don't trust eating
- Once per week – much is discarded

Feelings about throwing away food

- Bad – "need to get myself together"
- Don't know what to do with odd leftovers like pulp from juicing
- Blame placed on refrigerators – poor air circulation due to overpacking

Discovery of spoiled food

- When cleaning out refrigerator
- When storing new groceries
  - Often realizing they had same items, but forgot (and now the old is spoiled)
- Liquid substance at bottom of refrigerator
- Stench
- When searching for something specific that got hidden
- Color lost or molded
- Opening non-transparent tubber ware after long storage period

How is food stored

- Frozen if not immediately needed…. sometimes
- In drawers after best guess as to how it functions
- Liquids in large containers on top shelf
- Meats in the back / Veggies in the front
- Priority foods on door
- "Get in where you fit in"

Practices to help remembering to consume – has it helped

- Cost considerations – helps
- Spouse stages foods – helps, but not consistent
- Doesn't make big meals to avoid leftovers – hard to avoid so doesn't always help
- Makes a board – consistency struggles; chooses to eat fast foods instead
- Schedule dining out days – helps a little
- Create "leftovers" shelf then goes on "cooking strike" – helps sometimes
- Prioritize eating foods that spoil quick than others – still a struggle
- Only shop when ready to eat – helps when actually done, no consistency

Wishes for technological development

- Glass storage bins and drawers in refrigerator – instead of plastic
- Non-oxidizing refrigerators
- Better quality refrigerators
- Food In / Food Out tracking w/ voice command

- Mold detector / Air quality alert / running low on items alerts
- Leftover reminder w/ recipe tips
- Expiration date setting capabilities
- Refrigerators that have a way to reward children for eating fruits and vegetables before spoiling
- Suggestions on how to store and preserve properly, especially once items are cut or opened

The role of HCI and Informatics in Web Development

In today's rapidly developing world, especially around AI, and technology in general, it is imperative that developers move with the times and not only stay abreast of the latest technologies, but of what issues obstruct the flow of life when carrying out everyday tasks. In other words, every consideration needs to be given to the world's consumers whose lives depend on timeliness, accuracy, preciseness, communication, the flow of information and the integrity of it, accessibility, practicality, and security. To that end, when developing an application, the number one focus should be on the user and their experience with it. Human-Computer Interaction (HCI) and Informatics play an integral role in the overall user experience (UX) and should seek to improve the lives of those engaging with it. It should be noted that users come from various cultures, speak different languages, have contrasting fiscal reserves, may be limited in their physical abilities, differ in age, gender, education and responsibilities, with varying levels of exposure to technology. These UX determinants should therefore be woven into the fabric of the application development process; designers should ensure their interfaces are user-friendly, accessible, and applicable to the specific needs of the user.

Some key aspects of HCI in application development are discussed below.

Understanding User Needs:

This component of HCI is centered around what users need from a particular application, their goals, and certain user predictabilities as they engage with the interface. Cognitive abilities, mood, and experiences are all considered when creating a design to successfully deliver a virtually effortless experience as they navigate the system. SmartScan will be require little thinking, be without visual deterrents, aesthetically pleasing to invoke positive emotions and encourage in-home meal preparation and dining, and will be inviting to all adult users, including those who are not particularly tech savvy.

Achieving the Goal:

When users interact with a computerized interface, they do so in hopes of completing a certain task, or several related tasks. An example of this would be an accommodations application like Airbnb where a user wanting to experience more comfort and privacy than a hotel would provide at their price point could book a vacation stay. In the same way, using SmartScan would help grocery shoppers achieve the goal of uploading perishable items and assigning expiration dates to assist with remembering what foods they have at home that should be consumed within a certain window of time. The time it takes to complete a task on an application is also important in terms of the users' decision to engage with it. SmartScan will be precise, concise, and require a minimal number of taps from the user to get from point A to Z.

The Interface:

I consider the interface of an application the place where the user and the computer communicate back and forth through tapping, clicking, swiping, or by voice command, and depending on how well that communication flows, the user will either come away feeling accomplished or frustrated with little chance of revisiting the conversation, if you will. What also plays a part in this exchange is how clearly the optics are presented, font size, and colors.   When these attributes do not accommodate the user's needs, like adjusting the appearance and amount of information delivered to fit the type of device being used, the user will become uncomfortable with navigating and engaging with the interface, however subtly or subconsciously it may be felt. The impact is the same and almost always results in a hesitation, at the very least, to return to the application.

SmartScan will be designed for mobile phones and will thus deliver outputs to fit the screen and to make lettering and colors easy on the eyes. There will be no useless information on the different pages to make it challenging to the user what he or she should be focused on, and background objects and colors will not distract from the information put forth.

Feedback:

Feedback is another important component of an application. It lets the user know that the system has received their commands and, in the case of a delayed reaction, is working on responding. Feedback also comes in the form of wording that confirms the entry made or the tapped selection of button is valid. For example, after tapping the submit button, a page will pop up that will may show, "Thank you! Your submission has been received."

SmartScan will provide such feedback and/or navigate to the appropriate next page with clear options as to what needs to be done next or that the task has been successfully completed. The choice to sign out of the account will be a constant on every page upon signing into the application.

SmartScan End-Users

For the end-users SmartScan will be simplified to meet a few very specific requirements centered around creating a list of perishable groceries purchased by the account holder, and expiration dates of their choosing for each item scanned (or entered manually).

Stakeholders

The stakeholders for the SmartScan application are as follows:

- Users
- Manager
- IT Team
- Customer Service Team

The users are the most important stakeholders of this application; the impact of change and their level of influence on the design is the highest. It is, therefore, imperative that this design helps to

maintain their confidence in the fact that they will achieve their goals seamlessly as they engage with the interface.

As the manager of this application, the impact of change to it is high considering my role as the designer, and my level of influence much lower than the users'. SmartScan is tailored to the users' needs and any adjustments made will directly affect them. It is important that I remain abreast of how users feel about the application.

SmartScan is a very simple design both on the front and back ends and so the IT team will have a low level of influence on the design. Their impact of change, though, will be slightly higher since any adjustments or corrections that must be made will more than likely fall on them. The IT team will work in collaboration with the manager.

Finally, the customer service team will experience a low impact of change from design adjustments but will fall to a higher level of influence as they will have the pulse of the users – whether they are satisfied or dissatisfied with the application. The customer service team responds directly to user complaints and the way in which they do that will affect the users' choice to continue to engage with the application or find other ones to meet their needs. The customer service team must, therefore, be consistently monitored. See image in figure 2 below.

Figure 2: Stakeholder Map
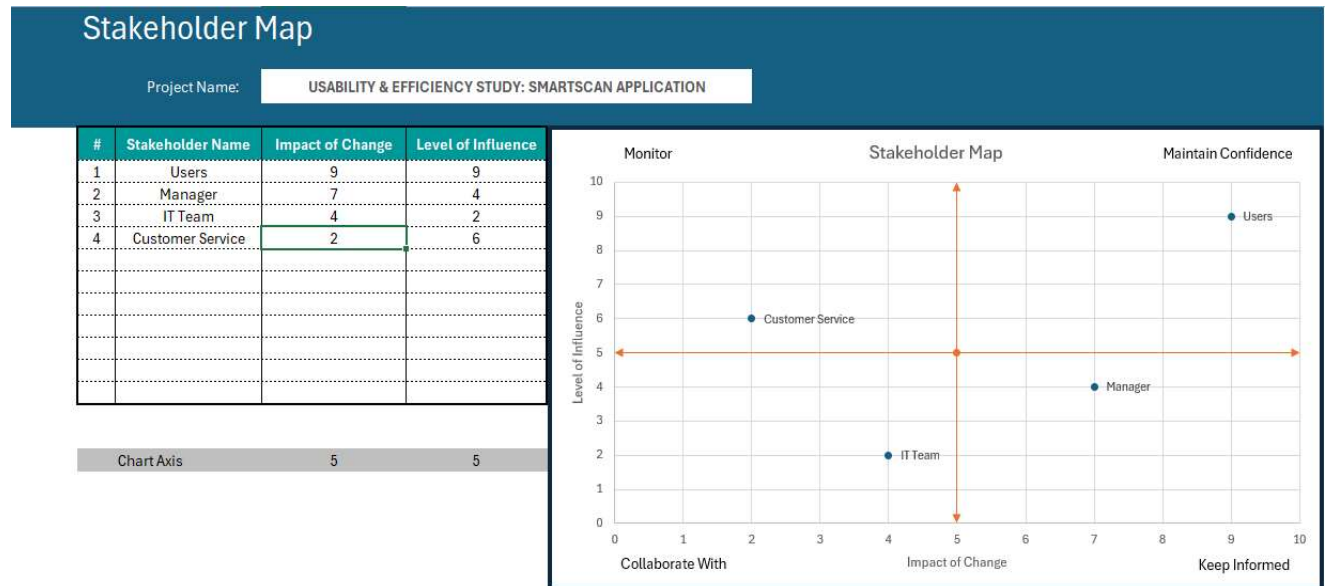
Features Needed

The SmartScan application will need the following features to ensure user tasks can be carried out successfully.

- PLU Code Reader: this will allow users to scan the PLU codes on their grocery items if they are available
- Allow users to manually enter product information and expiration dates
- Database: this is where information about grocery items and their assigned expiration dates will be stored

- Date Tracker: this feature will be synched to the internal calander of the Smart phones and will be used to prompt the app to send reminder notifications via text alerts, to cook or consume foods that will expire within a couple of days.
- Chat Box: this feature will be available on every page (except the Home page) as a ready assistant to users needing help with the application

Persona & Storyboards

The purpose of this project is to design an application that will allow users to scan the PLU codes or manually enter their perishable groceries before they store them in the refrigerator. This, in turn, will set them up to receive notifications to their smart devices about when foods are approaching their expiration dates. Below are three different personas that represent the end-users of the SmartScan application, their user scenarios, which include the tasks they will complete on the SmartScan app, and storyboards.

<u>Persona 1:</u>

CHERYSE

"Life is too beautiful to live it in disorganization"

SCENARIO

Cheryse is a married 41 year-old mother of 4 who quit her job with corporate America to be a stay-at-home mom. She currently resides in rural Pennsylvania and raises chickens and a few sheep. She struggles everyday to maintain order in her home which is especially challenging since she homeschools her 2 youngest boys. Keeping up with daily chores and finding ways to maintain balance between her childrens' schoolwork and leisure time, while carrying out wifely duties leaves her with very little time to focus on selfcare. Cheryse's biggest challenge is keeping track of groceries she has stored in her refrigerator and always ends up purchasing foods she already has at home. Because of this, the old food ends up spoiling and has to be thrown away. Cheryse decided to download SmartScan and go through her refrigerator, and manually entering all the fruits, vegetables, and meats she has, and giving them expiration dates.

BEHAVIORS

~ Tends to farm animals
~ Streams on YouTube to look up recipes
~ Attends church on Sundays

GOALS

~ Getting children through grade school
~ Starting her own YouTube cooking channel
~ Patenting her own kitchen spices

FRUSTRATIONS

~ Cheryse struggles with her mental health due to lack of time to decompress

PERSONALITY

Judging — Perceiving
Analytical — Creative
Extrovert — Introvert

MOTIVATIONS

Social
Pride
Achievements

BRANDS

SPROUTS FARMERS MARKET   TRADER JOE'S   YouTube
T·J·maxx   Walmart   HomeGoods   THE HOME DEPOT

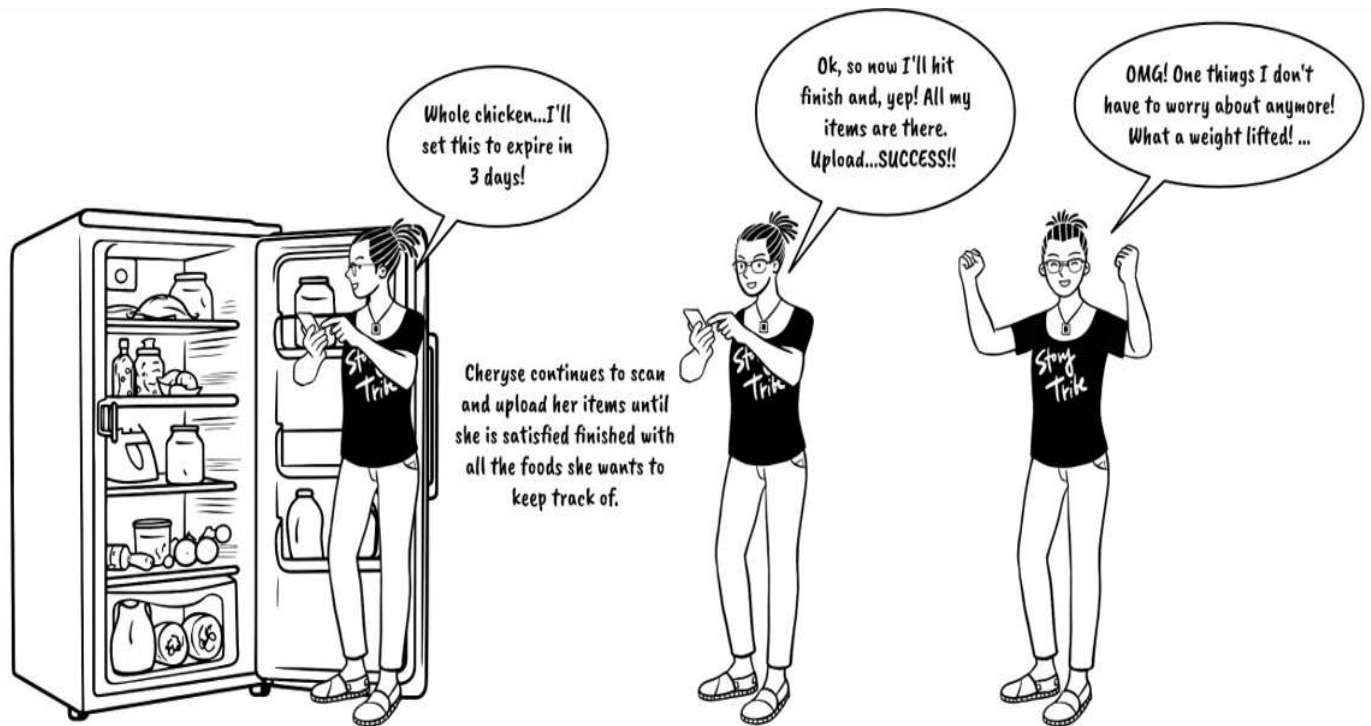**Cheryse's Storyboard:**

Persona 2:

VIRGINIA

"The goal is to get old!"

SCENARIO

Virginia is an empty-nester currently residing in Queens, NY with her husband. She lives a very active life decorating for special occasion events and writing plays for her church's various holiday productions. She tries to practice eating well and exercising. Dining out is something Virginia does pretty regularly because much too often she lets food in her refrigerator go bad. Her busy schedule makes it difficult for her to remember to eat what's at home. To solve this problem, she decided to download SmartScan, and the next time she went grocery shopping she used it to upload her perishable items and set expiration dates. That way, she could get text alerts about the foods that she needs to prioritize eating.

BEHAVIORS

~ Scrolling Pinterest for decorating ideas
~ Checking and sending social media to solicite and maintain clientele
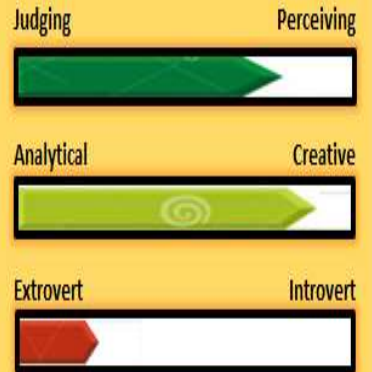~ Streaming on YouTube to study playwriting

GOALS

~ Getting contracted to decorate for high-end celebrity homes
~ Turning her plays into big-screen films

FRUSTRATIONS

~ Virginia struggles find an assistant to assist with her various job demands
~ Her husband's declining health and lack of mobility make it difficult for her to focus enough on keeping her home organized and which makes it hard to concentrate on her work
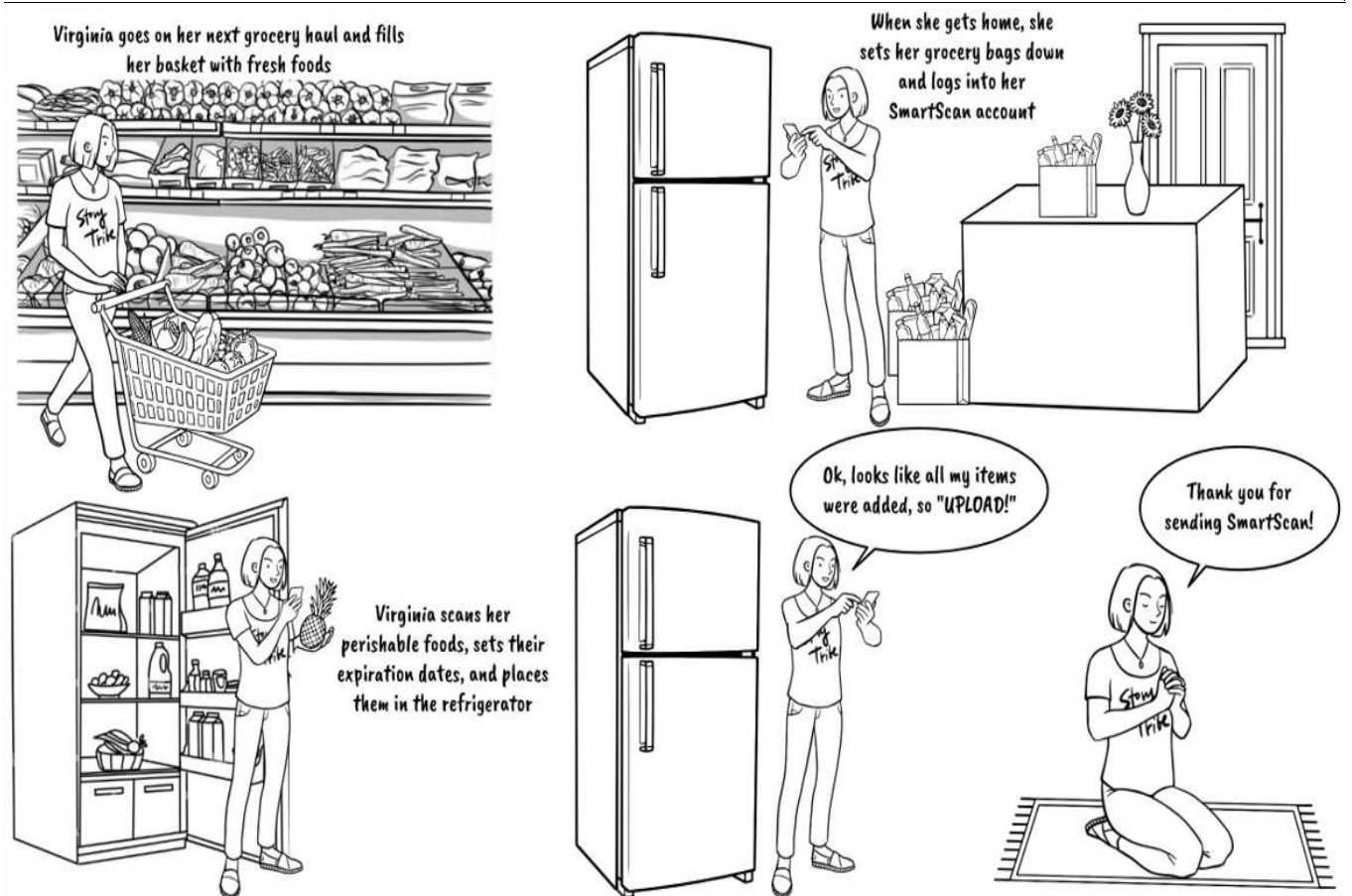
PERSONALITY

Judging — Perceiving

Analytical — Creative

Extrovert — Introvert

MOTIVATIONS

Social

Pride

Achievements

BRANDS

wayfair · Instagram · YouTube · Pinterest · facebook · THE HOME DEPOT

23

Virginia's Storyboard:

Persona 3:

ANDREW

"You don't fall behind. You fail forward."

SCENARIO

Andrew is a 26 year-old ambitious bachelor who works as an Elementary School teacher and personal fitness trainer. He recently relocated to Houston, TX and is trying to attract new clientele at the LA Fitness gym in his town, but is finding difficulty with competing with other trainers who have already achieved popularity at the facility. Looking the part is one way Andrew knows he will attract business, and to ensure this, he does a lot of juicing, making smoothies, and eating salads. He buys mostly organic non-GMO produce to make sure he gets as many nutrients as possible. The problem is, Andrew does not organize his foods in the refrigerator and often doesn't know ones to prioritize. So, much of his produce gets forgotten about long enough to grow moldy, and into the trash it goes. He decided the best thing he could do to help himself is utilize SmartScan.

BEHAVIORS

~ Working out
~ Grading students' homework
~ Creating curriculum-based assignments for students
~ Navigating social media pages to solicite new clientele

GOALS

~ Starting his own fitness club
~ Starting a YouTube channel and podcast to promote healthy living

FRUSTRATIONS

~ Struggles to pay his bills due to low-paying job as an Elementary School teacher
~ Sees peers exceling in their careers while he faces challenges trying to establish himself in a new town
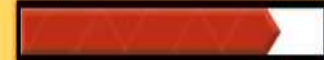
PERSONALITY

Judging — Perceiving

Analytical — Creative

Extrovert — Introvert
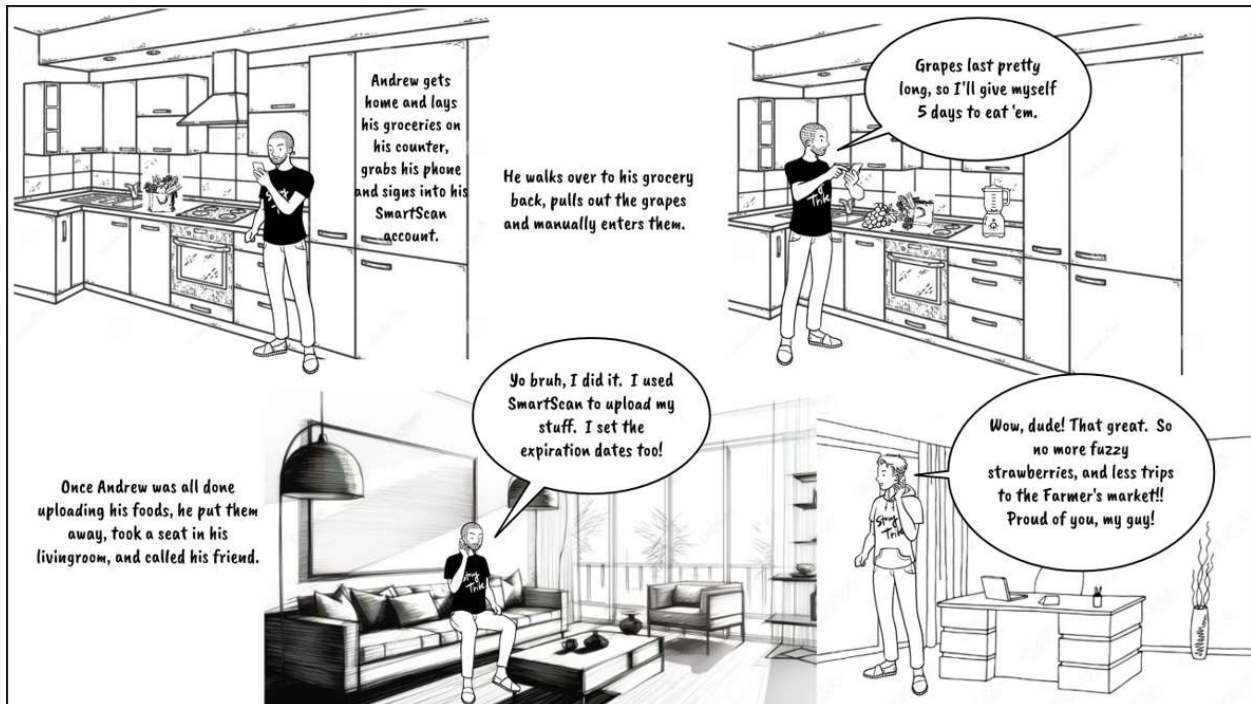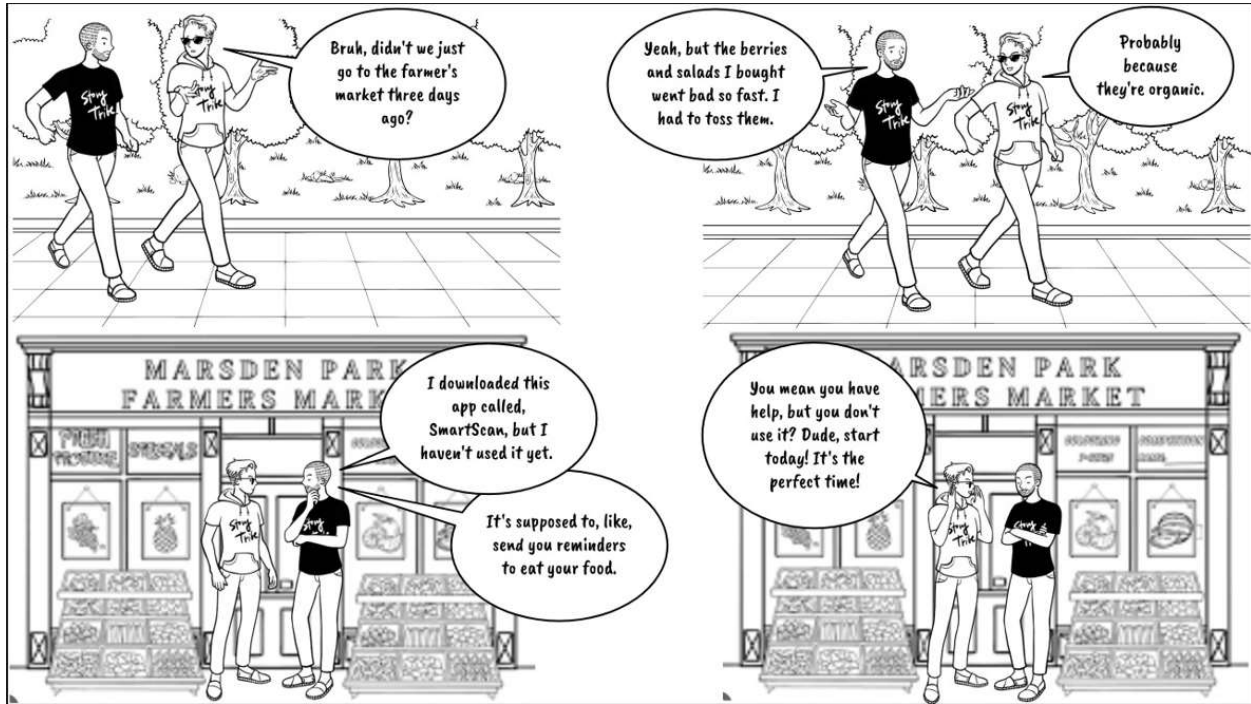
MOTIVATIONS

Social

Pride

Achievements

BRANDS

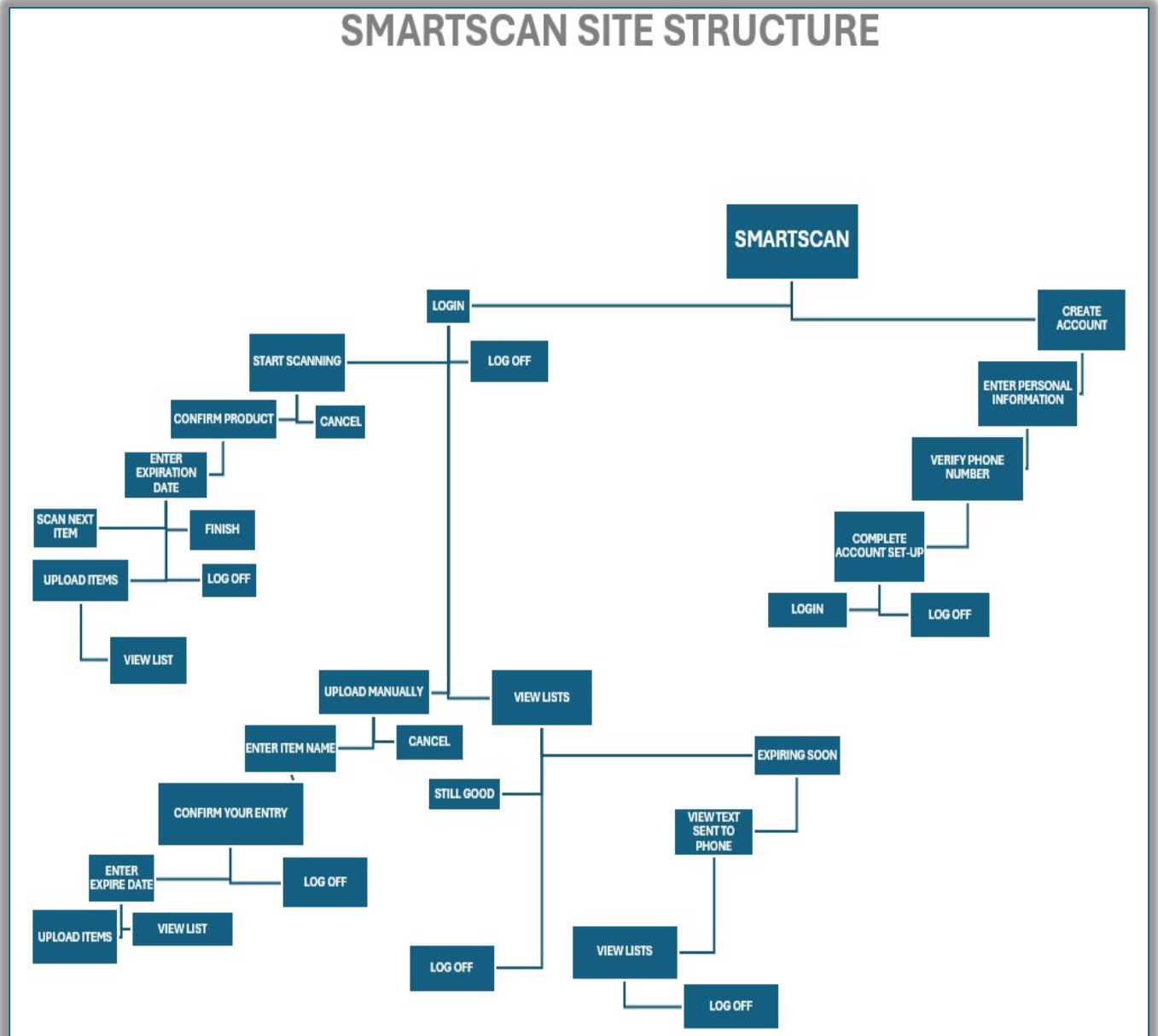Starbucks · DICK'S SPORTING GOODS · Instagram · TikTok · pressed · YouTube · facebook · NORDSTROM

Andrew's Storyboard:

Below is the site structure for the SmartScan application design. It shows how the application screens and content are arranged in a logical hierarchy.


Database Relationships

An important part of a successful interactive application is making sure the right relationships are established on the back end. When a user inputs their information, they expect to see the output reflect their entries, and if any calculations are to be made by the system, they should display outputs that are accurate. The SmartScan design will demonstrate this as illustrated below.

User & Perishables:
As shown on the right this user and <u>their</u> expiration dates have a one to many relationship in the system database.
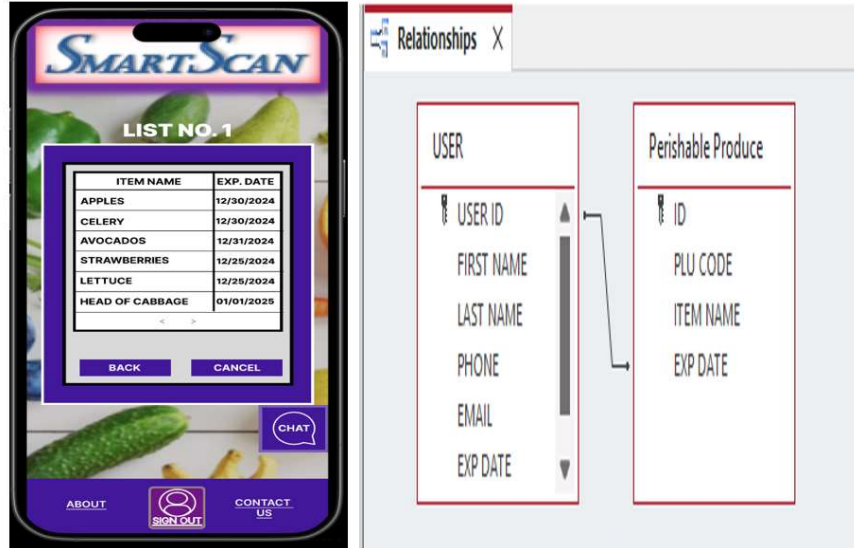
TECHNICAL SOLUTION DESIGN AND DEVELOPMENT 1.0

Prototype Version 1.0 – Black & White

Using paper and pencil I wanted to begin designing an interface that would mimic what users usually see on their phone screens when engaging with an application. I didn't want to create too many pages and felt it was important to be concise in terms of what the display showed. Throughout the process of creating the SmartScan application design, I consulted with different potential end users to gain insight into what they wanted to see on the various pages. The result was the below black and white prototype, consisting of 16 different screens. Click the object below to view the PPT for better visual.

BLACK & WHITE
PROTOTYPE.pptx

Note: to avoid duplications, I assigned more than 1 page number to a screen based on where the application would navigate to once a button was selected. For instance, since page 5 returns to page 1, instead of duplicating page 1 and calling it page 6, I added the number 6 to page 1 to demonstrate that.

SMARTSCAN PG's 1 & 6

2

SMARTSCAN PG 2

3

SMARTSCAN PG 3

SMARTSCAN PG 4

SMARTSCAN PG 5 (RETURNS TO PG 1)

6

SMARTSCAN PG 7

7

SMARTSCAN PG 8

SMARTSCAN PG 9

SMARTSCAN PG 10

10

SMARTSCAN PG's 11 & 17

11

SMARTSCAN PG 12

SMARTSCAN PG's 13 & 19

SMARTSCAN PG 14

SMARTSCAN PG 15

14

15

SMARTSCAN PG 16 (RETURNS TO PG 11)

SMARTSCAN PG 18 (RETURNS TO PG 13)

Testing and usability study

After sharing the above images with the participants from the interview and the instructor of this course, Feng Liu, some changes were made to improve the design. Where there were images of an item that was scanned, deletions were made, as this would call for a database with requirements beyond my current abilities and timeline. I also removed the component that would predict the item based on what the user would begin typing in the box provided when manually entering an item's name, along with the search icon. These too would call for additional design steps that my timeline did not accommodate.

Testable User Task List

Once the upgraded prototype was completed, I created a testable user task list in preparation for the next interview where participants would carry out different combinations of the following tasks.

- Task 1: User wishes to Create and Account in SmartScan App then sign out
- Task 2: User wishes to log into SmartScan account, scan groceries, set expiration dates, and upload items. Then sign out
- Task 3: User wishes to log into SmartScan account, manually enter grocery items, set expiration dates, and upload items. Then sign out

Technology solution Development and system version 2.0

I wanted SmartScan to look inviting to its users and relative to the purpose of the application. I also wanted to appeal to any desire to embrace a healthy diet and to inspire users to do more shopping around the perimeter of their grocery stores where the fresh fruits and vegetables are staged. So, I designed the background of the application interface to show the vibrant colors of carrots, cucumbers, bananas, etc. I put a black page on the back of it to blur the pictures of the image so that it would not strain the eyes while gazing upon the pages. By doing this, the user would be focused on the tasks at hand while thoughts of eating healthy were being uploaded to their sub consciences.

The SmartScan logo would be clearly seen across every page to create a memory around the brand. This would make it very easy for users to associate SmartScan with their shopping, meal planning, cooking, and food storage activities.

I feel purple is a very pleasant color and would make user feel a sense of fun and excitement while engaging with the application, so I made it the theme.

I wanted to keep the process of carrying out tasks on the application simple and stress free, so I included only what was necessary on the pages; every button and word phrase would be applicable to the specific task.

Following are the screenshots of the screens for this version of the SmartScan prototype. Click the object below to view the PDF for better visual or see link on landing page to view interactive prototype.

Collecting the success measure matrix and conduct data analysis

I sent the link to system version 2.0 (interactive prototype) and conducted individual interviews with 5 different people. The interviews lasted between about 5 and 15 minutes. This time lapse disparity was due in part to helping users see where certain tasks were not completed even though they assumed they were and helping them navigate back through the process while allowing them to give me feedback as to why they made the errors they did.

Most of the errors occurred due to a lack of emphasis on certain buttons; the users did not see the correct button and clicked another that seemed to be the correct next step.

For instance, on the "Enter Next Item Name" page, 2 out of 5 of the users missed the "confirm" button underneath the entry box and so chose to click the "finish" button lower on the screen. See screenshots of the pages below.
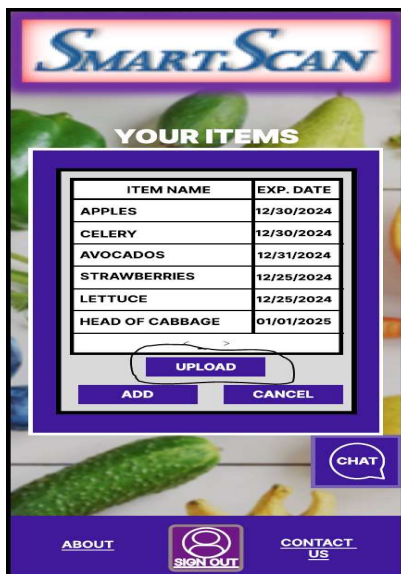
Correct choice
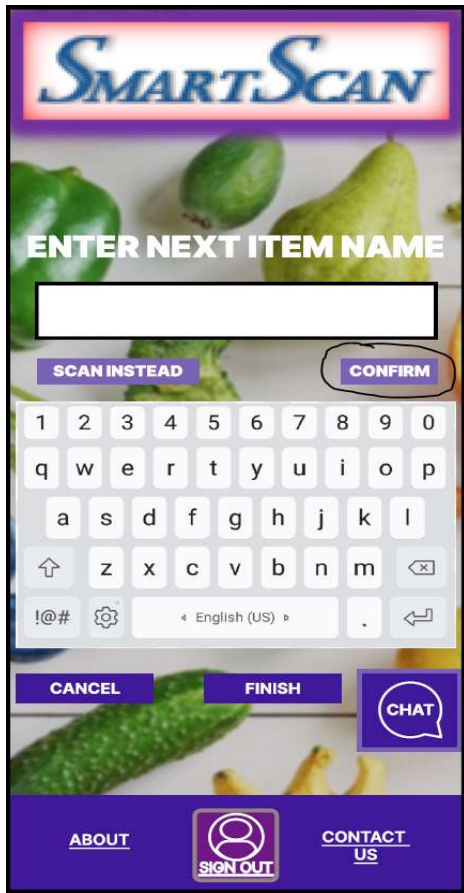
Incorrect choice
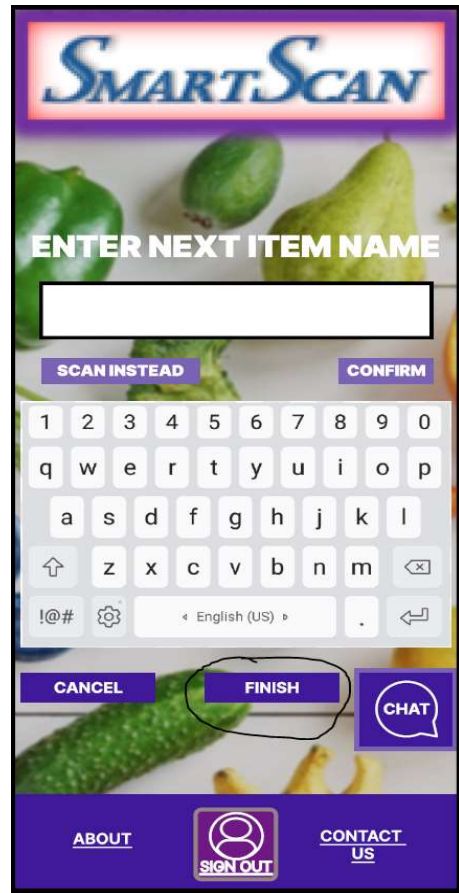
In addition to this, users skipped pressing the "upload" button on the "YOUR ITEMS" page. Seeing the list gave them the impression that the task was complete – that their items were saved and uploaded, so they clicked the "SIGN OUT" button. 2 out 5 participants made that mistake. See images below.

All participants successfully created accounts, logged in, scanned groceries, assigned expiration dates, manually entered items, view their stored lists, and signed out.

Some other feedback that I received from the participants was that the white lettering on some of the pages was difficult to see against the colorful backdrop. In addition, the lines placed under the dates in the "YOUR LISTS" page were not enough of an indication that this was a link that needed to be tapped to navigate to the "LIST NO. 1" page, where users could view the item names and expirations dates of the foods the uploaded. See image below.
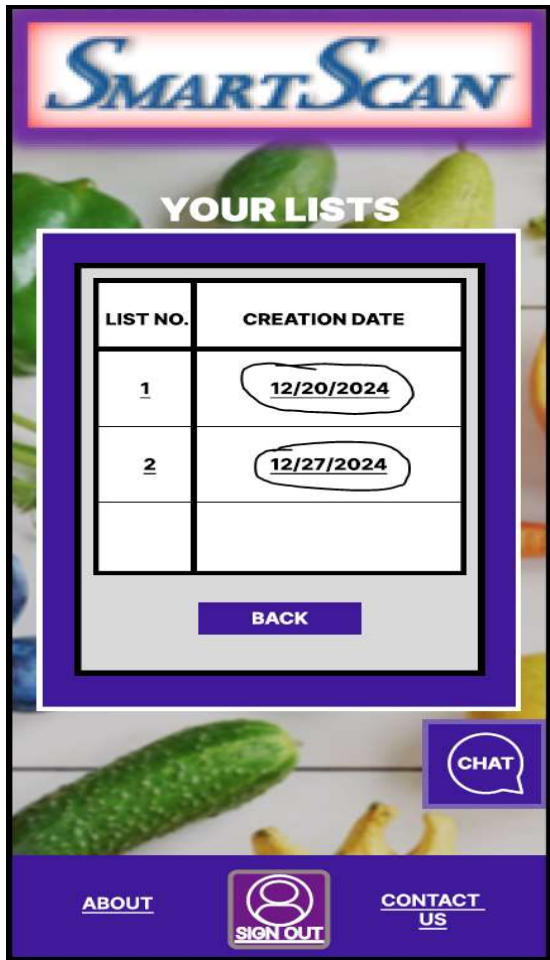
Success Measurement

The following are the results of the tasks carried out during the interview – how many participants were able to successfully complete the tasks unassisted and without error. See appendix IV for all 5 recorded interviews.

1. User will download the app and create an account – 5/5

2. User will sign in to the app - 5/5

3. User will scan their groceries then assign expiration date – 5/5

4. User will upload grocery list - 3/5

5. User will manually enter items then assign expiration date – 3/5

6. User will upload grocery list – 3/5

7. User will view their stored lists – 5/5

8. User will sign out – 5/5

Based on these results, I believe that I was able to make the changes necessary to address and eliminate all of the above issues.

Technology solution Development and system version 3.0

For the final version of the SmartScan prototype (3.0), I placed black strokes around the white lettering and increased the fonts so they would stand out more to the users. I also updated the pages where users would view their list of items uploaded to make it clearer where to tap.

The "CONFIRM" button under the manual entry window was enlarged to include the words, "CONFIRM YOUR ENTRY" so that users don't miss it and click the "FINISH" button instead.

Once the user navigates to the "YOUR ITEMS" list after clicking "FINISH" to signal that they are done scanning/manually entering their items and assigning expiration dates, they will see that I updated the wording on the page from "YOUR ITEMS" to "PRESS UPLOAD TO COMPLETE" so users know the task has not yet been completed. The choice to sign out will not be erroneously made here anymore.

Another adjustment that was made to make navigation easier was to the "YOUR LISTS" page. I removed the dates that were underlined to indicate that it was a link to an expanded list of uploaded items and expirations date, and provided clearer wording and a rectangular box around the wording to let the user know this should be tapped. There are two choices that could be made. The user could click "STILL GOOD" to see the items that still have a good number of days before expiring, or "EXPIRING SOON" to see which items are due to expire in the new few days or so.

The whole idea around creating this app was so that users could be reminded to eat the foods they have at home before they go bad, so I added one final page to demonstrate what a text alert to the user's mobile phone would look like. While the user is viewing the "EXPIRING SOON" page, they will have a choice to click a box called "VIEW TEXT SENT TO PHONE". This will

take them to the "NOTIFICATION ALERT" page, showing a text message on the phone screen. I also created a link in the text message to take the user to the "VIEW LISTS" page on the app. Click the PDF below to view the final prototype or click the "Interactive" link on my landing page.

SMARTSCAN
PROTOTYPE - 3.0.pd

Conclusion

We don't have to live in a world where food waste is the norm. But we tend to compartmentalize feelings of guilt for the parts we play in wasting food because of a lack of control over the situation. Life can be hard, and time gets away from us very easily. It is technology that has helped us not to lose our minds as we carry out our day-to-day tasks. The problem is some helpful tools are beyond the price points of many Americans who want to do better. As indicated in this document, all the participants of my interview do not own Smart refrigerators that come equipped with tools that can help the stay organized. I needed to create something for the little guys – for everyday people who are just as deserving of technological help as those within higher tax brackets.

SmartScan in its current state, is just the beginning of the solution to the problem of individual food waste. I will continue to build on my design to make it as optimal as possible. Taking your phone out and logging into SmartScan will become standard behavior for grocery shoppers across the country and, hopefully, around the world. Afterall, food waste is a global issue.

Creating this design wasn't just challenging; it was inspiring. I have more motivation to see it through than I had at the outset of this project, and I have every intention of protecting and nurturing it so that by the time it is rolled out as an official Smart phone application, I will already have design updates and improvements underway.

If you took nothing else from this project, remember this. Home is where the food is!

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a1186358482

Appendices

Appendix I

http://informatics.mercer.edu/~meahh/PRELIMINARY%20INTERVIEW.mp4

Copy and paste links into your web browser if clicking does not open links

Appendix II

CONSENT
FORM.pdf

Appendix III

CITI Program
Completion Certifica

Appendix IV

http://informatics.mercer.edu/~meahh/ANDRIE%20PROTOTYPE%20INTERVIEW.mp4

http://informatics.mercer.edu/~meahh/CHERYSE%20PROTOTYPE%20INTERVIEW.mp4

http://informatics.mercer.edu/~meahh/JO%20JO%20PROTOTYPE%20INTERVIEW.mp4

http://informatics.mercer.edu/~meahh/LEAH%20PROTOTYPE%20INTERVIEW.mp4

http://informatics.mercer.edu/~meahh/VIRGINIA%20PROTOTYPE%20INTERVIEW.mp4

Copy and paste links into your web browser if clicking does not open links