

PROJECT 2: MOBILE INTERFACES

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Insta-Finance: An Efficient Mobile Money Management Interface

PART 1: INTRODUCTION

a) Problem Domain/Problem Space

Our problem domain focused on monitoring and tracking users' various consumption behaviors and expenditure patterns. Our problem space specifically focused on key usability issues that hindered user's ability to track, monitor, and manage their personal finances. The problem space included storing, categorizing, and analyzing the user's spending patterns, using this expenditure analysis to optimize budgeting and planning of personal financial assets, real-time money management through recommendations, mobile interface layout/organization, UI/UX GUIs, and user-directed navigation. Some elements that we sought to address included intuitive interactions through GUI that emphasized recognition rather than recall, visibility of system status, seamless navigation to guide the user's experience that gave user control and freedom, and an All-In-One overview of all elements in our interface

b) Needs

Some needs that we identified for designing our mobile app interface where real-time and cross-platform functionalities to guarantee portability, ease of access, and ubiquity. Another need was to enable an integrated single view so that the user can have an overview of their expenses as well as their current budget. With this design idea, we also determined that categorizing and color-coding expenses based on higher-level abstractions like significance of purchase, timing of purchase, reasons and motivations behind the purchase, type of purchase, cost of item, and the item purchased would provide users with a categorical visualization of their spending trends and budget. We also identified that privacy leaks regarding user's account details, fund usage, and other financial information could be vulnerable to security threats which is a key user need to be addressed. We attempt to address this by providing a real-time authentication code for read-only access to personal financing details to eliminate security risks. Integrating all these

needs, we devised an application solution with the following functionalities:

1. A functionality to plan out the user's budget before that day given identified expense trends/patterns.
2. Daily budget recommendations based on previous spending calculated by taking a weighted average of each category.
3. A weekly progress report on user expenses to track and monitor their past spending history.
4. A money management plan that simultaneously evaluates current budget given user's spending history.
5. A real-time alarm that alerts users if spending for a certain category exceeds current budget level.

c) Target User Base

Our general target user base is all users who are consumers that expend on a daily basis. In a free market economy, expenditures are a key aspect of economic activities. Specifically, we wanted to target users who are seeking to efficiently allocate their financial assets to optimize budget planning, accommodate real-time financial management, and provide meaningful recommendations with regards to their spending. Ultimately, we wanted to target a user base who are active consumers in the market economy. We thought that by tracking and monitoring user expenditure patterns we were able to assess, understand, and analyze personal financing issues. This will provide a meaningful financial management solution to users by optimizing user budgeting and planning for future expenses by incorporating a real-time expenditure tracking app.

PART 2: UNDERSTANDING

a) Overview: We used a cultural probe because we wanted to capture meaningful experience as it takes place in the context of the user's natural settings. However, because it is impossible to directly observe the participants at all times, we decided to give them a cultural probe to capture meaningful information from the user's experiences. Specifically, we gave the users a cultural probe over a one week time window and asked them to fill out and self-report their expense patterns. We decided to use a cultural probe because user spending patterns are repeated and intermittent events that are spread out unevenly throughout the day in unpredictable environments. To address all of these issues and track and monitor the user's spending patterns throughout the day, we determined that cultural probes were appropriate

b) Design Space & Goals

Because we wanted to capture information in context of repeated and intermittent task exposure/experiences in the participants' natural setting, we gave each participant a cultural probe and a task associated with the given probe, namely requesting them to file a self-report of their weekly expenditures and consumption patterns over a one-week period using Google Forms. We integrated various higher-level focal points and categories as columns of our entry. This supports our goal of understanding user needs in our problem domain because data about participant buying patterns could be categorized on key higher-level categories. Ultimately, we wanted to track and monitor user expenditure patterns to assess, understand, and analyze personal financing issues. By optimizing user budgeting and planning for future expenses using a real-time expenditure tracking app we enable efficient allocation of personal financial assets and simultaneous money management, especially for college students who tend to be under a tight budget.

c) Problems Identified

Application content organization was a potential problem that hindered the user's personal financial management process. This meant that users have difficulty learning and navigating throughout our application. Another potential problem we identified was privacy leaks regarding user's account details, fund usage, and other financial information. Since banking details are privacy-sensitive information, they need to be secure, confidential, and discrete. We recognize data leakage as a potential vulnerability to security threats. Another problem we identified was the ability to implement a real-time budgeting recommendation functionality based on user's expense analysis. This means that we need to integrate statistical measures to quantitatively analyze user's spending patterns. Initially, we intended to design our cultural probe by requesting users to file and report each purchase on notecards in a binder ring. However, we realized that this approach was inefficient and inconvenient because purchases are made in random locations and the users had to always carry the notecards with them. In addition, since the number of purchases a participant makes in a week occurred in intermittent intervals, it was difficult to assess how many notecards to give to each participant. We concluded that the best design for our cultural probe is an online form for each user. Every time the user makes a purchase, they submit a corresponding entry on the online form. Each user was given a unique form link, which enabled us to isolate each participant's purchases. Since the user was able to fill out the forms on their phone, this guaranteed both convenience and portability. Additionally, since each purchase is an additional submission that corresponded to an entry in our table, our cultural probe design eliminated redundancy while maintaining data integrity, reproducibility, and consistency. Finally, we decided to integrate quantitative and qualitative approaches by statistically analyzing self-reported expenditure patterns and conducting an open-ended follow-up interview to collect snapshots of each user's thoughts,

feelings, and motivations regarding each purchase.

d) Participants

To make our problem domain focused, we restricted our target population group to current college students at a public university (UW-Madison). We thought that a cultural probe was appropriate because we determined that the nature of our given task associated with the cultural probe (self-reporting of intermittent daily expenses over a one-week period) would give sufficient in-situ datapoints regarding daily expenses that occurred in intermittent intervals. We decided to use a cultural probe targeting college students because we identified that college students were in unpredictable environments especially during the COVID-19 pandemic, constantly on the move, and not comfortable with us observing them all the time. In this way, we attempted to focus our principle of representation to better identify and understand user needs within the personal finance domain.

e) User Demographics Analysis

We conducted a cultural probe on three college students (participant A, B, and C from hereon to maintain anonymity and confidentiality) who are current attendees at UW. Participant A is a junior (23 years old), female, and a STEM major. Participant B is a senior (23 years old), male, and a computer science major. Participant C is a male senior (24 years old) and a finance major

e) Cultural Probe Design: Initially, we intended to design our cultural probe by requesting users to file and report each purchase on notecards in a binder ring. However, we realized that this approach was inefficient and inconvenient because purchases are made in random locations and the users had to always carry the notecards with them. In addition, since the number of purchases a participant makes in a week occurred in intermittent intervals, it was difficult to assess how many notecards to give to each participant. We concluded that the best

design for our cultural probe is an online form for each user. Every time the user makes a purchase, they submit a corresponding entry on the online form. Each user was given a unique form link, which enabled us to isolate each participant's purchases. Since the user was able to fill out the forms on their phone, this guaranteed both convenience and portability. Additionally, since each purchase is an additional submission that corresponded to an entry in our table, our cultural probe design eliminated redundancy while maintaining data integrity, reproducibility, and consistency. Finally, we decided to integrate quantitative and qualitative approaches by statistically analyzing self-reported expenditure patterns and conducting an open-ended follow-up interview to collect snapshots of each user's thoughts, feelings, and motivations regarding each purchase.

f) Cultural Probe Process

Step 1: We held face-to-face briefings, with the participants, introduced project goals as mentioned in part b) and debriefed them about the required probe tasks.

Step 2: The required probe task involved giving each participant a cultural probe and a task associated with the given probe, namely requesting them to file a self-report of their weekly expenditures and consumption patterns over a one-week period using Google Forms. We integrated various higher-level focal points and categories as columns of our entry to use as subpanel titles in our application interface design.

Step 3: We conducted intermediary follow-up interviews to check-in and verify the quality of our data. Our follow-up questions were formulated to address points that could not be extracted from the self-report; they were conducted to gain a qualitative insight and understanding of user's thoughts, feelings, and motivations regarding each purchase.

Step 4: We received the cultural probes in real-time over Google Forms

Step 5: We conducted a final interview to debrief the participants on our findings and direction of our project

g) Cultural Probe

Background Information of Users for Cultural Probe

Each user only fills out this form once. The goal is to gauge their weekly budget and then also see the impact of the seriousness of the budget upon the actual data we get.

Figure 1

Form Users Submit for Every Purchase Made

This form is filled out after each purchase the user makes. The data fields that we collect are Item Bought, Cost of Item, Day of Week, Purchased, Time, Type of Purchase, Reason of Purchase, and Significance of Purchase.

Figure 2

Cultural Probe Collected (example using participant 1)

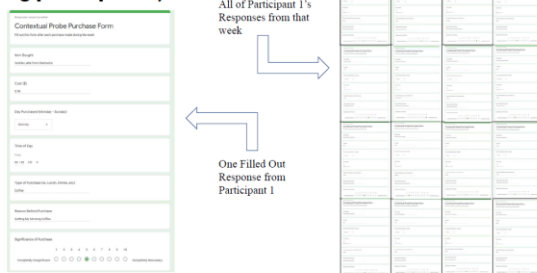


Figure 3

h) Quality Control Procedures

Since our cultural probe is a self-report from the participants, our quality control procedures involved using a real-time, online, mobile phone-based submission form that corresponds to each purchase. This design ensured efficiency, convenience, and portability of the self-report. Prior to conducting the cultural

probe, we provided each participant with a 15-minute debriefing session to clarify the goals, overview, procedures, context, and timeframe of our study. Each purchase was an entry in our table and were categorized based on columns that provided insight on higher-level focal points such as significance of purchase, reasons behind the purchase, cost of item, etc.

i) Focal Points: There were numerous data points that we extracted from our cultural probe. In terms of higher-level data focal points, we focused on the significance of purchase, timing of purchase, reasons and motivations behind the purchase, type of purchase, cost of item, and the item purchased. We categorized these higher-level focal points as columns that corresponded to specific purchases in our table entry.

j) Data Collection: Data was collected by requesting participants to file a self-report of their weekly expenditures and consumption patterns on Google Forms over a one-week period. Every entry on the submitted Google Forms corresponded with each purchase that each participant made throughout the week. Open-ended follow-up interview was conducted to assess how each purchasing decision was made and user experience regarding each purchase. We also color-coded each type of purchase in our data to visually categorize each type of purchasing item.

k) Data Collection: Participant 1

Type of Purchase						
Essentials						
Luxury						
Miscellaneous						
*Note that all follow up interviews are on separate sheets						
Participant 1						
Weekly Budget: \$150						
Item	Cost	Time of Day	Day of Week	Type of Purchase	Reason Behind Purchase	Significance of Purchase (1-10)
Vanilla Latte from Starbucks	\$2.50	9:40 AM	Monday	Coffee	Getting my Morning Coffee	5
Korean BBQ Buffet from Gildes	\$15.50	12:30 PM	Monday	Lunch	Eating Lunch With Friends	7
Groceries from Fresh Market	\$36.79	2:30 PM	Monday	Groceries	Getting Essential Groceries for the Week	9
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Tuesday	Coffee	Getting my Morning Coffee	5
Pizza from Lucille	\$21.40	12:30 PM	Tuesday	Lunch	Ordering Food for Lunch	6
Materials for Class Project	\$19.45	3:20 PM	Tuesday	School Materials	Necessaries Items for a Class Project	10
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Wednesday	Coffee	Getting my Morning Coffee	5
Chiliies from Urban Outfitters	\$39.20	1:30 PM	Wednesday	Chiliies	Buying a Few Shirts	4
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Thursday	Coffee	Getting my Morning Coffee	5
Random Items from Target	\$36.10	11:45 AM	Thursday	Shopping	Getting a Few Items for the Apartment	7
Vanilla Latte from Starbucks	\$5.50	11:45 AM	Friday	Coffee	Getting my Morning Coffee	5
Drinks from The Double U	\$19.56	10:00 PM	Friday	Drinks	Grabbing Drinks with Friends	4
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Saturday	Coffee	Getting my Morning Coffee	5
Drinks from The Double U	\$11.00	11:16 PM	Saturday	Drinks	Grabbing Drinks with Friends	4
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Sunday	Coffee	Getting my Morning Coffee	5
Dinner + Shake from CULX	\$18.20	7:10 PM	Sunday	Dinner	Friends Birthday Dinner	6
Total		\$182.20				

Figure 1

Participant 2

Participant 2						
Weekly Budget: \$300						
Item	Cost	Time of Day	Day of Week	Type of Purchase	Reason Behind Purchase	Importance of Purchase (1-10)
Groceries from Aldi	\$12.50	10:30-12:00	Monday	Groceries	Getting Essential Groceries for the Week	10
Legion Vietnamese Sandwich	\$5.15	1:15-2:00	Monday	Lunch	Eating Lunch after workout	8
Bluetooth Speaker	\$45.50	4:30-5:00	Monday	Accessories	Getting a loud speaker to play music	2
Venti Mocha Frappé from Starbucks	\$7.80	8:30-9:00	Tuesday	Coffee	Starting the day with a coffee	6
Clothes from Thrift Store	\$10.00	12:30-2:00	Tuesday	Clothes	Getting some nice clothes with friends	4
Legion Vietnamese Sandwich	\$5.15	1:30-2:00	Tuesday	Lunch	Eating lunch after tennis	8
Venti Mocha Frappé from Starbucks	\$7.80	8:45-9:00	Wednesday	Coffee	Getting Coffee with some friends	4
Groceries from Aldi	\$12.50	9:00-10:00	Wednesday	Groceries	Getting Essential Groceries for the Week	10
Shower Head	\$15.00	5:30-6:00	Wednesday	Utility	Getting a shower head for the bathroom	5
Groceries from Aldi	\$12.50	9:30-10:00	Thursday	Groceries	Getting Essential Groceries for the Week	10
Clothes from Thrift Store	\$8.00	1:00-1:30	Thursday	Clothes	Getting some nice clothes with friends	4
Drinks from Wanda's	\$11.50	11:00-12:00	Friday	Drinks	Getting Drinks with some friends	3
Groceries from Aldi	\$12.50	10:30-12:00	Friday	Groceries	Getting Essential Groceries for the Week	10
Drinks from Wanda's	\$11.50	11:00-12:00	Friday	Drinks	Getting drinks with some friends	3
Tall Mocha Frappé from Starbucks	\$6.00	8:45-9:00	Saturday	Coffee	Getting Coffee with some friends	4
Drinks from Wanda's	\$11.50	11:00-12:00	Saturday	Drinks	Getting drinks with some friends	3
Groceries from Aldi	\$12.50	9:30-10:00	Sunday	Groceries	Getting Essential Groceries for the Week	10
Total: \$197.30						

Figure 2

Participant 3

Participant 3						
Weekly Budget: \$300						
Batatas Rancheros from Forage	\$9.00	11:30AM	Monday	Breakfast	Eating Breakfast with Friends	8
Peace Kombucha from Forage	\$2.85	11:30-12:00	Monday	Beverage	Beverage to Drink with Food	6
Groceries from Madison Fresh	\$29.35	7:30PM	Monday	Groceries	Groceries for Tonight's Dinner	10
JUUL Pod from 7-Eleven	\$20.99	2:30PM	Tuesday	Miscellaneous	Friend is a Nicotine Addict	3
Alcohol from Riley's	\$42.50	8:30PM	Tuesday	Miscellaneous	For the House Party This Weekend	3
Snacks from Budget Market	\$5.25	12:30PM	Wednesday	Food	Snacks Between Classes	5
Uber to Friend's House	\$7.00	11:00PM	Wednesday	Transportation	Takes Uber to Friend's House	4
Amazon Transaction Settled (Clothes & Videogames)	\$121.80	2:30AM	Thursday	Shopping	Online Shopping	4
Chipotle for Lunch	\$12.50	1:00PM	Thursday	Eating	Lunch	10
Starbucks Americano	\$4.25	10:00AM	Friday	Coffee	Coffee To Start the Day	4
Five Guys for Dinner	\$13.50	7:30PM	Friday	Eating	Dinner	10
JUUL Pod from 7-Eleven	\$20.99	7:30PM	Saturday	Miscellaneous	Friend is a Nicotine Addict	3
Drinks from Nitty Gritty	\$30.00	9:30PM	Saturday	Miscellaneous	Drinks from A Bar	3
Hopert from Sage for Dinner	\$16.35	7:30PM	Sunday	Eating	Dinner	10
Groceries from Madison Fresh	\$21.00	12:30PM	Sunday	Groceries	Groceries for Tonight's Dinner	10
Total: \$87.88						

Figure 3

I) Data Analysis

Part 1: Affinity Diagrams

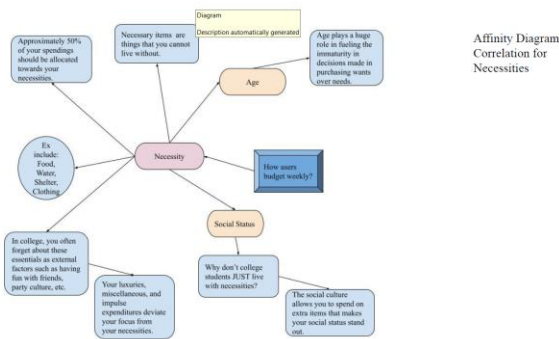


Figure 4

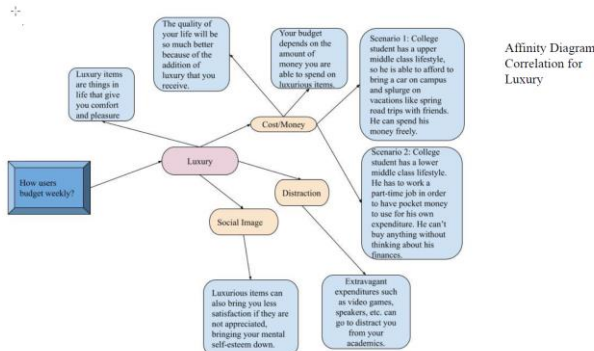


Figure 5

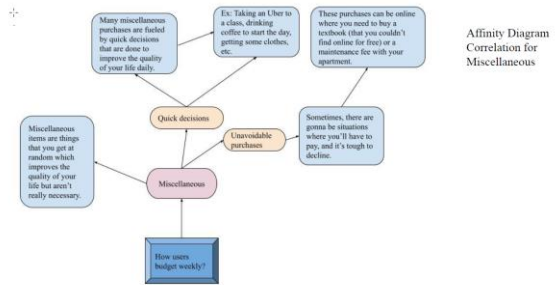


Figure 6

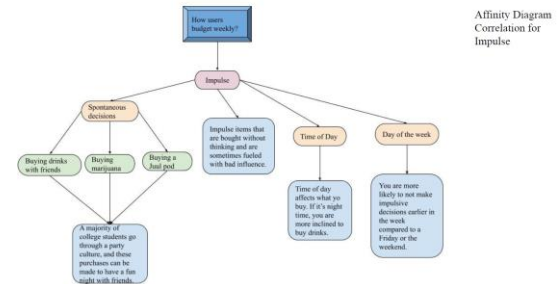


Figure 7

Part 2: Statistical Analysis

These graphs relate to each other because it allows to



As you can see in this graph, there is a positive correlation between lower average significance of purchase as you progress through the week.



As you can see in this graph, there is a positive correlation between daily spending decreasing (except for the outlier of participant 3) as the week goes on.

Figure 8

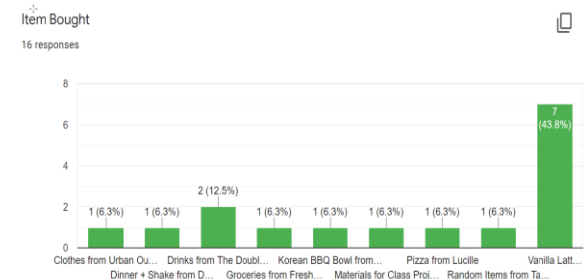


Figure 9

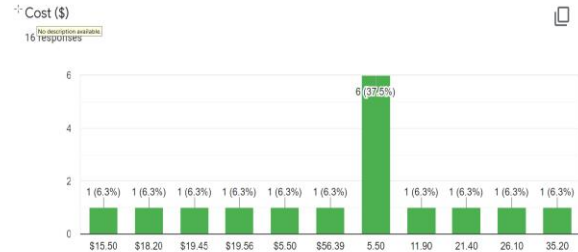


Figure 10

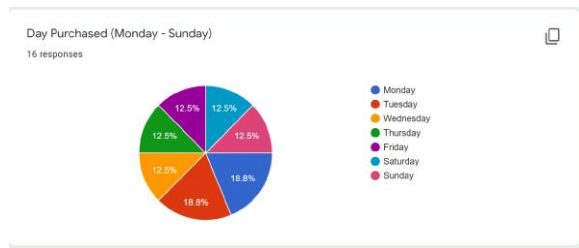


Figure 11
Time of Day
16 responses

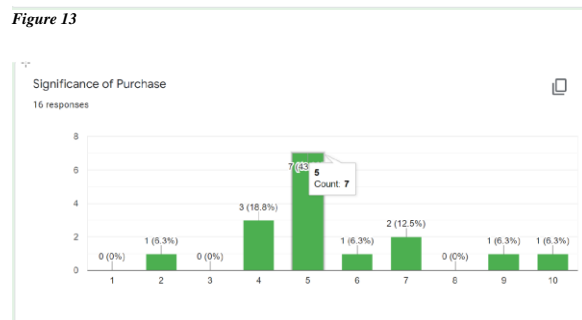
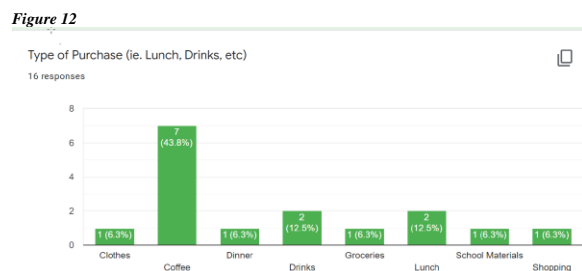
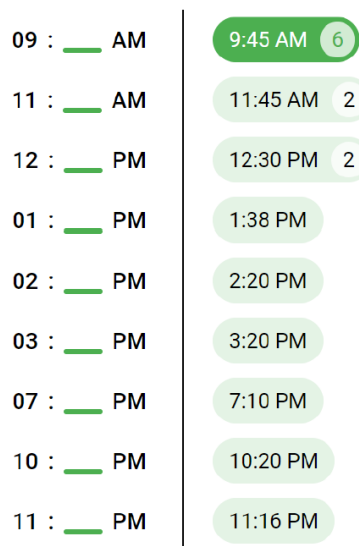


Figure 14

m) Stories The stories generated attempted to capture key higher-level concepts regarding a user's buying patterns throughout the time of the day and week. It captures categorical information on how personal assets were allocated as well as the implications, trends and patterns associated with buying behavior. Our stories also address key design opportunities, workarounds, and solutions to a particular user's context from the collected data.

Participant A: "Participant A went way beyond her weekly budget, spending a grand total of \$262.2 given her weekly budget of \$150. Despite her tight weekly budget, she seemed to spend recklessly on miscellaneous items such as coffee, dining out, and alcohol. Being an avid fan of Starbucks and a Vanilla-Latte addict, she spent 20% of her total expenses to indulge in caffeine. Her spending was irregular and there was no distinctively identifiable trend besides her frequent indulgence in coffee. At the beginning of the week, she ate out more frequently but attempted to offset her reckless spending by cutting down on dining costs. A possible design approach for participant A would be a real-time expense tracker with alarm functionalities that could remind participant A an overview of her expenses vs current budget.

Participant B: "Participant B was more economic, spending a total of \$149.8 over a weekly period given a budget of \$200. He tended to leverage and balance his spending by limiting his spending on luxury items as evident in his decision to purchase clothes from the Thrift Store, which sells used clothing at an affordable price. Participant B also limited his expenses over the time window by going on grocery shopping regularly and frequently, only buying what he needs at that moment. This is evident in that he spends less than \$20 on each grocery shopping. A possible design approach for participant B

would be an app with money management functionalities that provides a single-view of his expenses organized based on expense categories. Since participant B is economic and was able to have a positive balance, an app with a savings option would be beneficial too.”

Participant C: “Participant C surpassed his daily budget by about \$90. He spent \$387.33 given his weekly budget of \$300. Participant C’s spending was unplanned and reckless. 5 out of his 13 purchases were color-coded red, which were impulse purchases. Being a nicotine addict and a social butterfly, more than 30% of his expenses accounted for buying JUUL pods, alcohol, and personal shopping. Although he did not consume a lot of miscellaneous goods besides snacks at the Badger Market, he dined out frequently, almost on a daily basis. A great design approach for participant B might be a real-time alarm that monitors and tracks his consumption patterns and alerts him on his impulsive purchases.

n) Findings:

After organizing, distilling, and modeling key information from the data that we have collected using affinity diagrams, statistical/quantitative analysis, and graphical analysis, we have summarized our findings and corresponding evidences in the list below:

1. Participants tended to spend additional money on impulsive/social purchases which they categorized as low significance, which constrained their budget for necessity goods

Evidence: Refer to average significance of level (categorical spending vs significance level) and monitoring daily spending graph

2. Participants with more lenient weekly budgets tended to forget about their budget as the week went on. In other words, their spending habits were not affected by the budget due to lack of focus on the current budget

Evidence: Refer to cost bar graph and time of day/day purchased (time of week) chart

3. Participants with a stricter budget tended to overcompensate on saving money after making a relatively expensive purchase on a non-necessary good

Evidence: Refer to timing of purchases on the raw data collected

4. Participants struggled to manage their budget due to unclear planning on what they were going to spend money on that day, making it hard to keep track of the budgeting since most purchases were made without forethought.

Evidence: Refer to affinity diagrams, and monitoring expenditure patterns graph

5. Participants with less strict weekly budgets tended to overspend on non-essential goods which led to exceeding the initial weekly budget that they had set.

Evidence: Refer to timing of purchases on the raw data collected and time of day/day purchased (time of week) chart

6. Participants’ spending habits changed due to the Covid-19 pandemic. Since our demographic target population was college students, weekday/weekend spending patterns tended to blend due to lack of in-person classes. However, in general, participants’ tended to spend more on low significance purchases during weekends.

Evidence: Refer to google forms questionnaire, follow-up interview, affinity diagrams, and monitoring expenditure patterns graph

7. No one was truly satisfied with how they budgeted their money for that week and believed that trying to track their budget by themselves manually led to poor money management.

Evidence: Refer to google forms questionnaire, affinity diagrams & follow-up interview

PART 3: IDEATION

a) Breakdowns: Some breakdowns that we identified were the user's ability to track, monitor, and manage their personal finances. The problem space included storing, categorizing, and analyzing the user's spending patterns, using this expenditure analysis to optimize budgeting and planning of personal financial assets, real-time money management through recommendations, mobile interface layout/organization, UI/UX GUIs, and user-directed navigation. Some elements that we sought to address included intuitive interactions through GUI that emphasized recognition rather than recall, visibility of system status, seamless navigation to guide the user's experience that gave user control and freedom, and an All-In-One overview of all elements in our interface

b) Overview: We identified design ideas from the breakdowns and opportunities that we identified during the cultural probes, data analysis, and findings. Some ideas that we identified after distilling our data and identifying breakdowns is that the mobile app interface needs to be real-time and cross-platform to guarantee portability, ease of access, and ubiquity (Figure 7). Another design opportunity is to enable an integrated single view so that the user can have an overview of their expenses as well as their current budget. With this design idea, we also determined that categorizing and color-coding expenses based on higher-level abstractions like significance of purchase, timing of purchase, reasons and motivations behind the purchase, type of purchase, cost of item, and the item purchased would provide users with a categorical visualization of their spending trends and budget (Figure 13). We also identified that privacy leaks regarding user's account details, fund usage, and other financial information could be vulnerable to security threats (Cultural Probe 1). We attempt to address

this by providing a real-time authentication code for read-only access to personal financing details to eliminate security risks. Integrating all these design opportunities, we devised an application solution with the following functionalities:

DESIGN IDEA 1. A functionality to provide a weekly progress report on user expenses to track and monitor their past spending history and plan out the user's budget before that day given identified expense trends/patterns accordingly

This is because there were identifiable patterns in user expenses. For example, according to findings 5 (Diagram 1) and finding 3 (Diagram 2 & 3), Participants with less strict weekly budgets tended to overspend on non-essential goods which led to exceeding the initial weekly budget that they had set. Conversely, participants with a stricter budget tended to overcompensate on saving money after making a relatively expensive purchase on a non-necessary good. (Diagram 3). Please refer to the following diagrams for evidences from data gathered.

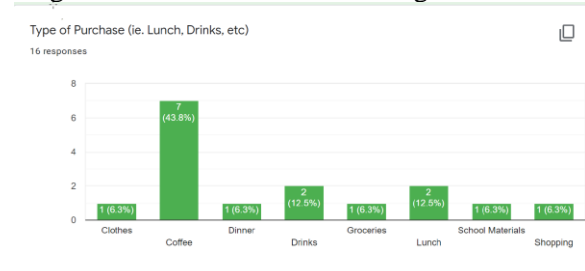


Diagram 1

Time of Day

16 responses

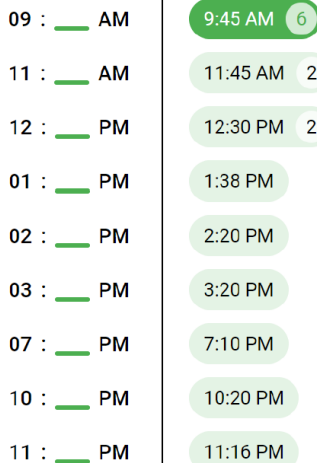


Diagram 2

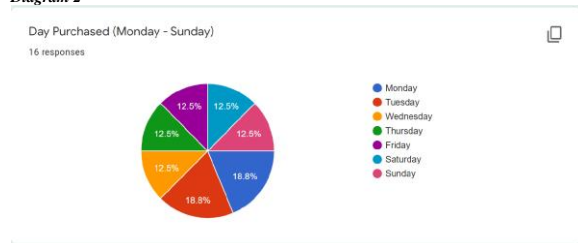


Diagram 3

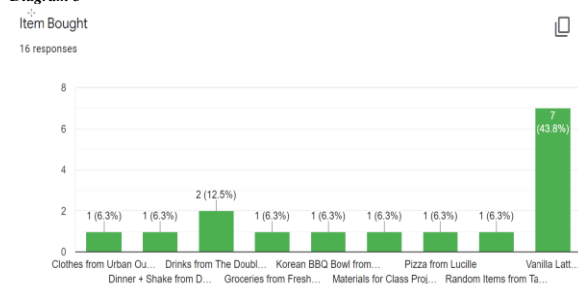


Diagram 4

DESIGN IDEA 2. A real-time alarm that alerts users if spending for a certain category exceeds current budget level.

This is because according to finding 7, no one was truly satisfied with how they budgeted their money for that week and believed that trying to track their budget by themselves manually led to poor money management. Furthermore, according to finding 4, participants struggled to manage

their budget due to unclear planning on what they were going to spend money on that day, making it hard to keep track of the budgeting since most purchases were made without forethought. Refer to the following diagrams as evidences to observe how real-time alarm alerts can be useful in addressing these breakdowns.



Diagram 5

Type of Purchase	Cost	Time of Day	Day of Week	Type of Purchase	Reason Behind Purchase	Significance of Purchase (1-10)
Necessity						
Luxury						
Impulse						
Misadventure						
Participant 1						
Weekly Budget: \$150						
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Monday	Coffee	Getting my Morning Coffee	5
Korean BBQ Bowl from Gubbi	\$15.50	12:30 PM	Monday	Lunch	Eating Lunch With Friends	7
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Vanilla Latte from Starbucks	\$5.50	9:45 AM	Saturday	Coffee	Getting my Morning Coffee	5
Drinks from The Double U	\$11.90	11:16 PM	Saturday	Drinks	Grabbing Drinks with Friends	4
Vanilla Latte from Starbucks	\$5.50	9:45 AM	Sunday	Coffee	Getting my Morning Coffee	5
Dinner + Shake from DLUX	\$18.20	7:10 PM	Sunday	Dinner	Friends Birthday Dinner	6
Total	\$262.20					

Diagram 6

Type of Purchase	Cost	Time of Day	Day of Week	Type of Purchase	Reason Behind Purchase	Importance of Purchase (1-10)	Day of the Week
Necessity							
Luxury							
Impulse							
Misadventure							
Participant 2							
Weekly Budget: \$200							
Groceries from Aldi	\$22.50	10:30 AM	Monday	Groceries	Getting Essential Groceries for the Week	10	
Longan Vietnamese Sandwich	\$5.15	1:15 PM	Monday	Lunch	Eating Lunch after workout	8	
Macaroni Salad	\$40.50	4:30 PM	Monday	Appetizers	Getting a food order to play music	7	
Vanilla Mocha Frappé from Starbucks	\$7.00	8:30 AM	Tuesday	Coffee	Starting the day with a coffee	4	
Clothes from Urban Outfitters	\$15.00	1:30 PM	Tuesday	Clothes	Getting some nice clothes with friends	4	
Longan Vietnamese Sandwich	\$5.15	1:30 PM	Tuesday	Lunch	Eating lunch after tennis	8	
Vanilla Mocha Frappé from Starbucks	\$7.00	8:45 AM	Wednesday	Coffee	Getting Coffee with some friends	4	
Groceries from Aldi	\$22.50	9:00 AM	Wednesday	Groceries	Getting Essential Groceries for the Week	10	
Shower Head	\$15.00	5:30 PM	Wednesday	Utility	Getting a shower head for the bathroom	5	
Groceries from Aldi	\$22.50	9:30 AM	Thursday	Groceries	Getting Essential Groceries for the Week	10	
Clothes from Urban Outfitters	\$5.00	1:00 PM	Thursday	Clothes	Getting some nice clothes with friends	4	
Drinks from Starbucks	\$5.50	11:00 AM	Thursday	Drinks	Getting Drinks with some friends	3	
Groceries from Aldi	\$22.50	10:30 AM	Friday	Groceries	Getting Essential Groceries for the Week	10	
Drinks from Starbucks	\$5.50	11:00 AM	Friday	Drinks	Getting Drinks with some friends	3	
Vanilla Mocha Frappé from Starbucks	\$7.00	8:45 AM	Saturday	Coffee	Getting Coffee with some friends	4	
Drinks from Starbucks	\$5.50	11:00 AM	Saturday	Drinks	Getting Drinks with some friends	3	
Groceries from Aldi	\$22.50	9:30 AM	Sunday	Groceries	Getting Essential Groceries for the Week	10	
Total	\$387.30						

Diagram 7

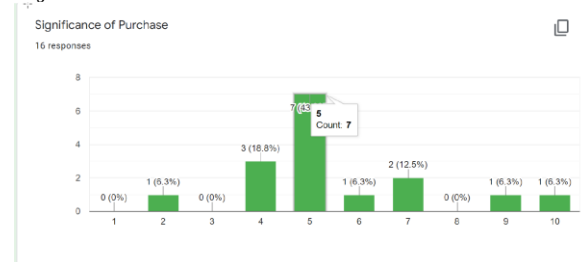


Diagram 8

PART 4: PROTOTYPING

DESIGN IDEA 1.

A functionality to provide a weekly progress report on user expenses to track and monitor their past spending history and plan out the user's budget before that day given identified expense trends/patterns accordingly.

DESIGN IDEA 2.

A real-time alarm that alerts users if spending for a certain category exceeds current budget level.

LOFI PROTOTYPES

LOFI PROTOTYPE ITERATION 1

PICTURE:

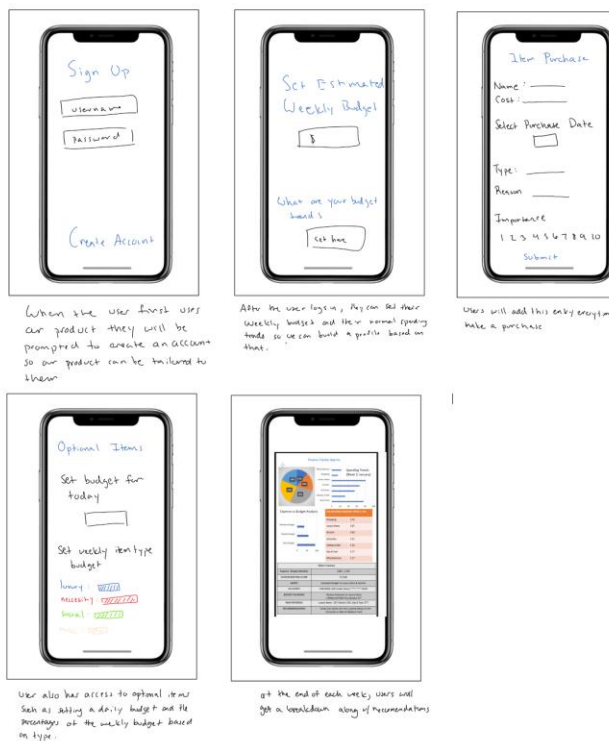


Figure 1

LOFI PROTOTYPE ITERATION 1 EXPLANATION:

In this iteration, we see a brief overview of how our application is going to work. Evidently, we want a rough guideline. When

we go to implement this in Adobe XD, we would want to make it detailed and functionality to it. Roughly, this lofi design includes a login page, a set budget page, add item purchase page, and a detailed view of your budget in each a category. Now we will go into some details on how we will implement the application's design ideas in a lofi prototype.

LOFI PROTOTYPE ITERATION 2

PICTURE:

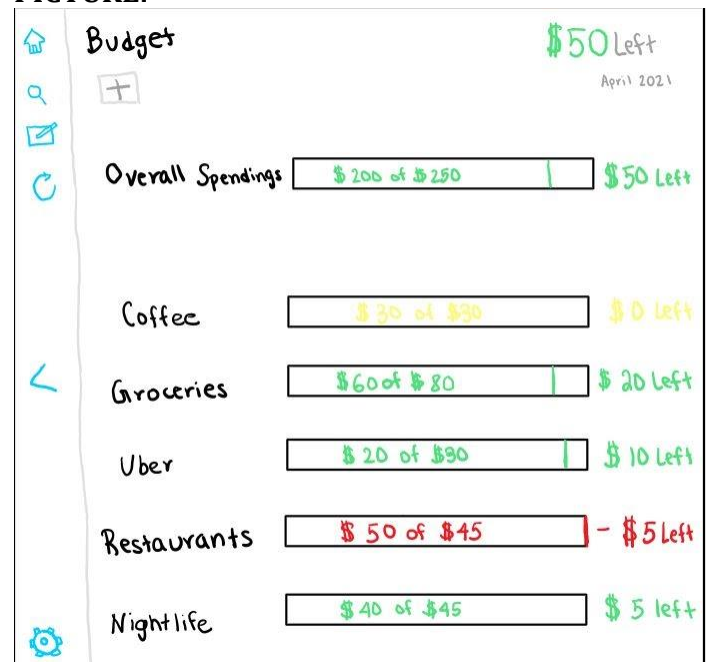


Figure 2

LOFI PROTOTYPE ITERATION 2 EXPLANATION

In the second iteration of our lofi application, we wanted to address the first design idea of tracking user expenses and provide a weekly progress report. So, as you can see, we implemented color encodings to represent categories such as "over budget", "budget on track", and "under budget". This meter system is an effective and intuitive visual representation of the current budget levels for the user to understand within the context of their daily

lives. In the next iteration, we will address the next design idea.

LOFI PROTOTYPE ITERATION 3 PICTURE:

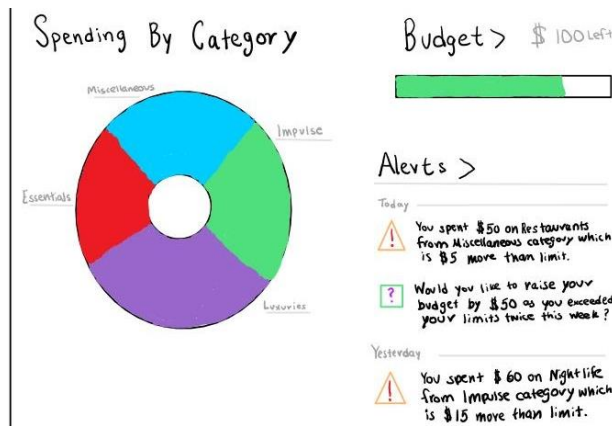


Figure 3

LOFI PROTOTYPE ITERATION 3 EXPLANATION

In the third iteration, we chose to implement active alerts that would allow you to see how much you are spending over your budget if you have been. For example, if you spent more in the category of "Nightlife", the application would send you an alert notification, warning you to spend accordingly. Additionally, it will send you push notifications if you would want to set your budget lower if it is getting too hard to be in your goal. In the next iteration, we will address more details and visual analysis that the user can see based on pure data how he/she is doing.

LOFI PROTOTYPE ITERATION 4 PICTURE:

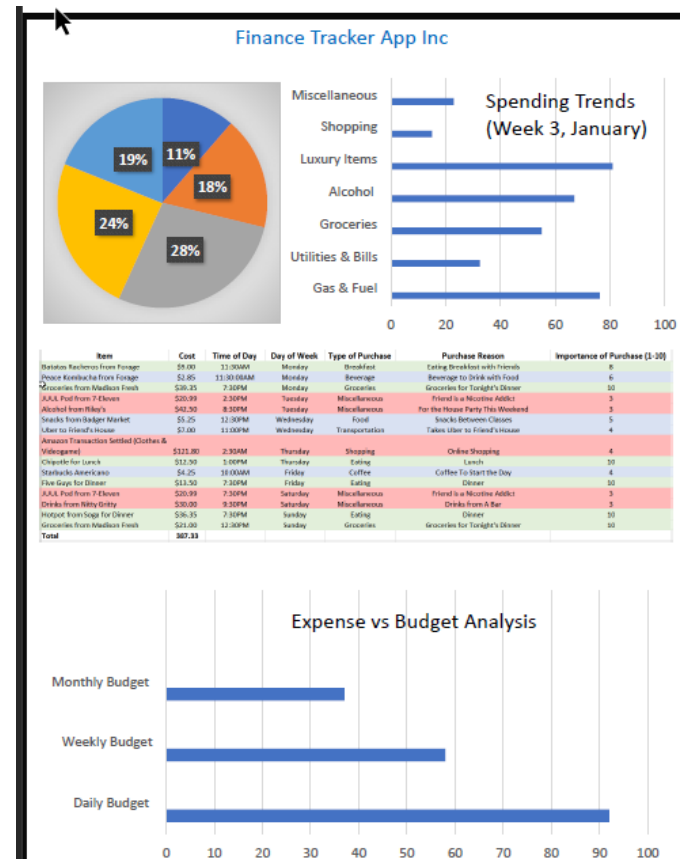


Figure 4

LOFI PROTOTYPE ITERATION 4 EXPLANATION

In the fourth iteration, we see that we included graphs of pie charts, bar charts, and excel spreadsheets to show through data, the spending, and the trends. We thought that this was vital in portraying because it will allow the user to see what they need to do to better spend in their next cycle of income. Now, we will go into some recommendations and tips that the user can follow from these trends.

LOFI PROTOTYPE ITERATION 5

PICTURE:

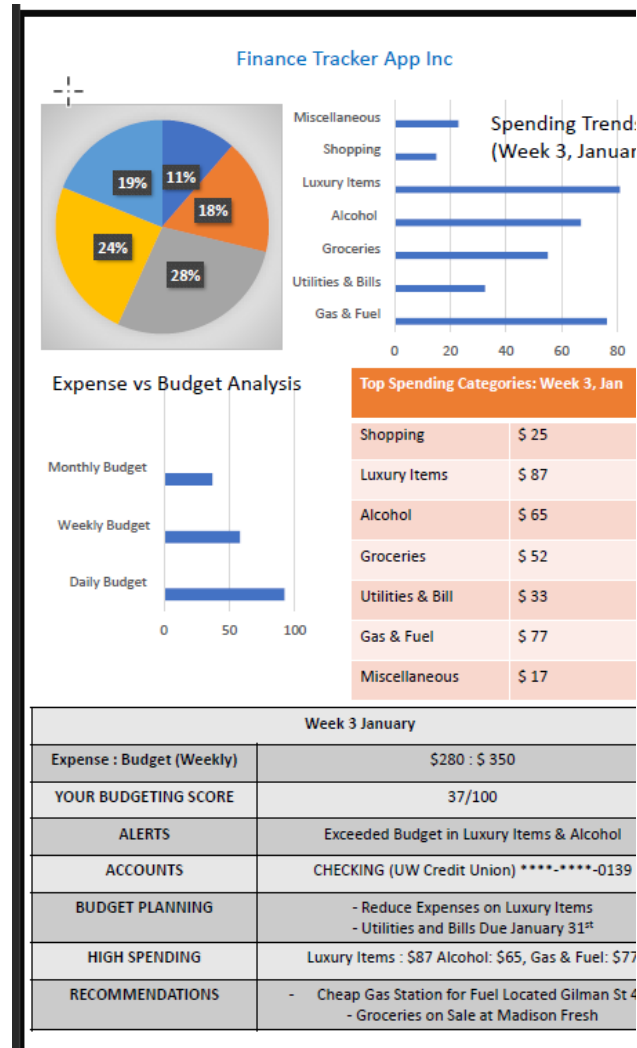


Figure 5

LOFI PROTOTYPE ITERATION 5 EXPLANATION

In the fifth iteration, we chose to offer guidance on how to better spend for their next income cycle. As you can see by the chart, it takes all the trends and offers recommendations on what the user should do to be spend even better with their money. This part ties a knot in a bow on helping in on the things that the user can do to be proactive in learning how to be frugal with their money.

HIFI PROTOTYPES

DESIGN IDEA 1.

A functionality to provide a weekly progress report on user expenses to track, monitor, analyze the user's past spending history and plan out the user's budget before that day given identified expense trends/patterns accordingly.

DESIGN IDEA 1 HIFI PROTOTYPE ITERATION #1 PICTURE:

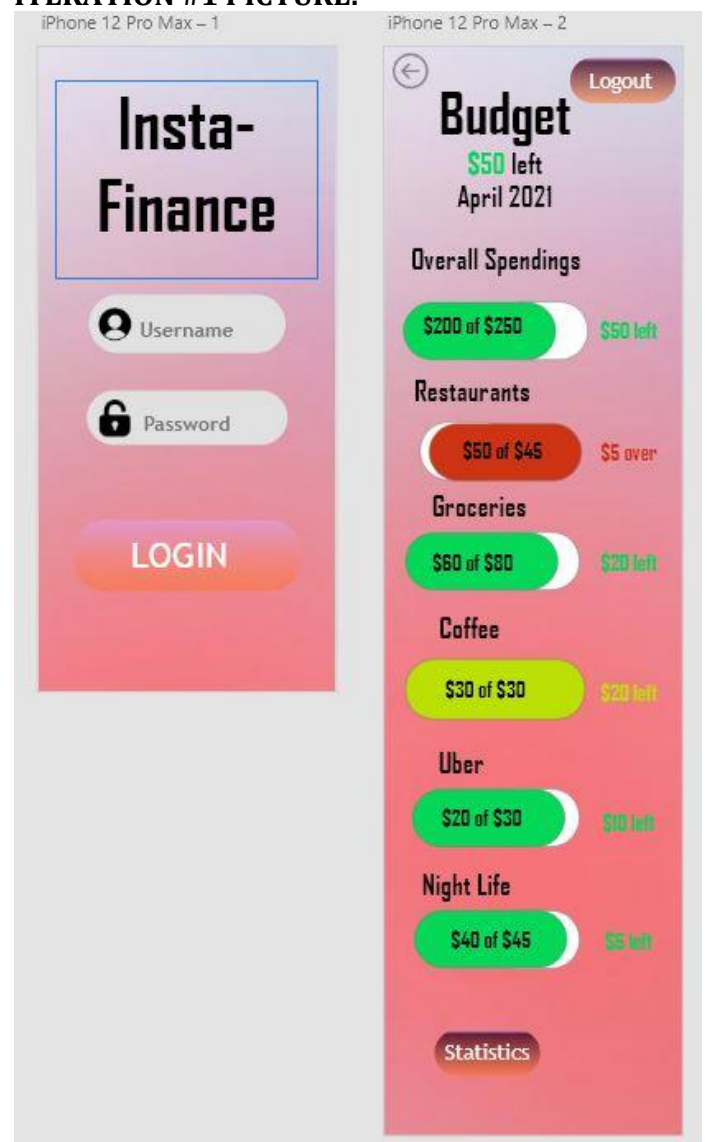


Figure 1

DESIGN IDEA 1 HIFI PROTOTYPE ITERATION #1 EXPLANATION:

For our first iteration, we chose to achieve a simple visualization of organizing your expenses. We have a login page and a simple view page of a categorized budget planning. We chose to convey eye-popping color encodings for green being underneath each category's budget, yellow meeting the budget, and red going past the budget. Additionally, there is a tracker that checks to check the balance. There is so much that the user can learn about the user expenses and to analyze. There are so many visuals that are missing from the application that can be potentially helpful for the user. Thus, that is what we strove to achieve in the next iteration of the application.

DESIGN IDEA 1 HIFI PROTOTYPE ITERATION #2 PICTURE:

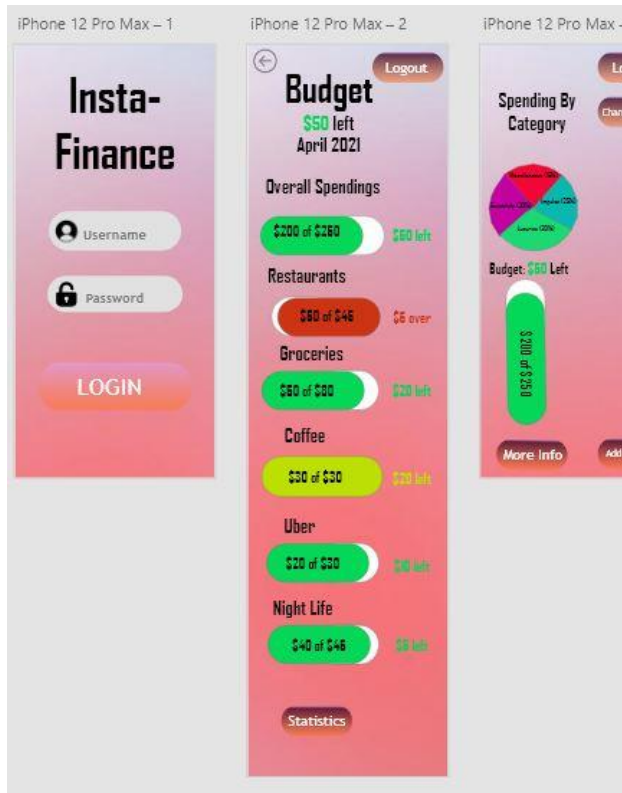


Figure 2

DESIGN IDEA 1 HIFI PROTOTYPE ITERATION #2 EXPLANATION:

For our second iteration, we added a pie chart from scratch using a protractor to measure the slices of each category carefully. We could have added a picture of a pie chart as well, but it did not look as nice as making it. Additionally, we added a small meter to let you see how much of the budget that you have used up. Through this visual we can accurately see how much we are spending in each category. Our main statistics that we point you towards the trends in the data is missing from our prototype.

DESIGN IDEA 1 HIFI PROTOTYPE ITERATION #3 PICTURE:

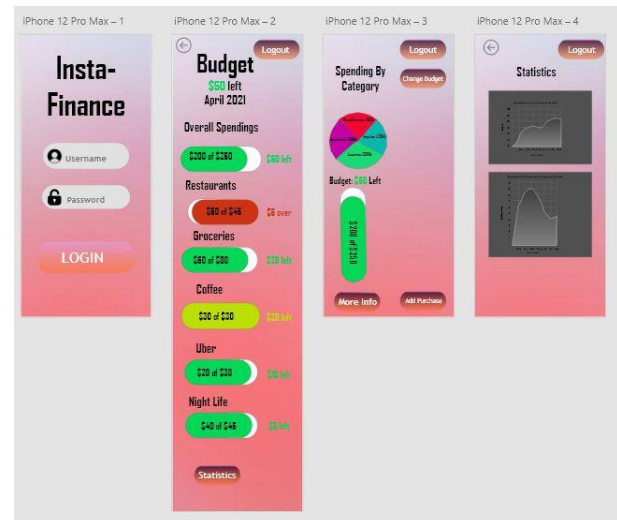


Figure 3

DESIGN IDEA 1 HIFI PROTOTYPE ITERATION #3 EXPLANATION:

For our third iteration, we address the problem of including statistics to analyze your spending trends. we also made the graphs from scratch by including the linear gradients to make it user readability convenient. So now, we will move onto Design 2 where we will address the problem of alerts to give the user a

proactive way to change the way they are spending.

DESIGN IDEA 2.

A real-time alarm that alerts users if spending for a certain category exceeds current budget level.

DESIGN IDEA 2 HIFI PROTOTYPE ITERATION #1 PICTURE:

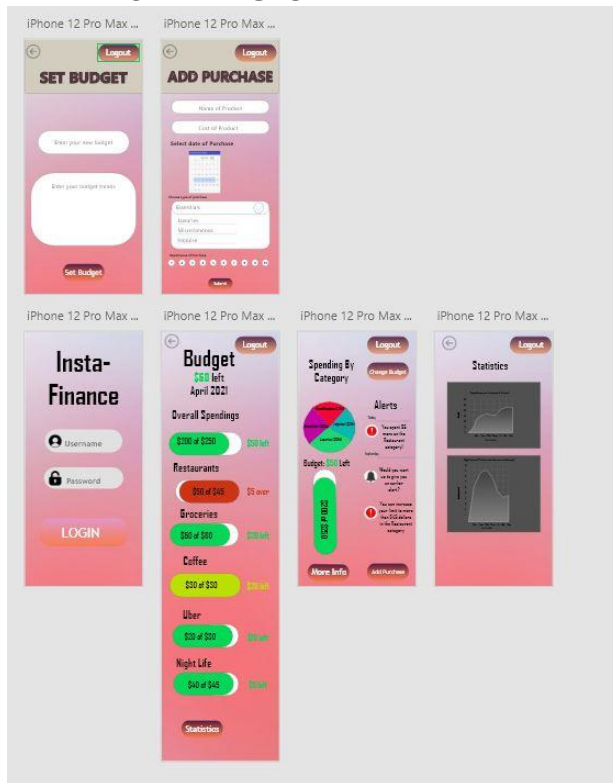


Figure 4

DESIGN IDEA 2 HIFI PROTOTYPE ITERATION #1 EXPLANATION:

For our first iteration, we made a great deal of changes. One of the changes is the alerts that you see in the “Spending By Category” where you see that the alerts are there to warn you that you have been going over in the category of “Restaurants” for example. Additionally, it also offers a notification system to give you advise if you would like to lower budget plan if it is too ambitious or if you would like to alert you sooner. We

also wanted to add this alert system is also added in the statistics section, so the application could give you an accurate justification from the data. Also, we implemented the main data collection boards as you can see with the “Set Budget” and “Add Purchase” sections. What we did in the “Set Budget” board gives us a way to change the budget to be lower if you are exceeding many of your budget expectations or higher if you are mostly in the range of your budget expectations. What we did in the “Add Purchase” is to keep a log of each purchase which would interact with the amount of money spent in the Budget planner. In the next iteration, we tried to implement the interaction with these main data collection boards.

DESIGN IDEA 2 HIFI PROTOTYPE ITERATION #2 PICTURE:



Figure 5

DESIGN IDEA 2 HIFI PROTOTYPE ITERATION #2 EXPLANATION:

In the second iteration, we made a lot of changes from the previous iteration. First, we changed the button implementation completely because the first iteration resembled too much of a web application rather than a mobile system. As you can see, most of the boards have the icons to direct you to other boards in the application to achieve ease of navigation and intuition usability. In other words, all the panels are visible/accessible from the get-go. There is a home icon that redirects you home, there is a logout button that sends you back to login page, there is a statistics icon that takes you to the statistics page, there is a setup budget icon that takes you the appropriate board, there is a add purchase that takes you to the appropriate board, there is a more info icon that takes you a detailed budget progress page, and there is a question icon that takes you to more about budgets pages. In the main data collection boards, we added a sample example button to demonstrate how the form can be filled out. The “Add Purchase” board only adds it to the budget board. However, we see that “Set Budget” board also has this sample example button that fills out a new budget for the whole application. As a result, it redirects you to a new budget planner that has updated the budget accordingly. We also added a feature where you can accommodate for a particular category in the budget if your budget has increased from before. For example, since, the Restaurants category has been exceeded its limit, and the Coffee category has been at its limit. So, we can put more money in that category budget limit to make it flexible with more money to be spent in it. It is obvious you are spending more money in those categories, why expand its limit? By accommodating more

money with the addition icon, the application changes the sliders as well to make it a little bit more interactive. You can also reset back to your original budget as well. Lastly, we added alerts to the “Statistics” page in order it to analyze what you are doing right or wrong in each scenario as it changes based on your budget and purchases. Even though we covered most of our breakdowns in this iteration, there are still some missing pieces and small tweaks we had to make to have a better overall picture of the application.

DESIGN IDEA 2 HIFI PROTOTYPE ITERATION #3

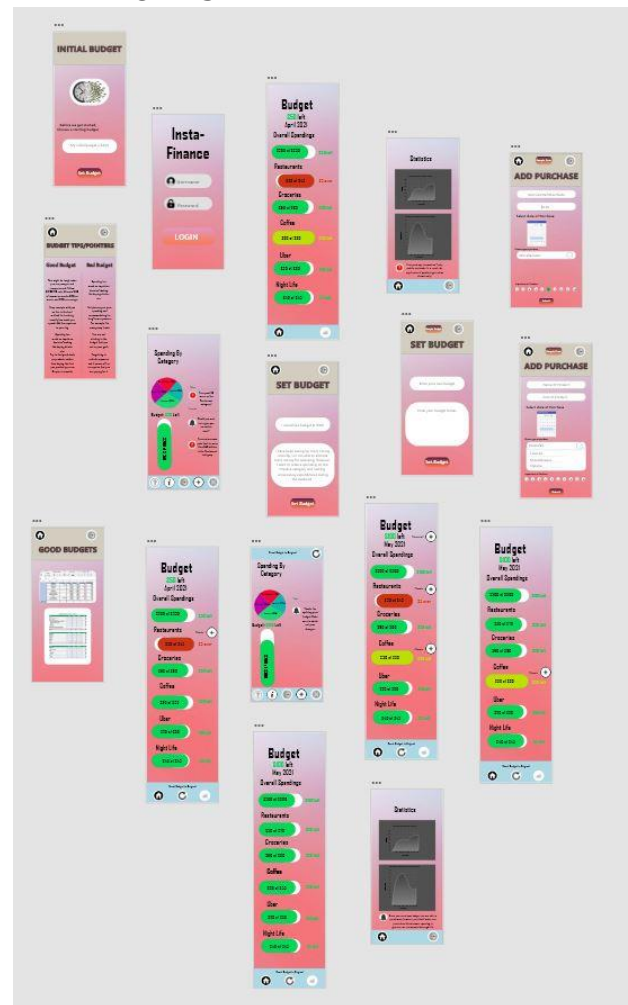


Figure 6

DESIGN IDEA 2 HIFI PROTOTYPE

ITERATION #3 EXPLANATION:

In the third iteration, we included the “Budget Advice” pages for the original budget flow and the updated budget flow as well. With the original budget flow, we decided to include some budget advice that is more rudimentary and for an introduction that would be useful for any user that is going through this process for the first time. With the updated budget flow, we made sure to include an experienced spreadsheet as a guideline to keep track of their expenses in complements with the application. A loophole that we observed with our application is that our initial budget came out of nowhere and a set budget was not included after logging in for us to analyze off of. I added a board that you can make an initial budget that allows you to choose your starting point. Finally, we saw our final product coming together in addressing all our design ideas.

PART 5: EVALUATION

a) Heuristic Evaluation Methodology

Step 1: Being a group of three with a background in computer science as well as front-end design, we first individually evaluated our design iterations applying Nielsen’s 10 Heuristics “Rule of Thumb”. These were rules of thumb on recognized usability principles that guided our evaluation.

Step 2: We joined together as a group after our individual evaluation and discussed, analyzed, and assembled our key findings. We applied severity ratings to each heuristic principle and focused on overlapping/repeated heuristics.

Step 3: We wrote a report about the noted heuristics that appeared repeatedly in this section.

b) Cognitive Walkthrough Methodology

Step 1: We presented our LOFI and HIFI prototypes to other CS students in UW, giving them a set of criteria and focus questions to assess our prototypes.

Step 2: We gave each evaluator a task based scenario as well as the task’s context and sequence of actions.

Step 3: We reviewed how easy it was to learn the interface by exploration using incremental learning and usability inspection protocols.

Cognitive Walkthrough Questions:

- 1. Will the user be able to seamlessly navigate through our interface without much trouble?*
- 2. Will the user be able to set his/her budget that is simultaneously updated real-time into the interface?*
- 3. Will there be corresponding simultaneous budget recommendations and real-time alerts that aid the user’s usability of the interface?*
- 4. Will the user be able to ultimately budget his/her financial assets in an efficient manner?*
- 5. Does our interface guarantee consistent standards, aesthetic and minimalist design, and an overall structure that allows user to use our interface through recognition rather than recall?*

c) Heuristic Evaluation & Cognitive Walkthrough of LOFI Prototypes:

We used a storyboard approach as our LOFI prototype because we wanted to quickly

address and experiment with key functionalities/features and overall concepts.

Iteration 1) We included a simple login page with a real-time authentication code for read-only access to personal financing details to eliminate security risks.

Heuristic Evaluation: A simple login page without a lot of clutter enhances aesthetic and minimalist design and improves visibility of system status. Real-time authentication code enables users to safely protect their login information as well as private banking details.

Cognitive Walkthrough: Assessed that the interface will not address user needs if the budget levels and Spending patterns are not updated simultaneously in real-time.

Solution: We decided to include a budget setter panel in iteration 2

Iteration 2) We included a “budget setter” panel so that users can set their estimated weekly budget.

Heuristic Evaluation: Allowing the user to set their weekly budget enables a match between the system and the real world because the user’s current financial assets are reflected into the system. It also allows the system to be user-oriented, allowing user control and freedom because the user can set his/her budget levels.

Cognitive Walkthrough: Assessed that we also needed to update the user’s purchased items list simultaneously in real-time so that the application can better analyze, track, and monitor user’s spending categories.

Solution: We decided to include a budget setter panel in iteration 2

Iteration 3) We included the “purchased item information” tab so that users can

track and monitor their spending history.

Heuristic Evaluation: Allowing the user to record their purchased item history enables a match between the system and the real world because the users spending patterns are reflected into the system. It also allows the system to be user-oriented, allowing user control and freedom because the user can set his/her budget levels.

Cognitive Walkthrough: Assessed that users might have difficulty seamlessly navigating through our interface if we had multiple windows, tabs, and pages.

Solution: We decided to include an “All-In-One” view in iteration 3

Iteration 4) We integrated all the subpanels into an “All-in-One-View” window so that users can navigate throughout our interface seamlessly.

Heuristic Evaluation: This enables a simple, minimalistic, and intuitive design where the emphasis is on recognition rather than recall. Since all the subpanels are integrated into one view, this also accommodates consistency and standards.

Cognitive Walkthrough: Assessed that to make the application more interactive and intuitive to use, we needed to include interactive GUIs like budget recommendations and real-time alerts.

d) Heuristic Evaluation & Cognitive Walkthrough of HIFI Prototypes:

After establishing proof of concept in our LOFI prototypes, we incorporated Adobe XD to create a fully functioning, polished, higher-fidelity designs for the design ideas that we addressed in our LOFI prototyping stage. These were interactive computer-based designs that not only conveyed the functionalities but also the visual details of our design ideas.

Iteration 1) We included a simple login page with a real-time authentication code for read-only access to personal financing details to eliminate security risks.

Heuristic Evaluation: A simple login page without a lot of clutter enhances aesthetic and minimalist design and improves visibility of system status. Real-time authentication code enables users to safely protect their login information as well as private banking details.

Cognitive Walkthrough: Assessed that the interface will not address user needs if the budget levels and spending patterns are not updated simultaneously in real-time.

Solution: We decided to include a budget setter panel in iteration 2

Iteration 2) We included a “budget setter” panel so that users can set their estimated weekly budget. However, in our HIFI prototyping stage, we noticed that the “budget setter” functionality can be enhanced by incorporating slider toggles that corresponded to a bar graph. This not only enhances the visual appeal of our application interface, but also its interactivity and ease of use.

Heuristic Evaluation: By incorporating a slider-based budget setter functionality, we enhanced user control and freedom as well as flexibility and efficiency of use because the user can simply slide the slider button to set his/her budget level. Allowing the user to set their weekly budget enables a match between the system and the real world because the user’s current financial assets are reflected into the system. It also allows the system to be user-oriented, allowing user control and freedom because the user can set his/her budget levels.

Cognitive Walkthrough: Assessed that we also needed to update the user’s purchased items list simultaneously in real-time so

that the application can better analyze, track, and monitor user’s spending categories.

Solution: We decided to include a budget setter panel in iteration 2

Iteration 3) We integrated all the modules and included an “All-in-One” View that allows the user to have a bird’s eye overview of his/her spending patterns, spending categories, budget levels, and spending/saving recommendations. We also included a real-time alarm to alert the user if his/her budget level has exceeded.

Heuristic Evaluation: By integrating all the modules and incorporating an “All-In-One-View”, we enabled a simple, minimalistic, and intuitive design where the emphasis is on user recognition rather than recall. Since all the subpanels are integrated into one view, this design also accommodates consistency standards as well as flexibility and efficiency of use. By including real-time alarms that alert users based on his/her budget level as well as saving/spending recommendations, we facilitated an interactive application interface system that matched the real world in real-time.

Cognitive Walkthrough: Assessed that the application interface lacked statistical and graphical elements to aid the user to visually understand, track, and monitor his/her spending patterns, spending categories, and budget levels.

Solution: We decided to integrate a “statistics panel” so that user can visually and graphically understand, monitor, and track his/her spending patterns, spending categories, and budget levels.

Iteration 4) We integrated a “statistics panel” which can be accessed directly from the “All-in-One” Main window so

that the user can see corresponding graphical representations of his/her spending patterns, spending categories, and budget levels.

Heuristic Evaluation: By incorporating graphical elements as well as statistical analysis, we accommodated visibility of system status as well as flexibility and efficiency of use. This is because instead of the user having to pinpoint and read through how much they spend on a certain category by relying on words, graphs can organize and analyze quantitative data in well-structured formats.

Cognitive Walkthrough: Assessed that our application interface met all our predefined cognitive walkthrough questions, usability inspection standards, as well as Nielsen's 10 heuristic usability principles. We have decided to stop our iteration at this point.

PART 6: FINAL SOLUTION

a) Final Solution

Our goal for this project was to track, monitor, and analyze individual expenditure patterns as well as identify user needs, problems, breakdowns, and workarounds regarding personal financing. Ultimately, we wanted to assess, understand, and solve personal financing issues to provide an efficient solution to end users; to optimize user budgeting and planning for future expenses using a real-time expenditure tracking app. This allows efficient allocation of personal financial assets and simultaneous money management, especially for college students who tend to be under a tight budget. Our final solution Insta-Finance is a mobile budgeting app created with the purpose of making it easier for the average person to manage their budgeting needs while optimizing their spending on both

necessary and impulse goods. We used Adobe XD to implement our prototype.

b) Adobe XD Prototype Link:

<https://xd.adobe.com/view/c77d30a8-4039-4147-974d-2eb5ee51d054-922e/screen/2788fa52-6487-4f62-9b56-3f6d58054d54>

c) Task, Prototype & Technological Implementation

Task 1: Setting the Initial Budget

After the user creates an account with our solution, they will be prompted to enter the starting weekly budget they want to use. This number can always be adjusted later on, but when the users first start using our product, it would be important to have this number to tailor our recommendations to the user.

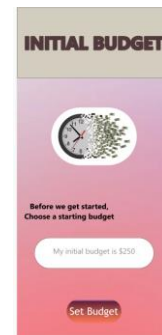


Figure 1

Task 2: Adding in Purchases

The first task that users will be able to accomplish with our solution is being able to track every purchase that they make. Our solution relies on the user tracking their purchases in order to track their budget progress and correctly displaying analysis on their spending. Due to the limitation with Adobe XD, you can click sample form to fill in the form with example information.

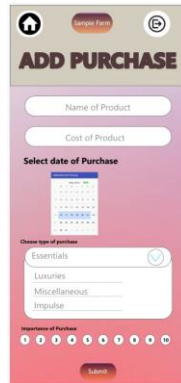


Figure 2

Task 3: Home Screen

The user's main hub of interaction with our project is the home screen. The goal of this page is to provide an all-in view of their current budget status. The user can see the breakdown of their spending by category. In addition, the user will receive daily alerts personalized to them to try and keep them on the right track based on their budgeting trends. The user will be given a snapshot of how much they have left to spend in their weekly budget. From the home screen the user will be able to navigate to the other tasks that our solution accomplishes.

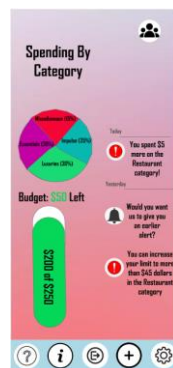


Figure 3

Task 4: Activity Recommendations

Based on the amount of money the user has left in their budget and the type of social and leisure activities that the user normally enjoys we provide recommendations on activities that they might enjoy while staying inside their budget.



Figure 4

Task 5: In Depth Budget Breakdown

The user has access to an in-depth budget breakdown for that week. The user can see their overall budget and money left. In addition, they can see their budget breakdown for each type of purchase so they can see which they are spending too much and too little on.



Figure 5

Task 6: Graphical Visualization of Data

The user can see a graphical breakdown of the data from that week. For example, some graphs they can see is the amount of money they spend per day over the course of the week and how the average significance of purchases changes over the course of the week. Based on these graphs we provide the user with budgeting tips and advice on what to improve on.

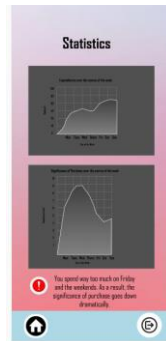


Figure 6

Task 7: Budgeting Recommendations

We provide budget recommendations, differentiating between a good and bad budget, these tips will change as we gain more information about the users.

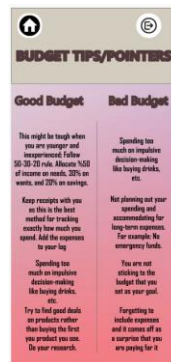


Figure 7

Our current prototype implements these tasks, however due to the limitations of Adobe XD, it is impossible to enter text so there is no data to change our prototype from. But there should be a static view of all these tasks in our prototype

c) Final Solution Explained

Some design opportunities that we identified after distilling our data is that the mobile app interface needs to be real-time and cross-platform to guarantee portability, ease of access, and ubiquity. Another design opportunity is to enable an integrated single view so that the user can have an overview of

their expenses as well as their current budget with ease of navigation. With this design idea, we also determined that categorizing and color-coding and graphically visualizing expenses based on higher-level abstractions like significance of purchase, timing of purchase, reasons and motivations behind the purchase, type of purchase, cost of item, and the item purchased would provide users with a categorical visualization of their spending trends and budget. We also identified that we needed to address simultaneous budget and spending recommendations as well as real-time alerts to signal users when certain budget levels have exceeded. With regards to Nielsen's 10 heuristic principles, enabling this accommodates a match between the system and the real world, consistency and standards, as well as flexibility and efficiency of use because the user's actual spending patterns and budget levels are reflected in the system. In our final solution, we addressed all these issues by implementing a mobile application solution with the following functionalities: 1. A functionality to plan out the user's budget before that day given identified expense trends/patterns. 2. Daily budget recommendations based on previous spending calculated by taking a weighted average of each category. 3. A weekly progress report on user expenses to track and monitor their past spending history. 4. A money management plan that simultaneously evaluates current budget given user's spending history. 5. A real-time alarm that alerts users if spending for a certain category exceeds current budget levels.

