

Project report on,

Personalized data Visualization for Enhancing Shopping Experience

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Index

10	Abstract
11	Introduction
15	Design process
16	Shopping process
18	Personalized data visualization
21	Other arguments and controversies
27	User studies
43	State of art
55	Project brief
55	Problem statement
56	Personas
59	Concepts
82	Final concept
96	Scenarios
100	Evaluation
113	Future scope
114	References

Abstract

The high effort/low reward mechanism to input expenses and lack of responsive money management (react positively, appropriately and quickly to user's dynamic spending habits) are the reasons why people are not using the available mobile based personal finance applications to record their day to day expenditure.

This project aims at helping user to spend his money based on his needs and follows a logic based budget (a reasonable way of thinking about managing user's money for his day to day activities) rather than following up a budget made over fixed and non-responsive assumptions like how much money left - how many days to survive.

Here I am using visualization as a tool for the user to generate insights about his expenditure and help him accomplish his meaningful goals. I am also using prediction of user's daily budget and expenses to support user (remind user about expenses that he possibly may/may not have) and minimize the input effort.

This project led to the development of a mobile phone based finance application that involved the study of existing mobile personal finance applications, online shopping websites, identifying the existing problems and trying to solve each of them by different approaches.

I explored different ways to input expenses, create a responsive budget and finally designed a prototype and tested it over a

period of 30 days for accuracy of the prediction and usability of input mechanism.

Introduction

In India, where most people receive their salary on monthly basis, have to spend their money wisely to meet their day to day needs. They also have to save money for future needs.

People with low monthly income need to plan their expenses to survive until the next salary comes. The lack of proper planning may lead to situations like debt, poverty and many other issues like stress and depression. To avoid such situations, there is a need for a tool to keep track of their daily expenses, savings, calculate how much money they need to survive etc. People typically write down their expenses and calculated manually [Figure 1].

The advantage of maintaining such a record is that its user friendly (user can write down his expenses in the best understandable form) and portable. But since the calculations have to be done, it consumes a lot of time. With time the data grows more and more complex, user have to keep multiple sheets, books to maintain the record and there is a chance that it could be lost or irrecoverable. It is very difficult to find out how much money user has, to spend on a particular day or a month.

Excel sheets [Figure 2] are the best option at this point. Users who are computer literate can use Microsoft powered excel sheets/ Google spreadsheets very easily. Users can edit these sheets and save them in computer/internet drives for the later reference. In addition to this, these softwares also provided

inline (column-wise, row-wise) commands that could help calculations easier.

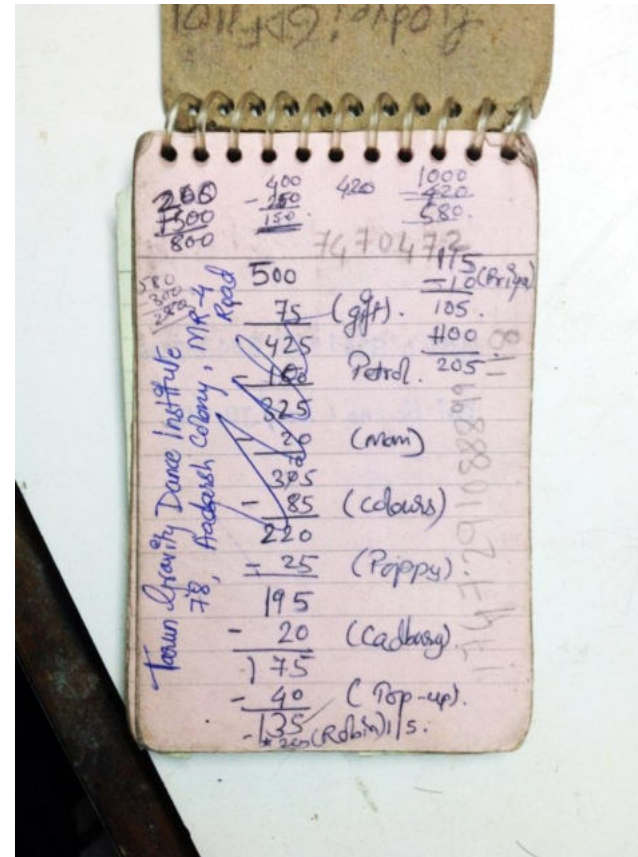


Figure 1: Personal expense notes

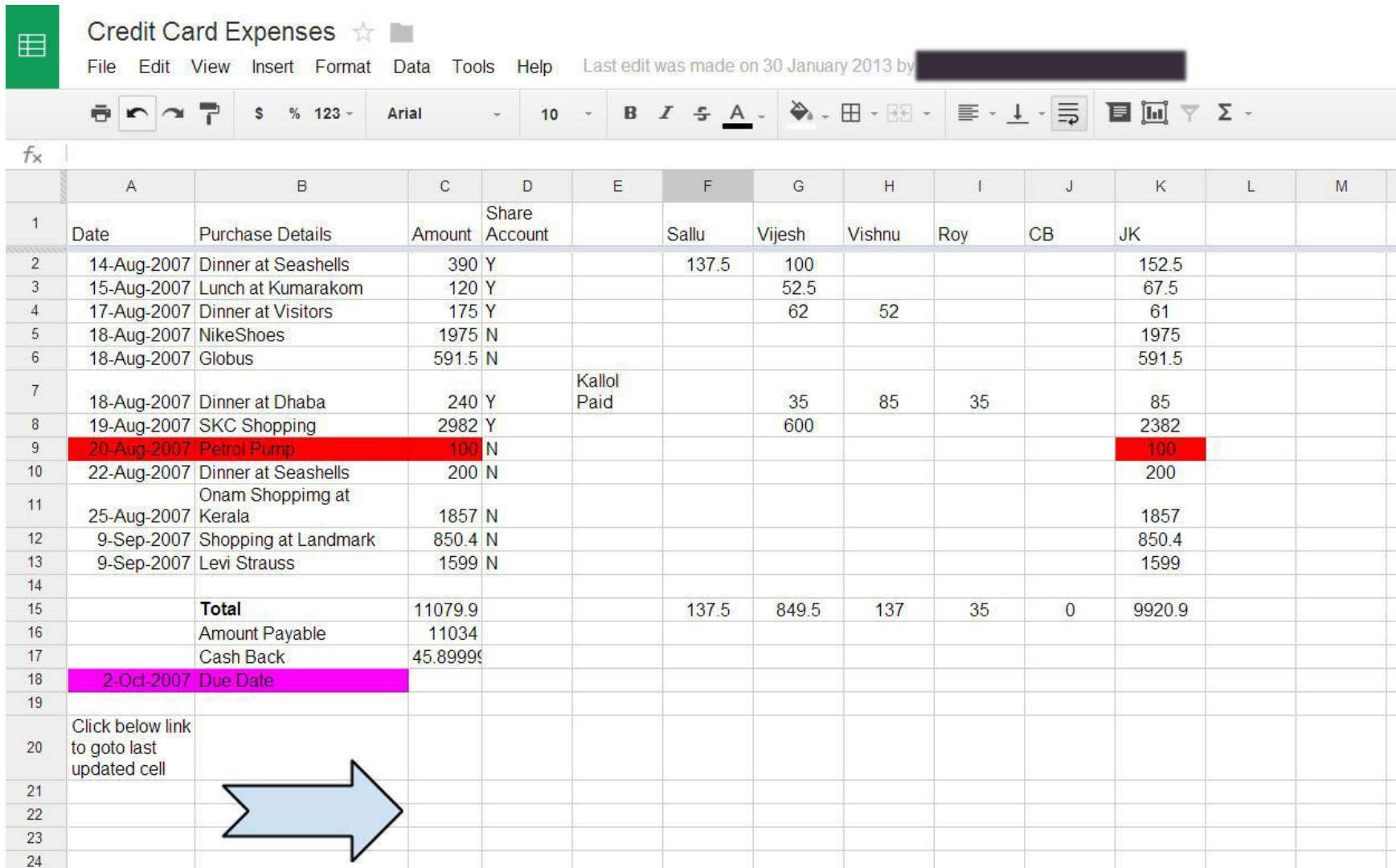


Figure 2: Spreadsheets

But having a number of sheets with data also doesn't make sense. Users have to choose from a number of best suited visualizations to understand the data.

The advantage of using software over a note is that it can be saved in the hard disk/cloud, calculates automatically (once the functions are added to the respective table). The data can also be graphically represented using the tools. But it's not portable as users have to use the computer to edit the content.

The study on State of art reveals that there are plenty of mobile based personal finance applications available that serve this purpose. They keep track of user's expense, they also have unique visualizations that tell user how much money is left and how many days user has to survive [Figure 3].

The advantage that these applications have over software's is that they are user friendly and portable. It runs on a mobile phone and user can input whenever he wants to, even when he makes a purchase [Figure 4].

All personal finance applications that are available currently, tries to solve the same problem in unique different ways. But what is the reason why people don't use it even though it has a lot of advantages over the other means?

There are many reasons why people are not using a personal finance application to manage their daily expenses. Each of these applications also has built in visualizations that show the current statistics but it limits the user's freedom to spend. Users also have to be disciplined to use these applications as they have to keep inputting their expenses regularly.

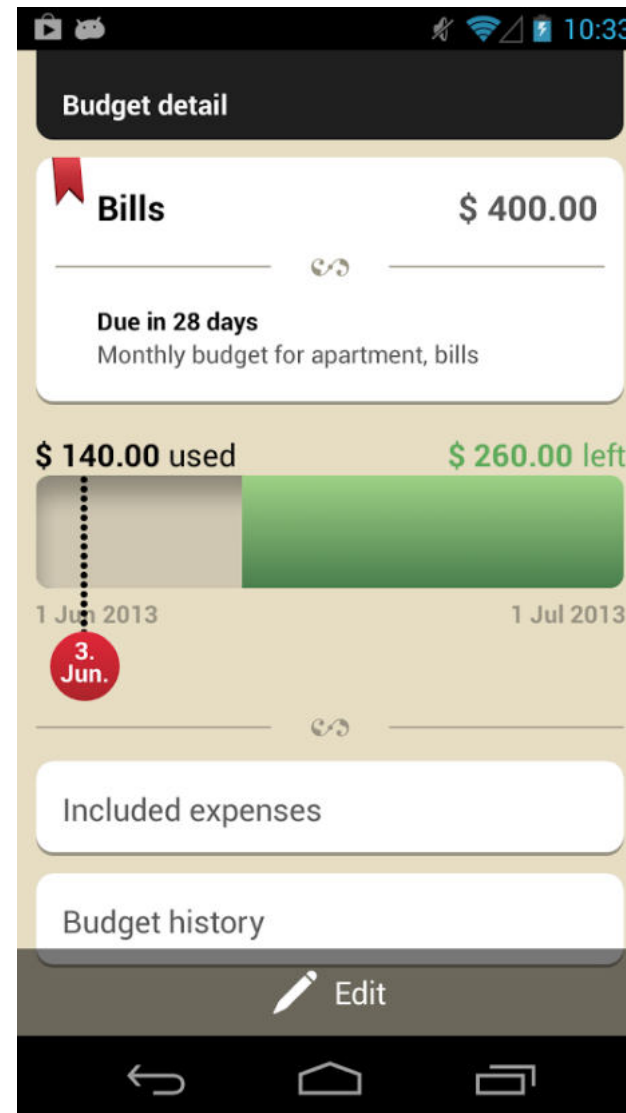


Figure 3: Visualization by Toshl

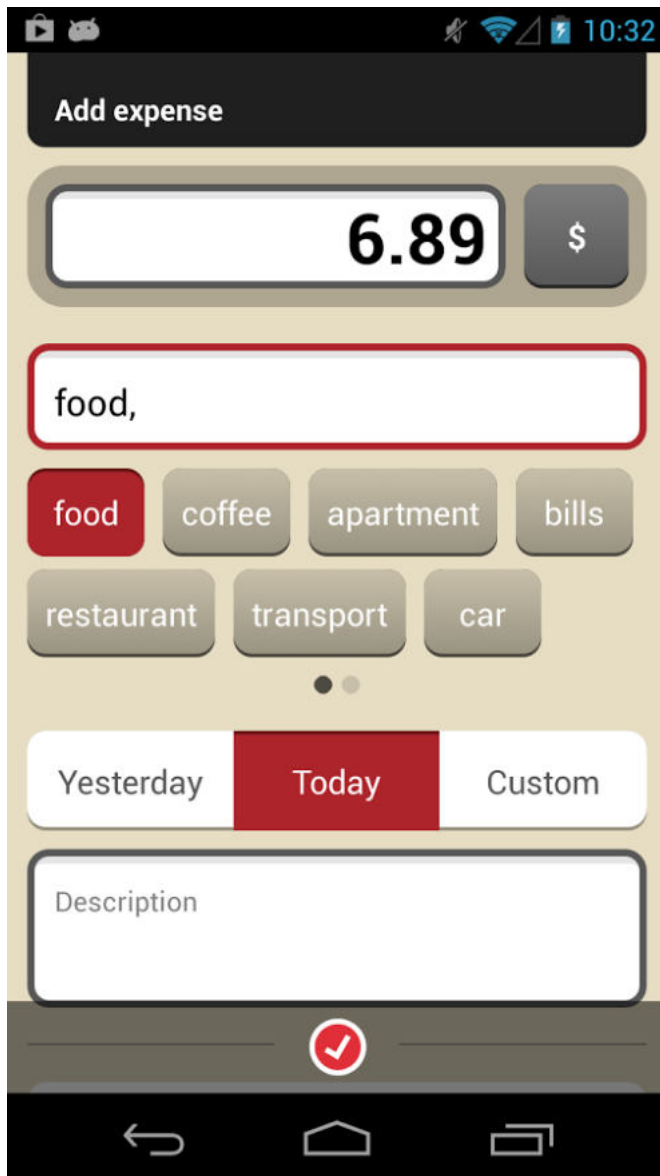


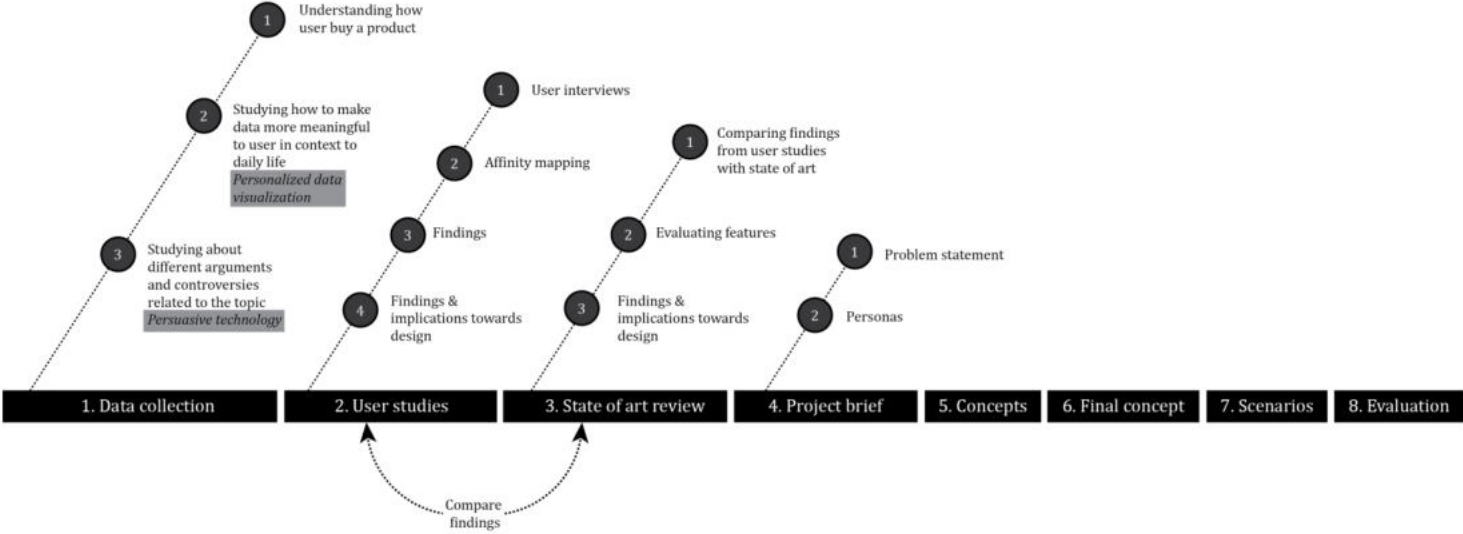
Figure 4: Adding an expense using Toshl

Most of the applications that are available in the market are just tools to calculate how much money a user have left in his account to sustain over a period of time. They generate a budget that is based upon non responsive assumptions (how much money left –how many days left) rather than user’s needs. A user may not have the same expense every day. Hence the budget should also differ from time to time. By taking a closer look at a user’s expenditure over a period of time, spending patterns can be derived.

In this project, I’m trying to derive patterns from user’s shopping habits to predict the possible expenses that the user can have and help him create a budget that is user friendly, Giving freedom to the user to spend his money with timely intervention when the help is needed and communicating the information effectively through necessary visualizations.

Visualizations that are generated can be used as a source of insights for the user to learn about his shopping habits and behavior. These insights can help him enhance his freedom to spend.

Design process



1. Shopping Process

The process of purchasing a product starts with a need. The first step is to find a retailer who sells the particular product. Nowadays we have online stores where we can place an order and the product gets delivered in a short span of time. In this project, I'm focusing more on the physical shopping where user goes and buy the product by himself.

How does a user find a particular shop for buying a product? There is a lot of information available through a number of sources around us for e.g. Internet, newspapers, fliers, advertisements etc. But in countries like India, people may depend more on "word of mouth" to make their decisions right. Word of mouth originates from an experience of a satisfied/dissatisfied customer. People tend to trust word of mouth better than any other sources since it's more trustful than any other means. Word of mouth can also be a product of an emotion connected to product or post choice satisfaction or a negative post-choice arousal (Whenever a customer is not satisfied with the choice he made) [1].

The information that the user gets may develop expectations about the product that he is going to buy. As the user approaches the retailer with these expectations, he will be provided with a number of choices of the same product to choose from. Now the user has to make a choice on what he should buy from the variants he should choose from.

There are two other dependent entities that influence the decision making process: Shopping habits and Personal habits.

These habits influence 45% of user's decision making during shopping process [2].

Then the user decides upon what to buy based on the choice he made.

1.1. How a habit is created inside human brain

The process within user's brain that creates a habit is a three step loop. It consists of

1. **Cue:** It's a trigger that tells user's brain to go into automatic mode and which habit to use.
2. **Routine:** A routine can be a physical/Mental/Emotional routine. E.g. A tea from *chaiwala* every morning
3. **Reward:** It helps the brain figure out if this particular loop is worth remembering for the future.

Over time, this loop-cue, routine, reward becomes more and more automatic. The cue and reward become neurologically intertwined until a sense of craving emerges. E.g. "*The scent of freshly cooked Thalassery Chicken Biryani can drive a person from the Logan street to the Paris hotel*". Cues and rewards happen so quickly (milliseconds) and they are so slight that user won't be aware of them at all. But the neural system notice and use them to build automatic behaviors.

Habits can be ignored, changed or replaced. But once a loop is established and the habit emerges, the brain stops fully participating in the decision making. So unless the user deliberately wants to change his shopping habits or personal habits, unless user finds new cues and rewards, the old pattern will keep repeating automatically. The most interesting part is

habits never disappear (Based on maze experiments done on rats by MIT neuroscientist, Ann Garybiel) [2].

1.2. Post choice satisfaction

The confidence that the user has made the right choice after buying a product is called post choice satisfaction. It also means that the user is satisfied with the purchase that he has made and the information based on which expectations were built.

It brings customer loyalty to the retailer who sold the product and he may also get more customers in future based on user's recommendations to his friends and relatives.

1.3. Product evaluation

After a product is purchased, user may evaluate the product in two ways. Firstly, by the emotions a product evoke to the user, it's the feeling a user gets from the purchase he had made. Secondly, by cognitive judgments (as through perception, reasoning or intuition, knowledge), When user is happy with the product choice he made, he experiences post choice satisfaction and if he is not, he may experience negative post-choice arousal.

1.4. Measuring post choice satisfaction

Post choice satisfaction of a user can be measured in two perspectives: transaction specific perspective and cumulative perspective. In transaction-specific perspective, attention will be specifically paid to all recent purchases of the consumer while in cumulative perspective, all purchase experience will be measured, not just the specific recent ones.

1.5. Conclusion

From the above study, I learned about user's shopping habits, how he buys a product, factors that influence a decision making, Post choice satisfaction, how post choice satisfaction can lead to customer loyalty, recommendations etc.

How post choice satisfaction can be used to enhance a user's shopping experience? Post choice satisfaction of one user can be used to give recommendations to another user in his social circle (friends, relatives etc.). If there is a way to capture a user's satisfaction, it could be used for referring similar products or services in future. For this, there is a need to study the habits, behavior and psychological processes in context of user's daily life. Using the study, identify the characteristics of the person and the kind of data they are currently experiencing. This can be achieved by tracking user's all previous purchase experiences and making sense out of it. So, by reducing the number of negative post-choice arousals, user's shopping experience can be enhanced.

2. Personalized data visualization

2.1. Personal data

The term *personal data* is widely used in context of data privacy and security. It means data which relates to living individual who can be identified from those data [3]. In this project, *personal data* means the information that user leaves behind like footprints in his daily life. This can be a “like” on a Facebook post, the kind of coffee user had at 3 pm this afternoon, a purchase or anything user does in his daily life. All his activity leaves behind an information footprint. This data reflects-user’s personal habits and behaviors.

With the increased power of computing and internet, we can capture these personal data and make sense of it. By the term personal data, it doesn’t mean *big data*. It’s about user’s own data. To understand this data, we have to make an observation in a context. For example, personal data can be used to solve a lot of problems user is facing, even the ability to extend his health span. This challenge can be solved by studying the health behavior and psychological processes in context of his daily life.

Now there is a need to understand the “personal” meaning of the personal data: What did I do? How did I do it? What did I learn? [4]

These questions can only be answered if we make this personal data more meaningful to the user so that they better understand

patterns in their life. The insights generated from this understanding can help user accomplish his meaningful goals.

2.2. Personalization of data

Personalization involves using technology to accommodate the differences between two individuals [5]. For example, the webpages are personalized based on the characteristics like interests, social category, context etc. of a user: YouTube gives recommendations based on the kind/category of videos user watch frequently, most of the advertisements in Facebook homepage is based on the kind of products user search on websites like Flipkart and other shopping websites. These recommendations/advertisements may differ from one person to another. Personalization implies the changes that are based on implicit data. The changes based on explicit data are called *customization*.

Personalization is used to improve the overall user experience online. However it can also be used for improving the way user interacts with his own data i.e. personal data. It can be used to predict the user behavior, needs or wants and even for tailoring offers and communications very precisely. This kind of prediction is called *predictive personalization*.

2.3. Data visualization

Now the challenge lies in communicating the personalized data effectively to the user. The information needs to be abstracted in some schematic form, including attributes or variables for the units of information. The creation and study of visual representation of data is called data visualization.

The main goal of data visualization is its ability to visualize data, communicating information clearly and effectively. To convey ideas effectively, both aesthetic form and functionality need to go hand in hand, providing insights into a rather sparse and complex data set by communicating its key aspects in a more intuitive way [6].

Data visualizations can also be made memorable. This can be achieved by using attributes like colors and the inclusion of human recognizable objects in visualization. The common graphs are less memorable than the unique visualization types [7]. E.g. Water Daily application for iPhone helps users to track daily drinking habits and reminds users to drink water [Figure 5].

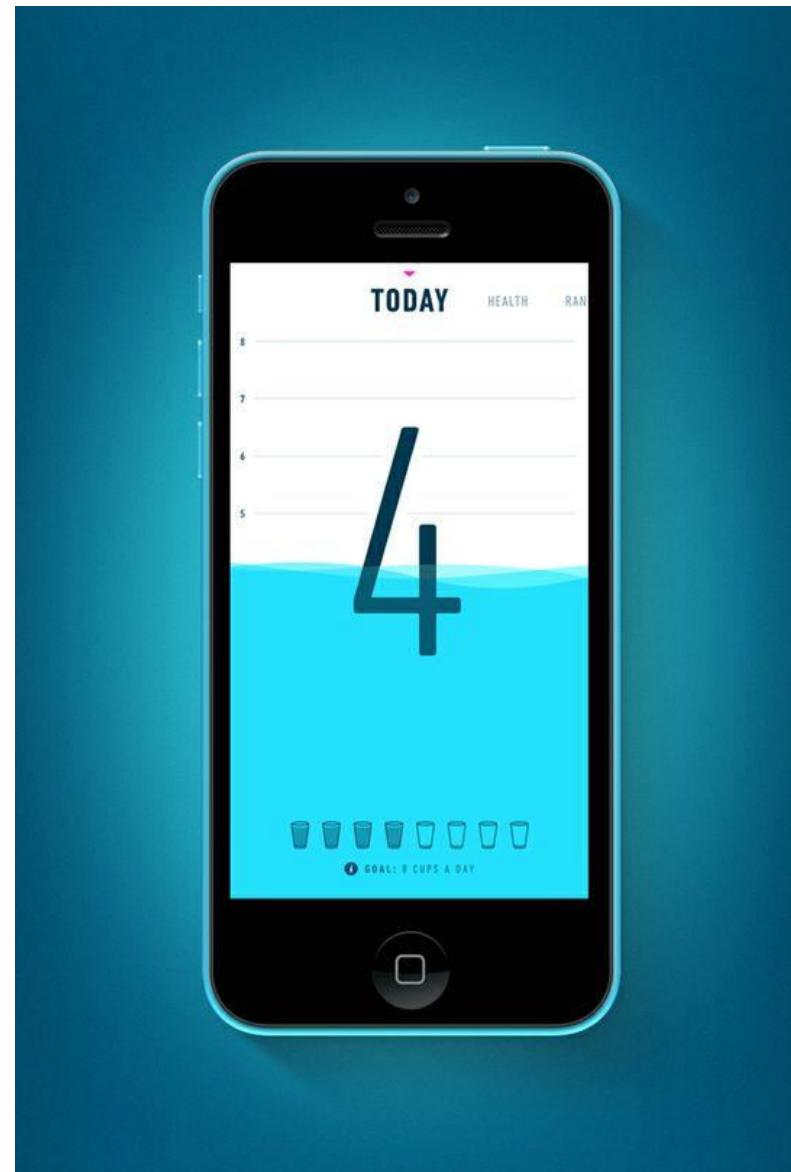


Figure 5: *Water Daily* application motivates users to drink water

2.4. Personalized data visualization

Personalized data visualization can be defined as approaching a problem and presenting a user's data in a way consistent with his goals and transforming the way he interact with his data. Personalized data visualization can also be defined as making data meaningful to a person in the context of daily life [8].

The goal of personalized data visualization is not just simplify and present the millions of bits of data as illustrations. It is to prompt visceral comprehension; moments of insight that make user want to learn more and to help him achieve his meaningful goals.

2.1. Conclusion

In this project, I'm trying to capture user's shopping habits from his daily expenditure, track it, analyze it, and present it back to him in a better understandable form, a personalized data visualization, that is consistent to his goals i.e. for example, control his spending habits and help him save money for future expenses.

3. Other arguments & controversies

3.1. Persuasive technology

Persuasive technology is defined as the technology that is designed to change the attitudes or behaviors of the users through persuasion and social influence, but not through coercion [9].

There are a lot of research around the areas of persuasive technology and how it can influence a person's behavior. The primary characteristics of the persuasive technologies that are available is their ability to collect user's data passively (e.g. **mint.com** where the bank accounts can be directly connected to the expense tracker) or with minimum effort (like **foursquare**). It collects user's data and presents them back through visualizations in a way that they are useful to the user. These applications have personalized intelligence about user's behavior.

These smart products collect data passively about the user and user's behavior and tell a story which is designed to directly influence the user. For e.g. the toothbrushes can be connected with sensors to collect data about user's personal behavior. These sensors can vary from GPS, accelerometers to RFID. These sensors can be used to collect the user data. Nike fuel band [Figure 6] and Mint.com [Figure 7] are some of the examples.



Figure 6: Nike fuel band (top) & iPhone application

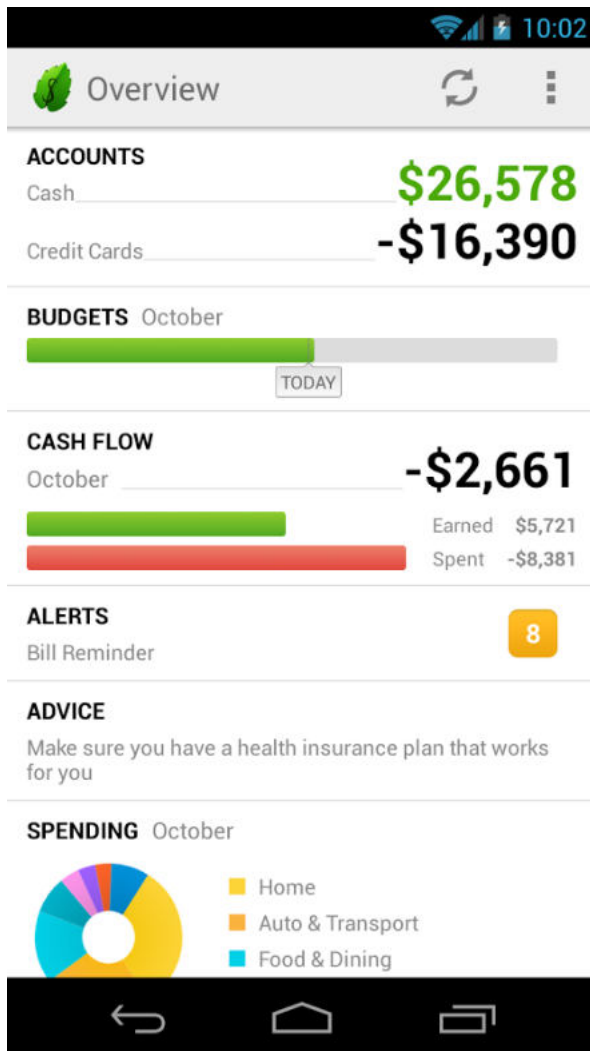


Figure 7: Mint.com

3.2. Telling stories with user data

Based on the data collected from these sensors, are analyzed and are send back to the user in the form of feedbacks and visualizations. User can therefore derive insights about his own data in this process.

One of the best examples of telling stories with data can be *Charles Joseph Minard's* map that portrays the losses suffered by Napoleon's army in Russia [Figure 8]. It has different layers like geographical data, chronological data, number/quantity of the soldiers before and after the journey etc.

This visualization tells a rich story about the war. For example, the dropping temperature was one reason why there was a significant drop in the number of soldiers. Rivers were also one another reason for the same. Every time the soldiers crossed the rivers, there was a significant drop.

The data collection for such a big event in history was a rigorous activity since they didn't have any of these products at that time. If they had, the information would have been more accurate. This real time information, if it was available to Napoleon himself, the course of war might have changed. It still stands as the best anti-war statement representing the annihilation or a desertion of half a million soldiers. [10]

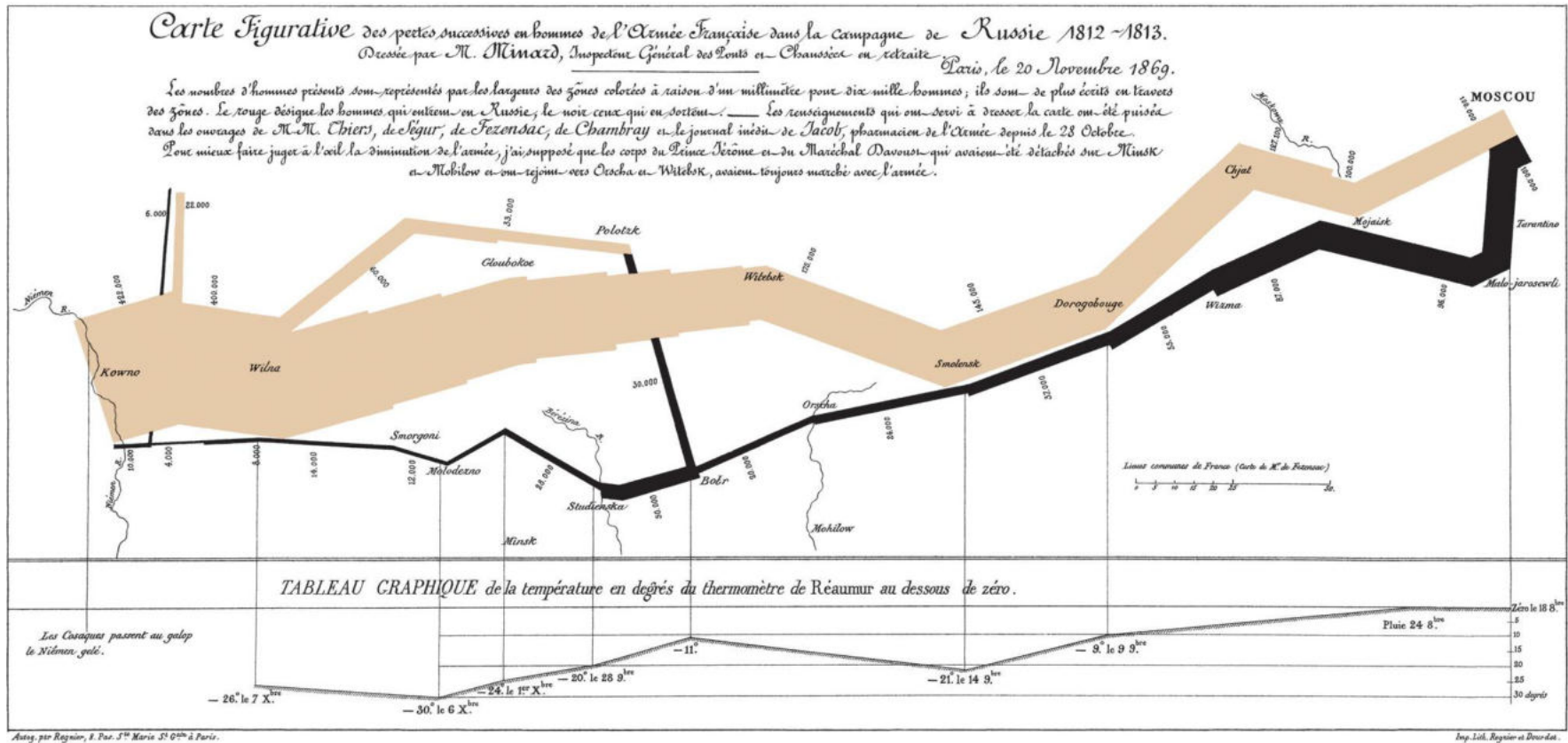


Figure 8: Joseph Minard's map on Napoleon's march to Russia. Image source: Wikipedia

3.3. Persuasive phase of Visualization

Visualization is an essential part of data mining. It permits assimilation of complex information and elicitation of patterns and knowledge from the data. "It reveals what textual representations could not hope to reveal by exploiting the high bandwidth of the human visual system in a way that permit to absorb information both rapidly and memorably" [10].

Many emphasis mechanisms are used in visualizations to draw attention of the user to points of interest. These may include colors, highlighting, visual grouping, distortions (like fish eye views) etc.

These mechanisms are then supported in a direct way by preattentive processing, a feature extraction process performed in human vision system prior to conscious attention. The features that can be processed preattentively have been organized based on

1. **Form:** line orientation, length, width, collinearity: size: curvature: spatial grouping: blur: numerousness.
2. **Color:** hue, intensity
3. **Motion:** flicker, direction
4. **Spatial position:** 2D position, (stereoscopic)depth, depth or convex/conclave shape from shading.

The consequence of preattentive processing is the increased speed with which information can be perceived, because it stands out when user sees it at a glance.

If the goal of the visualization is to make the information patterns stand out, and do this in a way that users finds it interesting, emphasis becomes a basic part of the process. There are many ways to communicate a message through visualization, this can be done by using highlighting, color and other preattentively processed graphic elements for directing the user's attention.

3.3.1. Emphasis techniques to direct attention

The emphasis techniques on the internal visual properties of a graph can be used to clarify or emphasize the message to be communicated through the information graphic. As discussed before[Section 2.3], the preattentive processing can be used as a basis for emphasis, and for gaining user's attention, by making symbols more likely to be visually identified, even after a short duration exposure, so that simple shapes and colors stand out from their surroundings. For effective communication, certain data points should be emphasized. If they fit the criteria for importance in the eyes of the maker of the presentation., whether the significance is in the urgency of a medical procedure or a big scale. All map makers "highlight the critical information" and "suppress the details of lower priority" [Figure 9].

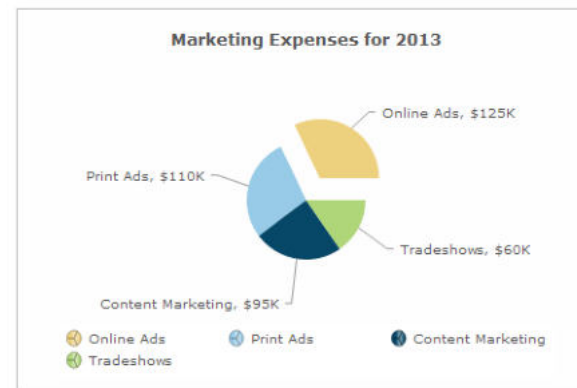


Figure 9: Example for highlighting critical information

Another method of emphasis in automatically generated information graphics is the enclosure of interested data points in a circle or a polygon or an icon [figure 10]. Distortions and fish eye focus can also be other techniques.

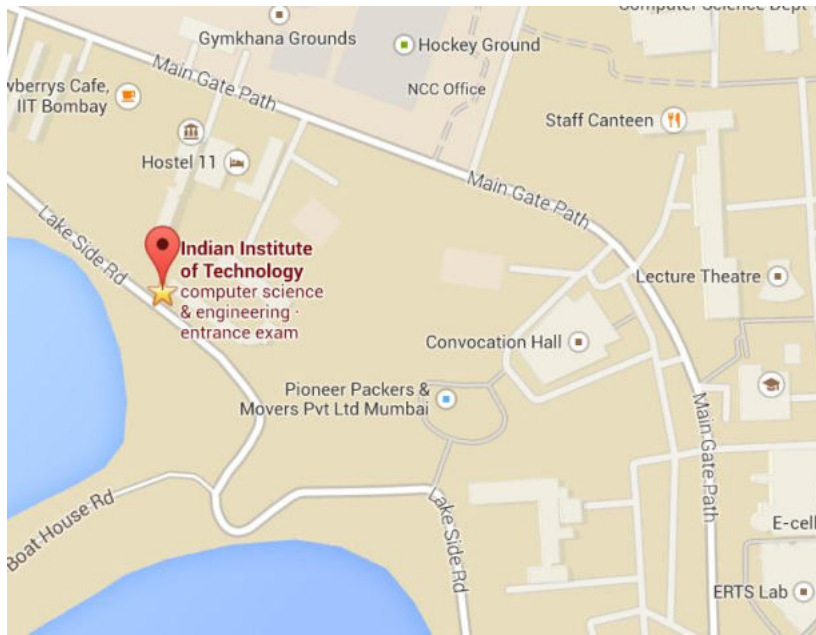


Figure 10: Information graphics using icons and different shapes

2.4. Controversy

Persuasive technology was included in this report just because of its relevance to the topic of visualizations, Computing devices can persuade. Persuasive technologies can bring constructive changes in the domains like health, safety, education and managing money. In this process it can help users improve their behaviors and habits in a positive way; however it can also be used for destructive purposes. The dark side of changing attitudes and behaviors leads towards manipulation and

coercion [11]. This is the main reason why persuasive technology is considered as a controversial topic in HCI.

2.5. Conclusion

The emphasis techniques can be used to ensure that user could perceive the critical data at a glance. This is relevant to this project as more emphasis should be given to the critical data that user is looking for. However there should be a balance between what needs to be highlighted and the degree of persuasion in the visualization. It shouldn't force user to manipulate user's behavior by coercion but help him change his spending habits if he wish to do it for the betterment of his life.

4. User studies

The project started with user studies with 5 people who were from different parts of the country. The study aimed at getting a bigger picture of their spending habits,

There were a certain set of questions for which answers were sought.

- Name, Age, Education
- A day in user's life
- Shopping habits
- How far do they travel for shopping, how many shops do they visit daily?
- When does user decide, "Ok, I should buy it"
- What makes user think that he is satisfied/ dissatisfied with his purchase?
- Do they visit the same shops again?
- Does user keep record of their spending? If so, by what means?
- How does user categorize his expenses
- Artifacts

All the answers were validated with artifacts. A master apprentice model was followed throughout the interview process.

The data collected as the part of the user studies were in the form of voice record files, quick notes, observations etc. these data needs to be organized in a meaningful way for the better understanding of the problem. All the interviews were converted into excel sheet transcripts in a Question-Answer pattern. All the

conversations were given a code, and an affinity mapping was conducted [Figure 11 & 12].

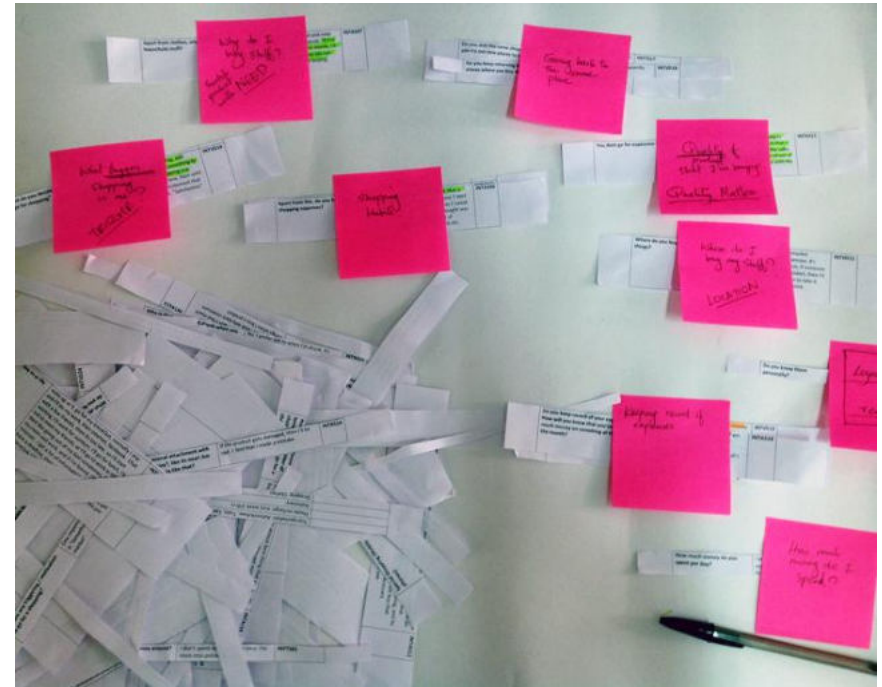


Figure 11: Affinity mapping

4.1. Users

All the users were in between an age group of 20-30, 3 Males and 2 Females. All of them were from different parts of the country, from different diverse traditions and customs.

Education

4 of them were degree students and 1 was a PhD scholar.

Tech Savvyness

All the users had mobile phones out of which 4 users had touchscreen 3G enabled phones and they could operate all the features on their phone. 2 users had one extra mobile phone each.

Summary

4 out of 5 users said that shopping is need driven. Users also stated that they do initial market study (product reviews) before going for shopping. They also said that rewards and loyalty are the triggers that persuade them to visit the same store again. 3 out of 5 users said that they don't prefer online shopping due to bad experiences that they had in the past. 3 users also maintained records of their day to day expenses but by different means.

4.2. Findings

1. What triggers shopping

Normally shopping in India can be classified into three types- personal need driven, market driven or mood driven. Personal needs can be a lack or a need. For example, purchases that are related to festivals, functions or events come under this. Market driven shopping is triggered either because of a new product in the market or a sudden sale or an offer. In this case the triggers are newspapers or other media sources that passes down the information to the user. Advertisements in Social media like Facebook, Gmail, YouTube etc. are some of the commonly found triggers. Websites like Flipkart.com, Myntra.com, Amazon.com and ebay.in are some of the most common online shopping

portals.



Figure 12: Findings

They keep sending personalized advertisements to users through Social media [Figure 13]. These advertisements also act like suggestions from friends and relatives. For example, “Vishnupriya Kaulgud likes Urban Ladder”. Here users shopping habits are directly influenced by the likes/dislikes of friends and relatives.



Figure 13: Facebook advertisements

Mood driven shopping is more like a retail therapy. Users tend to purchase things when they are stressed or sad. Shopping for them is like a stress buster.

To summarize

1. Three types of shopping triggers: Personal need driven, market driven and mood driven
2. **Personal need driven:** it can be triggered by a need or a lack
3. **Market driven:** it can be triggered by an advertisement or a new product release
4. **Mood driven:** it is like a retail therapy

2. Shopping habits

From the user studies, most of the users said that each of their purchases should satisfy the needs. Satisfying the need is the first priority, but shopping habits differ from user to user. Money is an important factor that influences the shopping habits of the user. People tend to spend more when they have money. One user said “I know what I want, I can see myself using the product, I bought a 40 inch plasma TV in less than 2 minutes”-This clearly states that most of the users do enough study about the product prior to the purchase. They go through all the information available in internet to make sure that all the requirements are fulfilled and the product is worth their money. Most of the users prefer to go for shopping without any prerequisites if the product they are going to buy is not that costly(mainly clothes). For this kind of people, shopping is like an adventure.

Quality also matters; users may compromise on price of the product, but may not compromise on the quality. One user said

"I'll search by the quality of clothes and not by colors". This states that the user focuses on other qualities like longevity and durability of the product rather than its aesthetics. They are frugal in their approach towards spending money but if they come across interesting or something of their choice, they won't think twice. Generally users find happiness in choosing things for themselves, collecting products in cart even if they don't want to buy it.

To summarize

1. Shopping habits differ from user to user
2. Money is an important factor that influences shopping habits of a user
3. Users may compromise on price but not on quality of the product
4. Users find happiness in choosing products for themselves
5. Users are frugal when it comes to spending money

3. How does a user decide upon choices?

User first tries to get satisfied over necessities, and then he decides upon which product is more adequate for his use. For example: A user prefers to buy Dettol soap over a Cinthol soap since he is having more body activity this month. Some users prefer to try the product before they actually buy it to make sure that the product is worth the money and most of them knows what exactly they need and what to buy. User also looks forward to the product features like price, brand, material, quality and longevity. Colors, appealing are also important. Some users also make sure whatever product they buy, with help of other people's help. They passively check whether anyone in their

family, relatives or friends are having them .They take help from online surveys: ratings and reviews [**Figure 14**]; even from friends and relatives. They prefer word of mouth than any other means because there is a sense of trust that comes along with it.

To summarize

1. Choices are made over the needs and the quality of the product
2. Online surveys and *word of mouth* are the two trusted sources on which decisions are made

4. Reasons why user is not satisfied with his purchases

The dissatisfaction may happen due to immature personal decisions that user may take while buying a product. In that case user may end up regretting later. Betrayal of trust can also be another reason. Most of the users complained that the products that they bought from online where looking good, but when they order and get it delivered it may look different. One user said that the shopkeeper tried to convince her to buy a jacket by claiming that it was a best fit and was looking good on her, but when she took it home and tried it again, she felt that she was cheated. She felt bad and regretted for losing the money. Another reason can be losing money as the retailer has taken more money than the actual price of the product and user comes to know about it when someone buy the same product at a lower price. Product failure also leads to similar situations when it can lead to damage to other products also. One user said *"the new bag I bought tore off and my mobile tablet fell down on the road"*. this states that the degree of dissatisfaction will be more. Even if the user gets replacement for the product, the trust and loyalty

has already disappeared. Bad service/ behavior from the retailer/ an employee at the service scape can also be another reason. In this case, the product has no role to play in the situation.

To summarize

1. Immature personal decisions and betrayal of trust are two main factors that lead to dissatisfaction
2. Users don't prefer buying clothes and other apparels online as the chances of getting dissatisfied is more
3. Dissatisfaction can also be caused by a bad service. In that case, product has no role to play
4. Dissatisfaction leads to losing customer, loyalty and trust

flipkart.com The Online Megastore

24x7 Customer Care Track Order Signup Login

Search for a product, category or brand SEARCH CART 0


ELECTRONICS MEN WOMEN BABY & KIDS BOOKS & MEDIA HOME & KITCHEN MORE STORES OFFERS ZONE

Newfeel Walking Shoes

★★★★☆ 32 Ratings | 7 Reviews [Write a Review](#) | [Add to My Wishlist](#)

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(Free home delivery)

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85% positive feedback [?] (2,505,848 ratings)

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In Stock.
Standard delivery in 2-3 business days. [?] Faster Delivery may be available [?] **New**
Check your delivery options:
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Roll over image to magnify




Figure 14: Online ratings and reviews

5. When does user experience post purchase satisfaction

Before user goes for a purchasing, he will be having expectations about the product that he is going to buy. These expectations are based on information that user acquired from various sources like television ads, newspapers etc. Satisfaction comes when user gets the expected results. But there are many more reasons to enhance that satisfaction quotient. If user gets a product for a cheaper amount than he expected after a bargain, when user feels that he has made the right choice and had a fun experience while shopping (It is user's mood dependent: for example when user is shopping along with his family or friends). Long term satisfaction can be achieved if the product is durable and the product survives for a longer period without any damage. This depends on the quality of the product.

The post purchase satisfaction can also be enhanced if user gets unexpected favors from the retailer. Sometimes, retailers tend to give away surprise gifts, give products for a lesser price than the Maximum Retail Price even without a bargain. Retailers do such

favors to retain the customer loyalty for a longer period. But it's not necessary that it can only be achieved only in terms of money and quality. The service provided on the servicescape can also have a huge impact on user's satisfaction. For example, a waiter who is taking super effort in accommodating the user beyond his duty during the peak hour time at a restaurant. He may not succeed in getting a seat for the customer, but he makes sure that user is being attended. Or, in a restaurant where user visits more often, they might already know user's preferences, and do the needful. This can also enhance user's experience.

To summarize

1. User experiences post purchase satisfaction when his expectations about the product are fulfilled
2. Post purchase satisfaction can be enhanced in a number of ways

6. Why user keeps going back to the same retailer?

User keeps going back to the same retailer because of various reasons. Firstly, customer services post purchase: The retailer provides service after the purchase, even if the product is faulty, user can always go back to the retailer. It's the confidence user has, that the post purchase services are guaranteed. It reduces the risk of losing money and saves time. Secondly, customer loyalty: the retailer knows what exactly the user wants and user trusts him. Retailer can also influence the user's choice at the time of shopping. User can also avail services offline without an immediate payment for the services. Mobile recharge and railway ticket booking can be the most common examples. Some retailers also provide personalized offers/ discounts to some of their customers. Even websites like myntra gives coupon codes that can be used to avail a discount.

To summarize

1. Post purchase services and personalized offers/discounts can trigger trust among the retailers and the users
2. Availing a service offline without an immediate payment is another way to gain trust of the users
3. Once trust is gained, retailer even influences the user's choice at the time of shopping

7. Shopping is location specific

From user studies, It was clear that users are ready to travel to any distance (depends on the means of transport and available time) for making a purchase depending on the experience and the number of choices available. For example, one user said that "60% of my clothes are from flea market, I travel to colaba to buy

clothes" This place is 35.5 kilometers away from the user's residence and it takes 50 minutes to reach(**Source: Google, traffic conditions may apply**). User also prefers the best places for their products. One user has three places to buy three products from, even though the same product (*but quality and other features may vary*) is available in a nearby super market. Another reason is inherited loyalty. There are shops that retain customers for a long period of time. They also provide the same service to the next generation, the same way they used to treat their parents. As a result, users tend to shop from the same place because he can avail discounts all the time. Users also plan shopping in such a way they can make purchases from the nearby shops/places also. Multiple purchases in one go saves a lot of money.

To summarize

1. Experience and number of choices are key factors for a user to decide where to do shopping
2. Users generally plan their shopping in such a way that they can visit a number of shops in one go

8. Why user doesn't keep record of their expenses?

The main reason why people don't want to record their expenses is because of their personal instincts. Users fear that it will be too much of work if they start doing it. For users with low monthly income, they feel that since they have a very less amount to spend, they don't need a tool to calculate their budget; they know how much money they are left with and how many days to survive until they get the money. Another reason was that spending time on calculating the budget is not rewarding unless

there is a sudden need to save money for a huge expenditure or to repay a debt. For this user needs to start saving money for months. This is impossible without a prior planning.

To summarize

1. Spending time on calculating budget is less rewarding unless there is a sudden need for saving money
2. Users don't record their expenses because of their personal instincts
3. For low income users, they feel that they know where exactly they are spending their money. But this notion fails most of the times since they don't have the habit of planning for future expenses. If a sudden expense comes, there is a probability that they may have to take debts or struggle with the money left to survive

9. Why user doesn't use mobile personal finance application/ software to record of their expenses?

The high effort/low rewarding mechanism to input expenses is one reason why users were not using budget applications. From user studies, it was found that users were using traditional ways to keep track of their expenses like writing down in a book or a personal diary [Figure 15]

Some users were also found to use Microsoft excel sheets/Google spreadsheets [Figure 16] to record their expenses; calculation is easier in excel sheets as user only need to add function once to the sheet. It calculates automatically based on the input given and presents the result on the desired column. Using a Microsoft excel sheet for recording expenses had a lot of advantages over the manual calculations done on paper.

These sheets were easy to store than the notes. Navigation was much easier. It's portable and could be shared with any other user in case of shared expenditures.

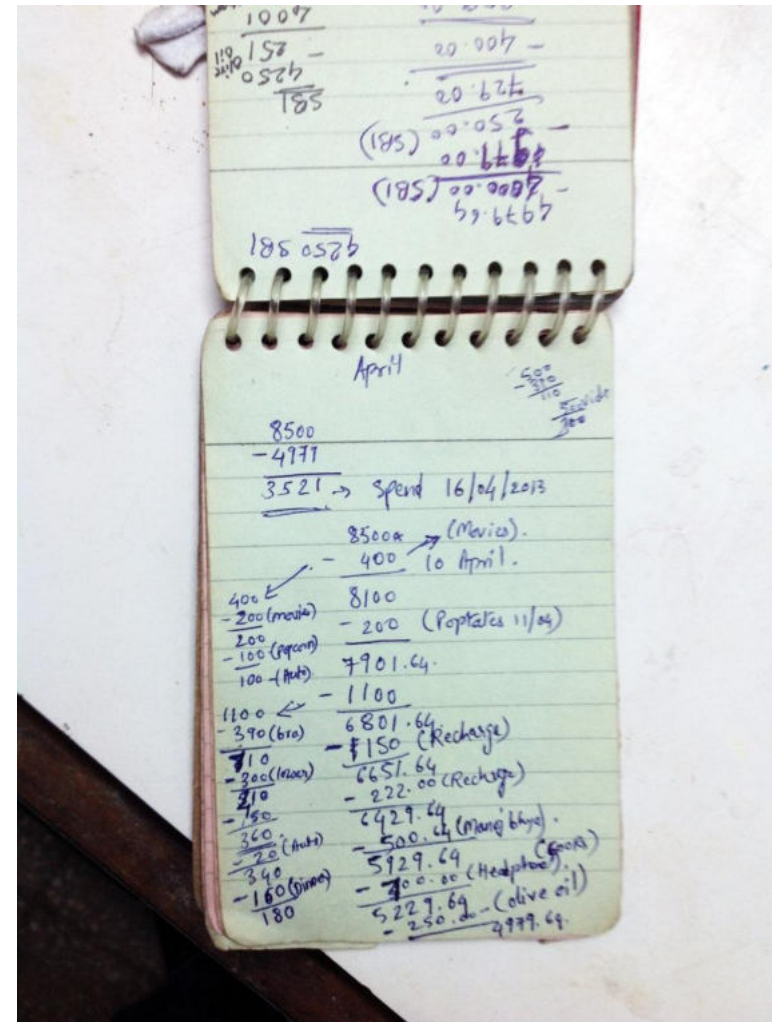


Figure 15: Artifact: Expenses recorded on notebooks

Some users have tried using Budget applications once or twice but they couldn't use it more than that, one such application is Toshl app [Figure 17]. There are a number of reasons why people are not using a budget application to manage their daily expenses. Each of these applications also has built in visualizations that show the current statistics but it limits the user's freedom to spend. Users also have to be disciplined to use these applications as they have to keep inputting their expenses regularly. There also exist some applications that can sync user's bank accounts. This can reduce the effort of inputting the expense if users are paying by card. But all users said that they prefer shopping using hard cash as most of the places they shop don't accept cards and the number of places where they shop with card is very limited. Users are also not ready to share their bank related details to any applications as they're afraid of the fact that it can be misused and may lead to loss of money.

The lack of responsive money management, a budget system that responds positively, appropriately and quickly to user's dynamic expenses and spending habits is another reason why people are not using the available mobile budget applications to record their day to day expenses.

To summarize

1. The personal finance application limits the user's freedom to spend their money
2. Users have to be disciplined to enter their inputs daily
3. They don't find any rewards of using an application since they feel that they can manage their money even without a tool

4. Users have different expenses for different days. They feel that the available personal finance applications doesn't adapt to users spending habits

10. How user categorizes his expenses

User studies reveal that expense categorization differs from user to user. It is highly user specific. Some users categorized their expenses based on location wise: Inside IIT/outside IIT, shop name (e.g. Starbucks, D-mart) etc., Money wise: Credit card/debit card, Categorization in terms of amount (e.g. <300, >300), "To get, to give" (for highly personal things like debts and lending), and others Expenditure wise: Transportation/recharge/stationary/shopping/gadgets, Daily expense/ future expense/ unexpected expense, Fixed expenses like 150 rupees for cigarettes every day.

To summarize

1. Categorizing expenses is highly user specific and dynamic
2. Providing pre-defined categories to the user won't be a good idea since user finds it difficult to adapt his expenses towards the new pre-defined categories

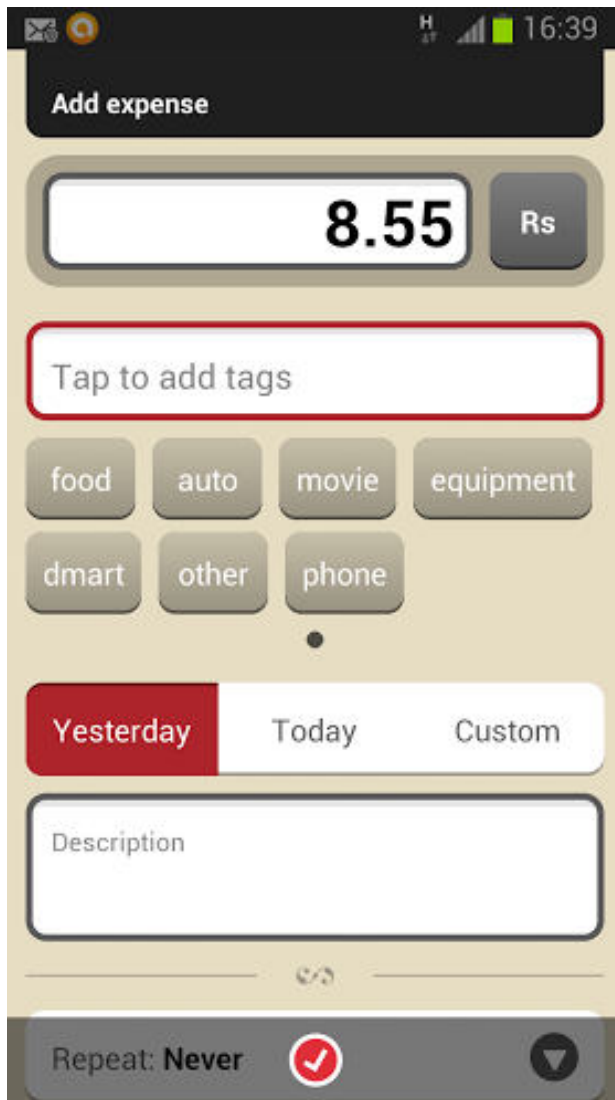


Figure 17: Toshl.com

4.3. Findings & implications towards design

4.3.1. How to improve the shopping experience

The user concerns about shopping applications were as follows:

1. Application that reminds user about his needs

The application should be specific and should only remind him of a product that he needs instead of bombarding him with suggestions that his friends and relatives have “liked” for example, If there is a product that is approaching its expiry date, user should be made aware of that. These suggestions should be inclined towards user’s budget. However once in a while, suggestions from friends can also be welcomed only if there is a need. The application can suggest user the best product available based on user’s budget. For example, user’s toothpaste is over, the application suggests the best toothpaste all my friends have tried and liked

2. Application that provides user a checklist of requirements before user goes for shopping

The application should generate a list every day that user can follow, just like making a short checklist before user goes for a shopping. The application should be intelligent enough to know the lifespan of each product that user buys. This can reduce user’s effort to create a list on daily basis to remember what to buy and what not to.

3. User should be able to compare multiple products in the same platform

User should have a platform where he could list out the products and compare them based on their features and select the most desirable ones. This can help user select products based on the need and save money from being wasted over irrelevant features.

4. User should be able to compare products based on requirements and budget

User should have a platform where he could compare different products based on their requirements and the budget for the product to know which product suits him better, here user's decision making is completely influenced by the need and the money he has, so that he could make better choices and thereby increasing the satisfaction value.

5. How to measure the quality of the product

Is there a way to sort products based on the quality instead of their colors and other features? How a user can choose a high quality product from a number of choices? Before making a purchase users take help from friends and relatives to decide upon his choices. Users follow user reviews and ratings to decide upon which product is best for him. Why can't we have a system where these ratings are personalized, and user gets products that are rated and reviewed by his friends and relatives? This can bring a better change in the way users see advertisements in Social media sites like Facebook.

6. how to measure the satisfaction of a product post purchase

As of now, we don't have a mechanism where a user can record their post choice satisfaction and give ratings after using the product. The existing rating mechanism cannot be used to derive insights about quality of the product. Users normally download; rate products based on the features available and the products they've moved to their wish lists. As a result these reviews that are available are highly biased towards their features and aesthetics. For example: A user may not give the same ratings if I ask him to rate it again after 15 days of using the product as the ratings he has given when he bought it. Usability evaluation is an important aspect of evaluating a product and this has an important role in deciding upon the quality of a product. For example, the application "My universe" in Google play store shows 4036 people has downloaded the app along with ratings recorded as 4/5 [Figure 18].



Figure 18: Download page of My Universe, Google play

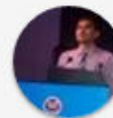
As we scroll down to the reviews page, we can read the following reviews by the users that even challenge the very structure of the app. This is an example that shows gap between user ratings and user satisfaction.



shailesh ingale 29 April 2014



Accounts not getting updated I am facing a problem. My bank and credit accounts are not updated. It fetched transactions the day I installed the app. Even if I do refresh it does not fetch the latest transactions. The app is of no use if it does not fetch transactions on its own.



Ashwani Namoli 20 April 2014



Cash balance There is no option where i can introduce a cash balance and then add entries pertaining to expenses made in cash so that i can check what cash remains in my hand



Mukesh Jha 27 April 2014



Not updates properly Good Aapps but too many error in data update.my actual a/c balance and balance in this apps always have lots of differences.

7. How to handle situation of product failures?

Product failures is another important aspect, most of the services that are being provided doesn't cover product failures. User has to directly contact the company instead of the shopkeeper from where the particular product has been purchased. However users tend to reach out to the place where he bought the product to get more details about post purchase services, if the product is under warranty period. So there should be a communication link between user and the retailer.

4.3.2. How to improve existing personal finance applications

The user concerns about budget based applications were as follows:

1. How to record expenses based on locations

Since most of the users had different locations for different purchases and specific shops for specific products, why can't we have a system where the expenses can be recorder right from the place where user buys it? If user visits the same place again he doesn't have to record the same category, product and the price again. This can reduce user's input effort.

2. How can user's future expenses be calculated

Expense trackers gather a lot of data from user's input. If these data can be analyzed, a pattern can be derived based on user's habit. If the application is smart enough to learn

user's spending habits, it will be able to predict how much money user is going to spend the next day or next month. This can bring a big difference to user's experience in using the application since it not just have brains, but knows more than what user knows about his own spending habits.

3. How to categorize user's expenses with lesser effort

Once user enters a product, the application should be able to categorize the expenses automatically, unless user wants to add the same product in a different category. If the application can learn from user's previous data, it will be able to predict under which category, a particular expense is going to fall under. This actually reduces the number of steps user needs to follow to enter an expense. Providing pre-defined categories won't be a good idea because users will find it difficult to adapt.

4. How to add bills and artifacts

From user studies, it was found that most of the users tend to save the bills and other artifacts related to an expense for future reference. If these artifacts can be electronically processed by clicking a picture of it and saving it in a storage device, it will reduce user's pain in collecting them and storing it. If there exist a technology to read the bill and derive the values from it, it can also reduce the user's effort in inputting the data. But the automatic receipt reading can error prone as there doesn't exist a common standard way of printing the bills. Even if the technology succeeds in deriving the product name and expense name, user always has to make sure that the data is entered right.

5. How to switch between currency if user is on a trip

It is also necessary that the user should be able to switch the currency in case if he travels to another country. This can help user in continuing using the product, even if user is abroad, and he doesn't have to do calculations prior to inputting the expense. It will be automatically converted into Indian rupees on request.

5. State of art

The aim for studying state of art was to test the validity of the user concerns and to see whether any of these findings have been already solved. If solved, how they solved it, if not, how the problem can be approached and be solved using innovative ideas.

5.1. Comparing problems with state of art








From user study, the user concerns were derived and compared with 11 products including 4 online shopping websites [**Figure 19**] and 7 Budget applications [**Figure 20**] that are commonly used. In the following charts, grey color shows the absence of the feature, green color shows that the feature is satisfactory, yellow shows the existing feature is not bad and red shows that the feature is not satisfactory.

Figure 19: Comparing online shopping sites with findings

Figure 19: User concerns Vs Online shopping websites	App reminds a user a need or a lack. Eg: In case a product is approaching its expiry date	Shows the product + retailer outlet	Gives personalized offers/ discounts	Gives suggestions based on user's location	Suggestions based on user's shopping History	User can post complaints/ Suggestions to the retailer in case of a product failure	Gives the best offer/deals based on the season/festival	Gives suggestions based on my mood/ Habits	Shows a checklist of requirements that I have before I go for shopping	Compare requirements Vs the Budget	Categorize the products based on Money Vs Requirements
Flipkart Online retailing> electronic products, books, stationary and lifestyle products. 		Sole Dealer	Discount on last viewed based on the user's browsing history + e-gift vouchers			Check attachments with chart (Attachment 1)	Sales + Festival offers	Based on My search History			Search by Price, type/categories, product features. Check the attachments with chart (Attachment 3)
Groupon Best deals online 		Shows Product + retailer	Discounts on the deals and availability	Suggestions based on user's location			Best offers + deals	Gives suggestions based on my habits: based on my frequently viewed products			
Foursquare Social Networking for Mobile devices> Check in's at venues 		Based on other user's suggestion	Personalized discounts based on user's number of visits. Eg. "Mayor" can avail 15% discount anytime	Tips to the venues: any user can read / write suggestions for things to do, see, or eat at a location							
Myntra.com Online shopping> retail fashion and lifestyle products. 		Sole dealer	Gives discount coupons			Check attachments with chart (Attachment 2)	Gives coupon codes for discounts and Sales	Gives suggestions based on last viewed product through ads			Search by categories, brand, colour and price. Check the attachments with chart (Attachment 4)

Qualitymeter: How could I measure the quality of the product that I'm going to buy	Measure the satisfaction after the purchase/ usage	Product Features	Product Reviews/Ratings	Customer side- Add the retailer to my loyal List	Add the product to wish list	Categorize the products on the best product First	Tracks the purchases made	Search based on the past history of the user. For eg: The product that I searched recently should come first.	Rewards	Compare Multiple Products.			
						Best product First			Gifts	Compares upto 4 products			such a feature doesn't exist
		Shows different views of the product	Shows how many people bought the product				Tracks the products based on the location and the deal's expiry						The feature is Satisfactory
					User can add the place under his mayorship or earn badges based on his number of visits			History page allows the user to search the check'ins based on category or where they were with time	Points				The existing feature is not bad
					Can add the product to the wishlist								The existing feature is not satisfactory

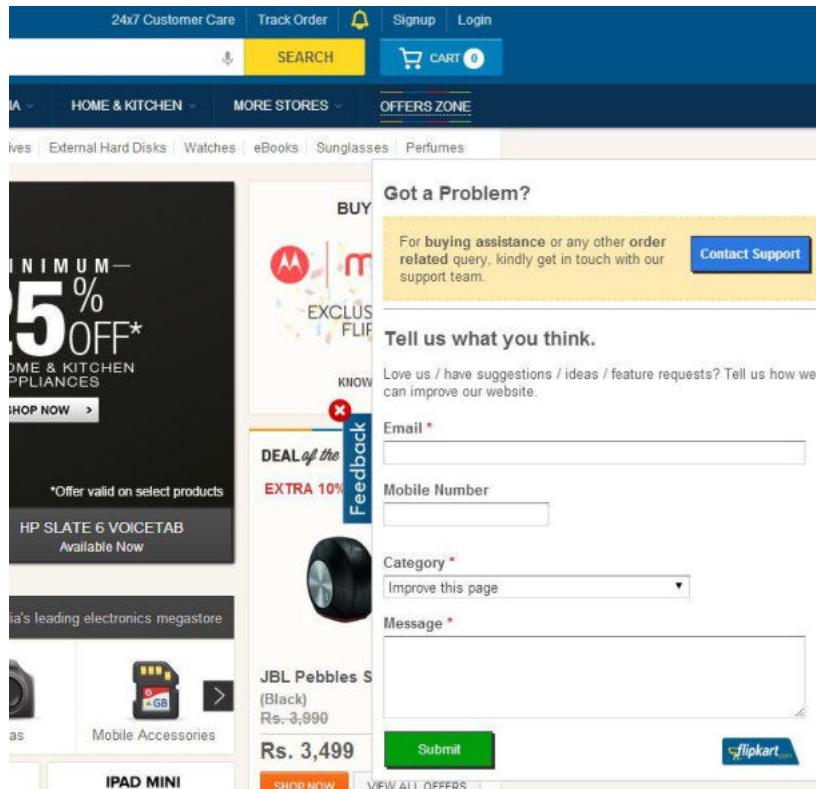
Figure 20: Comparing Finance applications with findings

Figure 20: User concerns Vs Budget applications	Maintains records of my Expenses	How much money I'm left with in my account	Categorizes the expenses	Where do I spent my money? location based expenses		How much Money I'm left with	How many days I've to survive	Visualizing the expenses / Graphical Representation of the data	Budget for the next month	Manage Multiple Bank accounts	Previous month's data visualization and Future forecast
MyBudgetBook Budget tracker 									This month's balance will automatically be carried over to the next month.		
StarMoney Online-Banking Software 											
Mint.com Web-based personal financial management service 											
Moneycontrol Real-time information about Indian and global markets 	In stock		Categorize by the name of the market stocks								
My Universe Online personal finance management platform 				Where money was spent. Photos of the location can also be attached.							
Splitwise Track bills and other shared expenses 	Tracks spending trends										
Toshl Finance Budget Personal finance manager and expense tracker 				track along with the currency change	can add tags also			with infographics: also help compare with last month's expense at the same time.	Move the remaining amount to the next month		

Categories + Subcategories to get an overview of the expenses	Make payments/ transfer the money between the accounts	Customized payment template	Automatically categorize the expenses	Alerts: Bill alerts, Bill reminders, notify about upcoming bills, files, etc.	Stay informed about the events that are going to effect your investments. (for stock)	How much money I've earned today(Stock)	Manual Input	Add Bills / artifacts	Travel companion with currency converter			
user should categorize manually							manual Input					such a feature doesn't exist
							Both manual and automatic update from credit/debit card					The feature is Satisfactory
user should categorize manually							Both manual and automatic update from credit/debit card					The existing feature is not bad
						On stock	manual input					The existing feature is not satisfactory
Automatically					in addition to the news, recommendations based on the user's portfolio is also given			Click and add images of the bill				
				email reminder for bill			manual Input					
				reminders for bills as they come due + loans			manual input		Custom exchange rates			

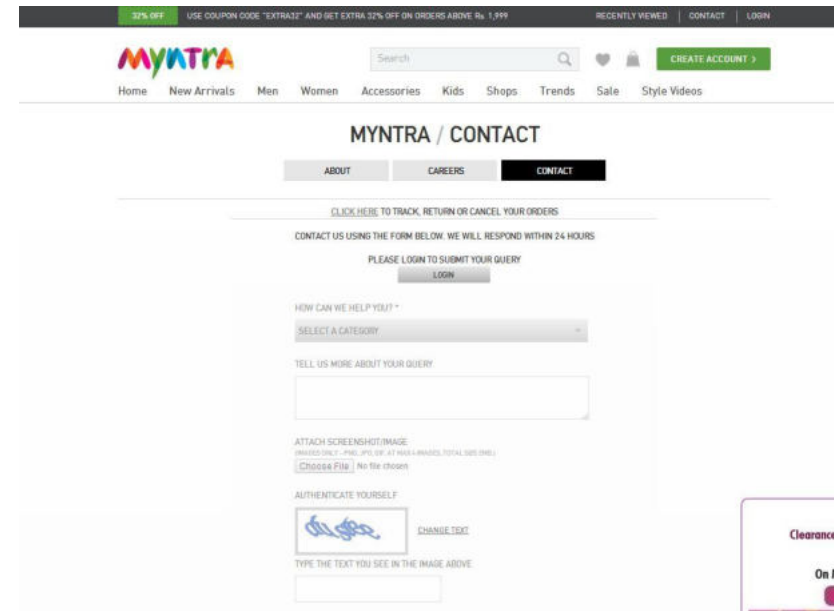
Attachments with chart

Attachment 1



Flipkart: Feedback/customer support form

Attachment 2



Mynta: customer support form

Figure 21: Flipkart's & Mynta's feedback/ customer support form

Attachment 3

Showing 9 products

MP3 Players (12)
TV & AUDIO/VIDEO PLAYERS (23)

REFINE

Price

- Rs. 2001 - Rs. 5000 (0)
- Rs. 5001 - Rs. 10000 (6)
- Rs. 30001 - Rs. 40000 (0)

Brand


- Sony (9)
- Olympus (0)
- Enem (0)

Discount

- Upto 10% (0)
- 10% - 20% (2)
- 20% - 30% (2)
- More than 30% (1)


Availability

- Exclude Out of Stock




Sony ICD-UX533F 4 GB Voice Recorder
and 1 more variant
★★★★★ (19 ratings)
in Voice Recorder
Rs. 8996 11% OFF
Rs. 7990
8 Sellers from Rs 5965

- 4 GB Capacity
- Built-in FM Radio
- Voice Operated Rec.
- Direct USB




Sony ICD-UX533F 4 GB Voice Recorder
and 1 more variant
★★★★★ (19 ratings)
in Voice Recorder
Rs. 9996 36% OFF
Rs. 6299
5 Sellers from Rs 6299

- Built-in FM Radio
- Direct USB
- Voice Operated Rec.
- 4 GB Capacity



OUT OF STOCK



OUT OF STOCK

Flipkart: Search by price, type/categories, product features

Attachment 4


Men Women Kids Sale More

FILTER BY

BRAND

- Nike (142)
- Reebok (109)
- Puma (98)
- Adidas (195)
- FILA (59)
- HRX (55)
- 21 more (+)

COLOUR




PRICE

835 items


Rs. 769 - Rs. 19,995

DISCOUNT


- 50% and above
- 40% and above
- 30% and above
- 20% and above
- 10% and above




Nike
Men Black Ballista IV MSL In Sports Shoes
Rs. 2,595



Nike
Men Grey Revolution 2 MSL Sports Shoes
Rs. 3,895





Myntra: Search by categories, brand, color and price

Figure 22: Flipkart's and Myntra's product search filters

5.2. Evaluating a feature

From the study on state of art, it was found that many of the applications had the features that users were concerned about. But, these features differed from each other on the basis of usability, and how efficiently they solve the user concerns. The product features were not evaluated with each other but, with the user concerns and how well they solve the problems. In the chart, the occurrence of a feature is further classified on the basis of its satisfactoriness. This will give a better idea of state of art.

5.3. Study of State of Art and its implications to design

The study on state of art gave insights about why the existing products fail to satisfy the user concerns. It also showed how to improve the existing products and how to incorporate new features to enhance the user experience. But, here a conscious decision had to be made, either to make a feature rich product or aim at a paradigm shift (a fundamental change in approach or underlying assumptions.)

1. Categorizing a purchase

From user studies, one user commented on the categorization of his expenses, *“As the number of categories increase, the transparency of the budget increases, but it becomes more and more complicated to analyze.”* This implies that the number of categories directly influences the understanding of information. As the number of categories

increases, it becomes too complicated to understand. So there should be a balance between transparency and number of categories. This also applies on the understanding over the visual representation of data over an interface. E.g. In most of the applications that are available, most of them have pie charts on their interfaces.

As the number of categories increases, the pie chart becomes more and more detailed and complex to analyze **[figure 23]**. Also if an expense on one category goes up, user has to spend less on other category to create a balance. This can affect both the user’s budget and savings, so there is a need to derive a general terminology on how to categorize user’s expenses.

The kind of expenses users have are

1. Single product, single category

E.g. A dinner at a restaurant

2. Multiple products, single category

E.g. A shopping at supermarket

3. Single products, multiple categories

A product that can fall in two categories, e.g. an unexpected travel can fall into “transportation” (or) an “unexpected expense”

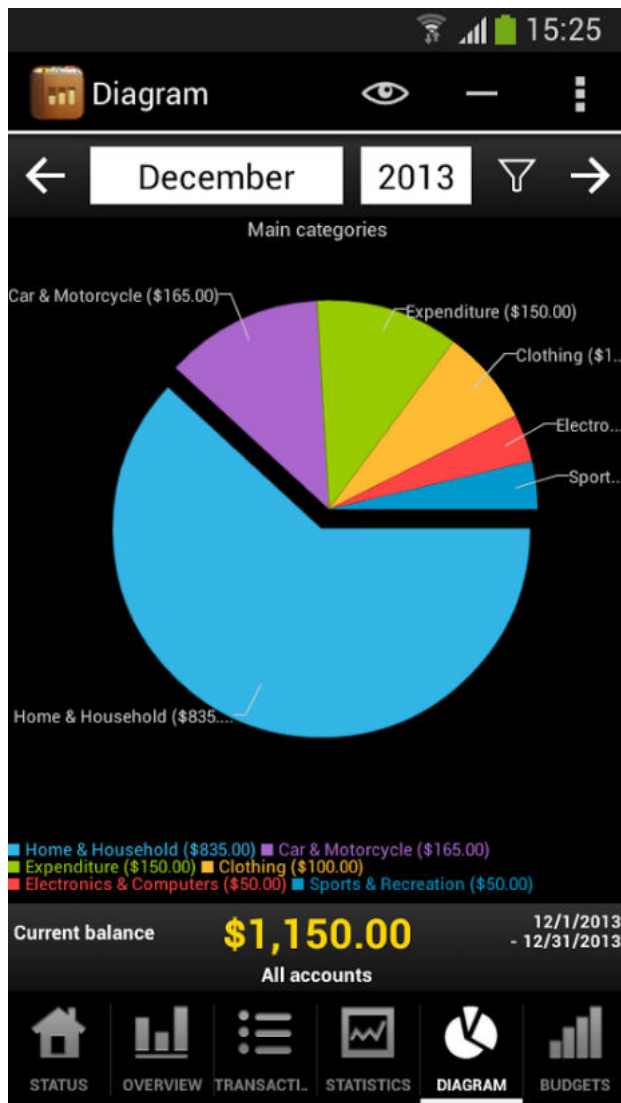


Figure 23: Pie chart in My Budget book

The process of categorization is entirely user dependent. No two users may have the same way of categorizing an expense. So it's better not to provide pre made categories to the user. Instead urge user to create own categories.

2. Visualizing the expenses

There are a number of facts that are associated with a single purchase like,

1. Product name, description
2. Shopping location
3. Categories (a product can fall in multiple categories)
4. Expense

From all the above, expenses and categories are more important for visualization than the product name or shopping location as it reduces the complexity of the visualization and enhances user understanding.

3. Setting up a budget

Users have different ways of recording their expenses, most of them write down their expenses, product-wise and expense-wise [Figure 24]. For e.g., one user said "I make one budget for an year, then fill it day-wise, month-wise, and sub-classifications like budget for each expense and the actual expense for each." This takes a lot of time to analyze at the end of the month. Some users categorized their expenses so that it can reduce the complexity of the expenditure.

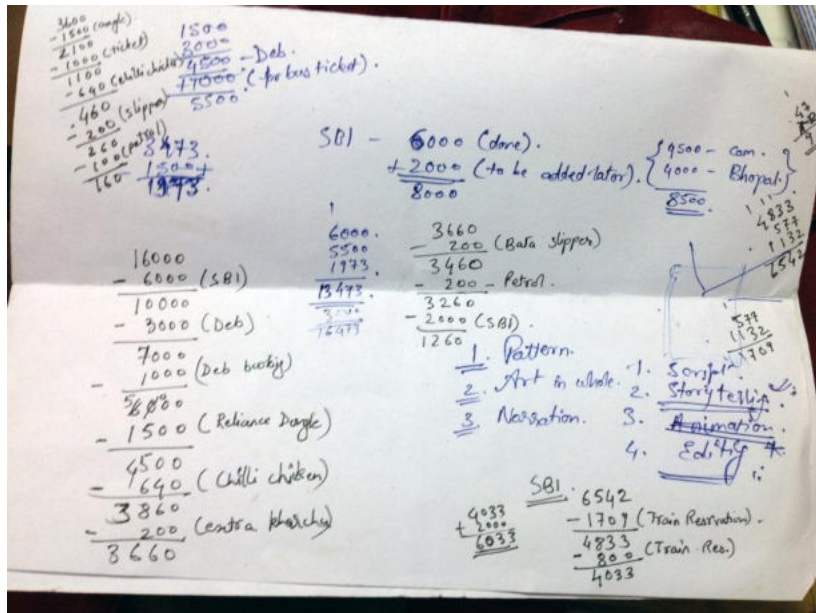


Figure 24: Expense-wise, product-wise recording

For setting up a budget, it's necessary that user should be aware of the categories and kinds of expenses he is going to have. User should be able to classify these categories into different kinds of expenses. They are:

1. Payments that are paid only once in a year
2. Expenses that do not change dramatically throughout the year (or) Fixed expense
3. Expenses that change dramatically throughout the year (categories)

The reason why user needs to set up a budget is, user should be able to make his payments without trouble. It should remind the user about the due dates. Huge expenses like

buying a car or a house needs a lot of planning the budget planning should help user save money for such expenses. User should be able to plan how his next month's/year's expenditure is going to look like, and he should be able to save money.

It was found from studies that, in India, there also exist practices like leaving cash with friends or relatives for safekeeping and reducing the user's temptation to spend it [12]. Why can't the same method be used to save user's money? Will users trust an application the same way they trust their friends or relatives?

4. How to input expenses with lesser effort?

One of the main reasons why users stopped using budget applications to track their daily expenses was because of the input mechanism that user have to keep inputting all the time. The user has to fill the product name, select category and input expenses. User has to be motivated and disciplined to do this activity.

Even when users are using budget applications, they tend to enter their expenses once in a day, i.e. by the end of the day. So, how can the users be motivated to be disciplined to input their expenses? In this case motivation can be enhanced by making the feedback mechanism rewarding. How about giving user a list for shopping, instead of asking them to remember what they have to buy? Or how about predicting the possible expenses for the day and user just have to just "tick" them like a checklist? If the application is smart enough to remember what user wants, this might help user as a

reminder, as well as a low effort mechanism to input expenses.

Another way to help user reduce his input effort is by using other means of input like voice input and location based input, where user makes an input at a particular place, the location gets recorded through GPS and next time user visits the same place next time, he gets an app generated call asking for the product and the amount spend. This method can be used to automatically categorize the particular expense as the app can remember the location and what kind of products user has bought from that particular location.

5. Comparing multiple products

Another important problem faced by the user was how to evaluate or compare a number of products based on their features and price to find out which product is best suited for user's needs? There are two existing ways for comparing the products. One is by filtering products based on the features, and other way is by selecting a number of products and comparing them with each other, to find which one is best suited for the user's needs.

Flipkart [Figure: 25] has an option to refine the product search based on a number of options like Price range, brand, discount, availability etc.

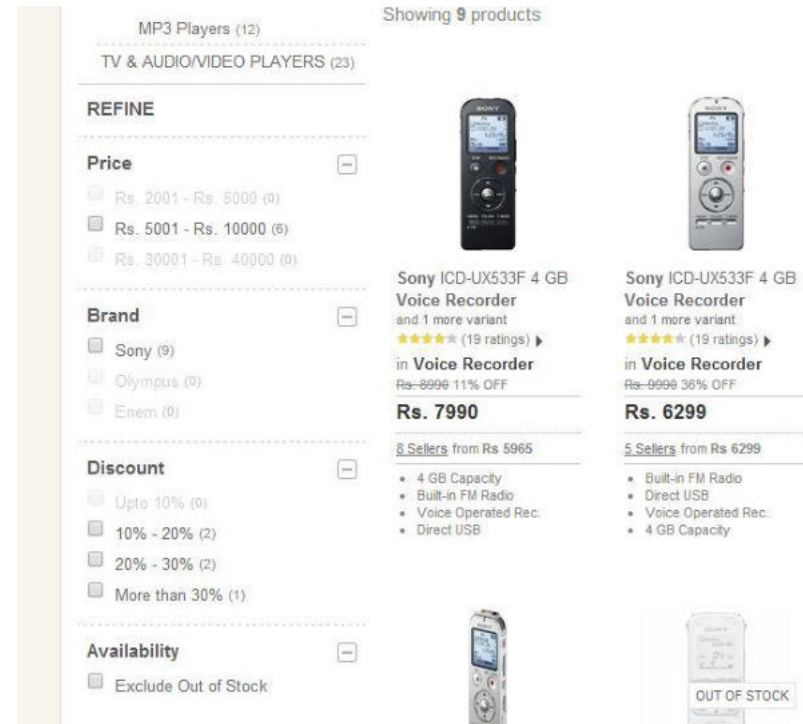


Figure 25: Flipkart's search refining engine.

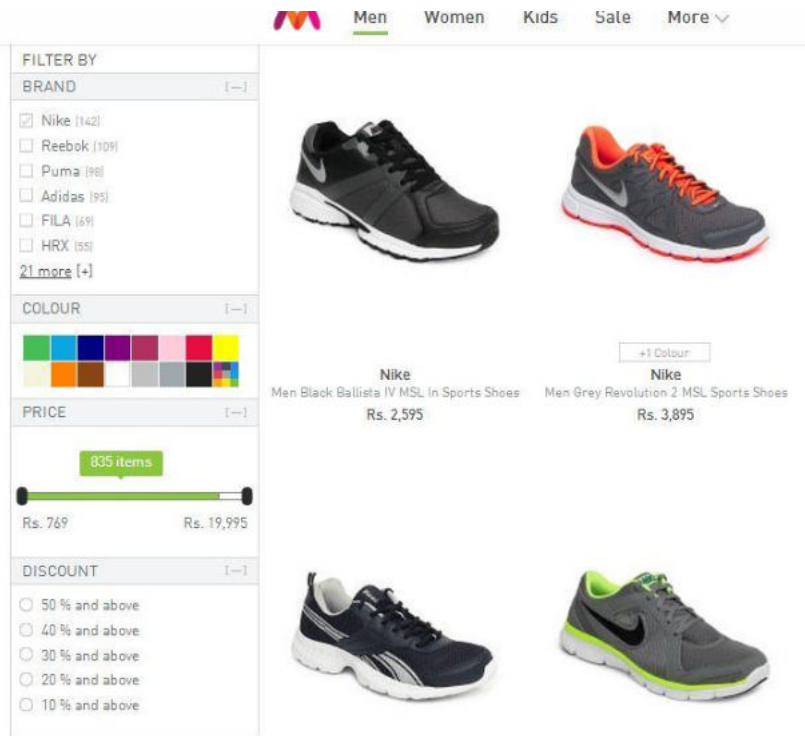


Figure 26: Myntra's product filter

Myntra [Figure: 26] has a slider based visualization that also gives information about how many products fall under the particular price range. User can sort the products based on colors also.

Flipkart also provides a comparing feature where users can add two or more products and compare them with each other based on their features like price and other general features [Figure: 27]. Both the kinds of comparisons are

essential to find the refine search and find the best product for the user needs. But this refining feature doesn't actually serve the purpose of helping user find the best product based on his needs.

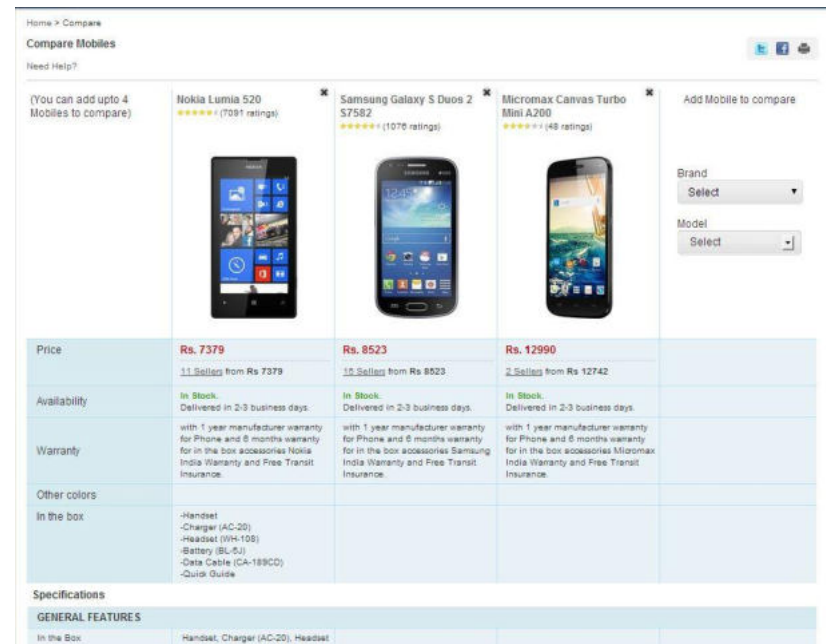


Figure 27: Flipkart's multiple product comparison window

For this, user needs to have a list of requirements like a checklist before he goes for shopping. It should also help user "think twice before he buy" as the refining mechanism should be able to know what difference the particular product is going to make to his budget. It should also help the user find the right store to find the particular product.

6. Project brief

After user studies and reviewing state of art, the initial brief and problem statement is defined with the help of the insights obtained from the analysis.

6.1. Problem statement

The following goals were set after interviewing the users and studying about how the state of art can be improved over their existing problems. Here more focus is given to come up with paradigm shift concepts than to build a feature rich product.

The goals of this project is

- User group: 16 to 26 years
- to build a mobile based expense tracking application
- track user's expenses
- use visualization as a tool to communicate personal data to the user
- help user derive insights about his expenditures
- help him save money for meeting his meaningful goals

6.2. Personas



Rohit: Always go for the best product in the market; doesn't care about the price

Rohit Raj

Rohit Raj is a 26 year old engineer in Chennai. He lives alone 10 kilometers away from his office. He shares his rented flat with two others. He basically eats his lunch outside, cooks his breakfast and dinner. He doesn't own a refrigerator so he buys his grocery daily. Rohit is a tech savvy person; he keeps changing his mobile phone every year. He always go for the best product available in the market.

Rohit's day is filled with office work; he boards the train from Velacheri and travels to Tidel Park. He doesn't miss his newspaper and a packet of cigarette before he boards the train. He has an account in the hotel where he eats his lunch, comes back home at 8 pm. He buys milk and other groceries on the way back. His weekends include a night out to a local bar with his flat mates on Friday night and the other days looking for the best restaurants around the city for lunch.

Financial Status

Rohit is not financially stable. He misses his due dates for paying the rent and electricity bills. His latest purchase of an iphone has claimed all his bank savings.

Some of his friends asked him to write down his expenses, but he stopped doing as it didn't help him much. Rohit is now worried as he has no savings and his expenses are increasing.



Deepak: fashionable and Biker

Deepak Soman

Deepak is a 22 year old College Student; he stays in college hostel with his friends at Christ College, Bengaluru and regularly travels to college located 2 kilometers away in his bike. He doesn't like hostel food so he prefers to have food outside in a local restaurant. Deepak is a fashion freak, spends his money on clothes and shoes.

His normal days are well organized; he leaves for college at 8 in the morning with breakfast on the way to college, lunch at college canteen and a late night dinner at his favorite diner. Weekends are fully occupied as he roams around the shopping malls and watching movies.

Financial Status

Deepak hails from a Malayali family. He is the eldest of 3 and his parents are government employees. His only source of income is from his parents and sometimes he has to ask for extra money as he doesn't have control over his expenses. Deepak feels bad for taking extra money from his parents as his younger brothers are also studying and his parents can't afford to pay him.



Radhika: Spends her money wisely

Radhika Krishnan

Radhika is 26 year old HR Manager in Pune. She lives with her family in a small town that requires 1 hour commute to the office. She spends much of her time at home with parents and does all the shopping for the family.

Her typical day starts at morning 5pm; she drives her bike to the bus stand where she boards the bus to workplace. She carries food to office every day. She leaves early for home so that she can be with her family. On weekends, she goes out with her friends and prefers good restaurants to dine.

Financial status

Radhika is the only earning member in her family and both her parents are retired. She takes care of the household expenses including monthly grocery. Her other expenses are on travelling and bike maintenance. She doesn't keep track of her expenses as her salary is not that big and she knows how much she is spending but she is always afraid to spent money. She keeps forgetting things to buy and is worried over her parent's wedding anniversary that is coming up after 2 months.

7. Concepts

Based on user study, the following design concepts were generated over the problems found. The idea was to generate both the extremes of applications for shopping experience and compare them with each other.

Concept 1: Saving Money

This concept is mainly aimed at saving money for his future expenses. The aim of this concept is to reduce the effort of inputting expenses, saving money, managing his expenses and finally, visualizing his expenses.

1. Input expenses

For inputting an expense, user just has to add the description, the amount and can drag a category and drop it into the corresponding text box. The categories are represented in the form of tags [Figure 28].

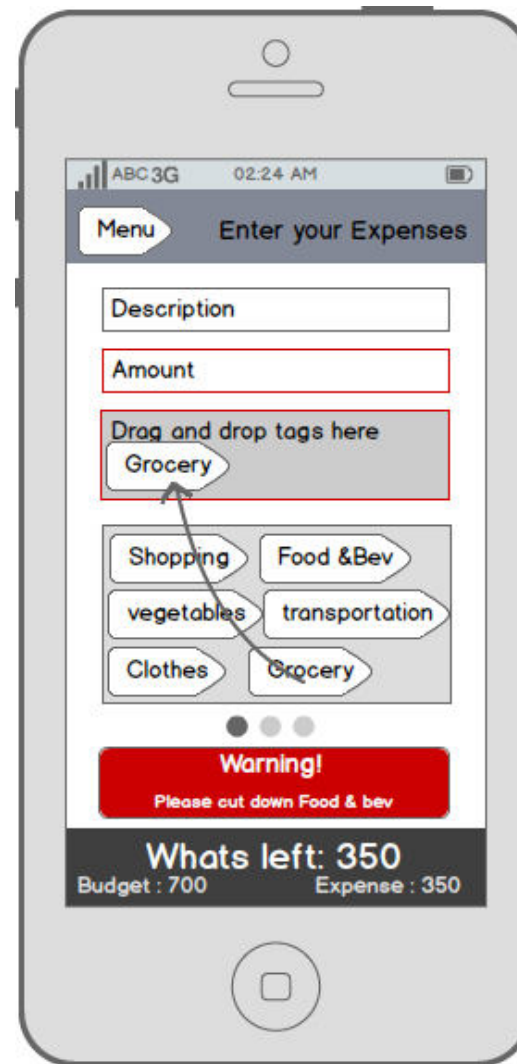


Figure 28: Interface for inputting expenses

This will reduce user's effort in typing the category name. The reason why tags are used is that the tag-box/tag-container has the most frequently used categories displayed, so user doesn't have to remember the category names every time. The tag-box also contains "target tags" and other "payment tags" [Figure 29]. Targets refer to the targets that are to be attained, like making a purchase that involves prior money savings. Once the target due date arrives, these tags appear in the tag box, it also acts like a reminder to the user. A payment refers to the fixed payments that the user has to pay every month, like rent, EMI, Insurance, debts etc. These targets are generated at the time when a budget is set.

The submit button also acts as an indicator that displays warning messages.

2. Setting up a Budget

Setting up budget is a 6 step process [Figure 30 & 31]; here user basically has to differentiate his payments (once-in-a-year expenses) and fixed payments (expenses that do not dramatically change all throughout the year) from the daily expenses. The idea is to separate the money and remove it from user's budget so as to reduce the temptation to spend it.

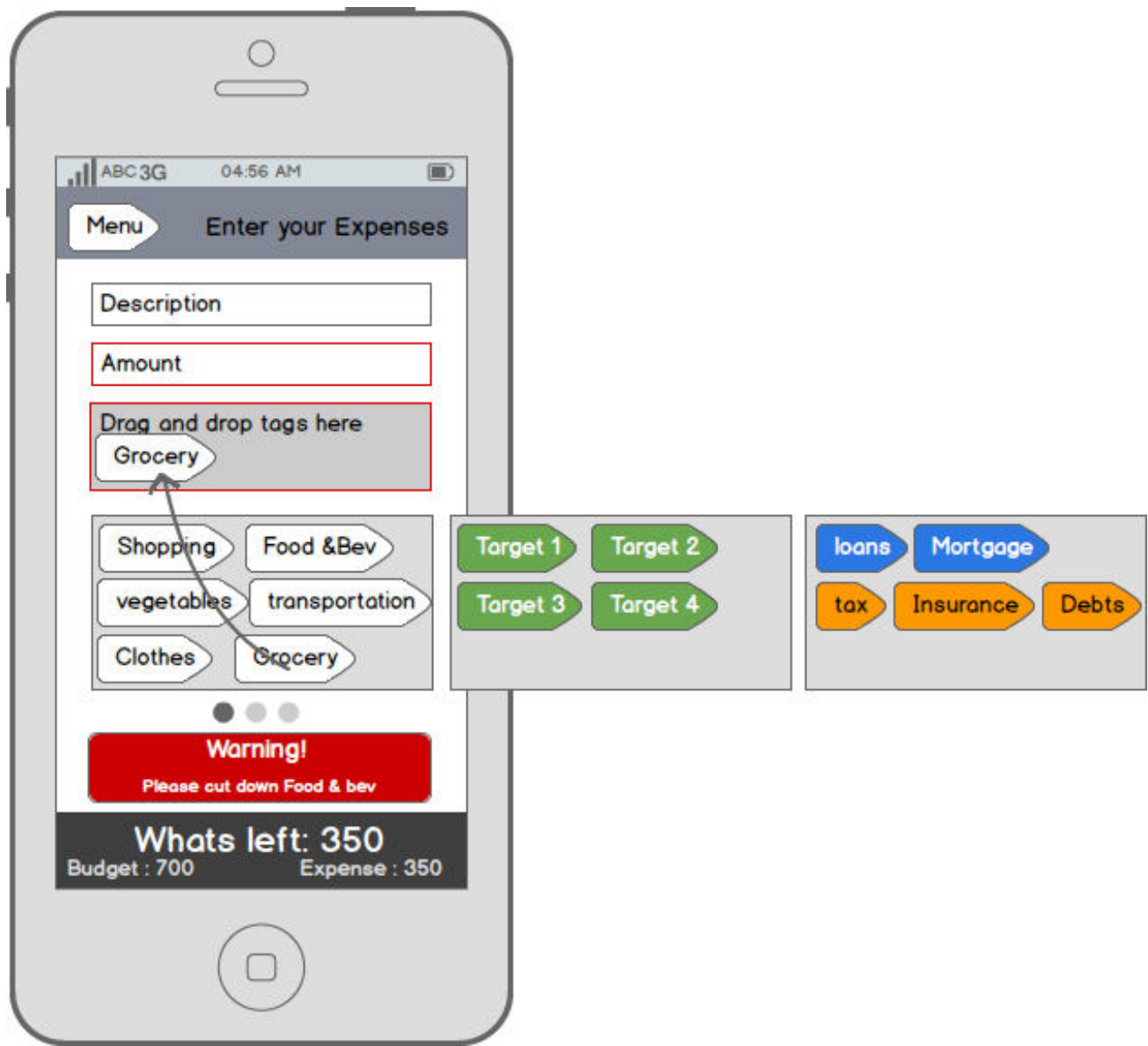


Figure 29: Different types of tags in tag-box

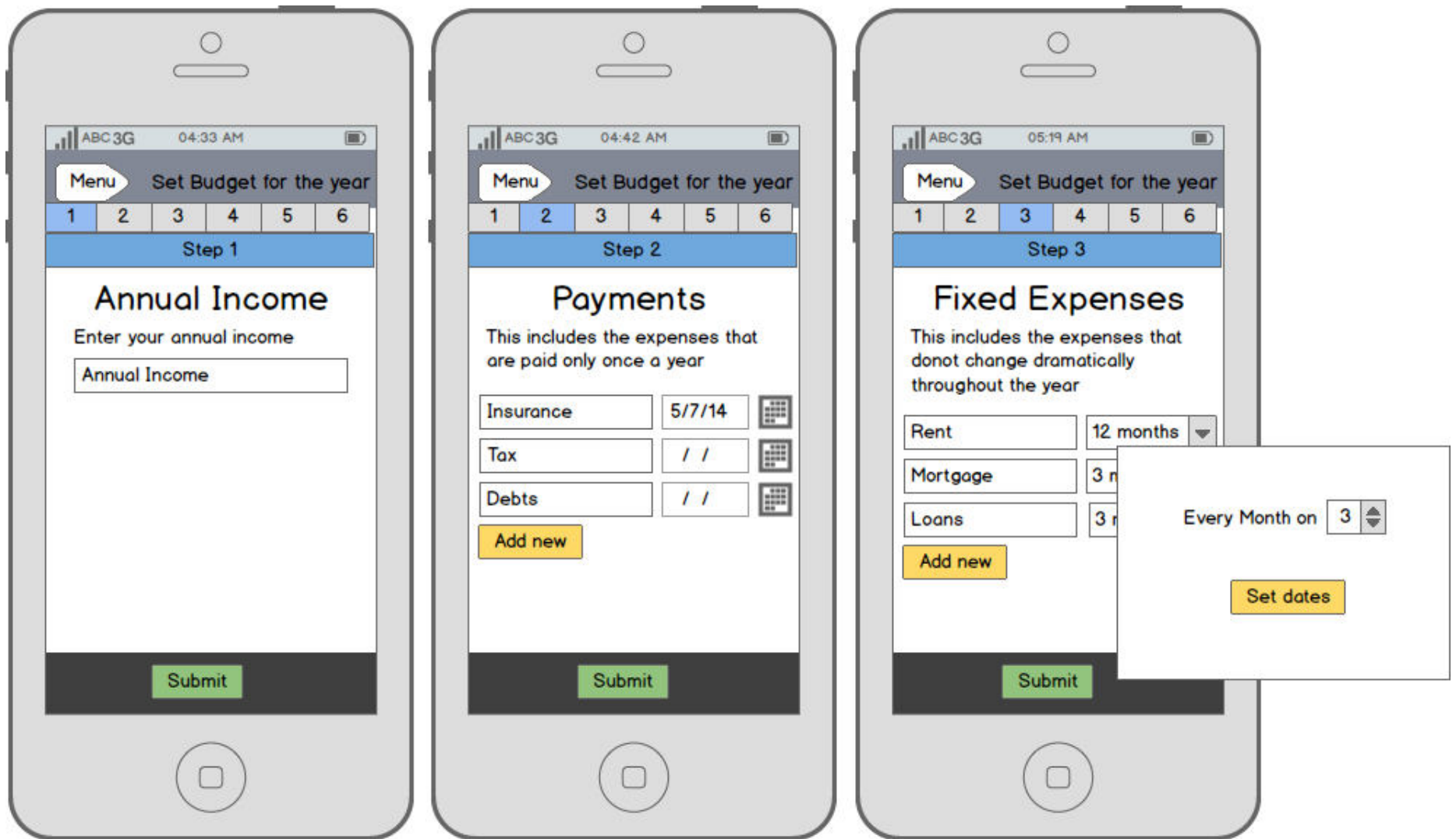


Figure 30: First 3 steps to setup a budget

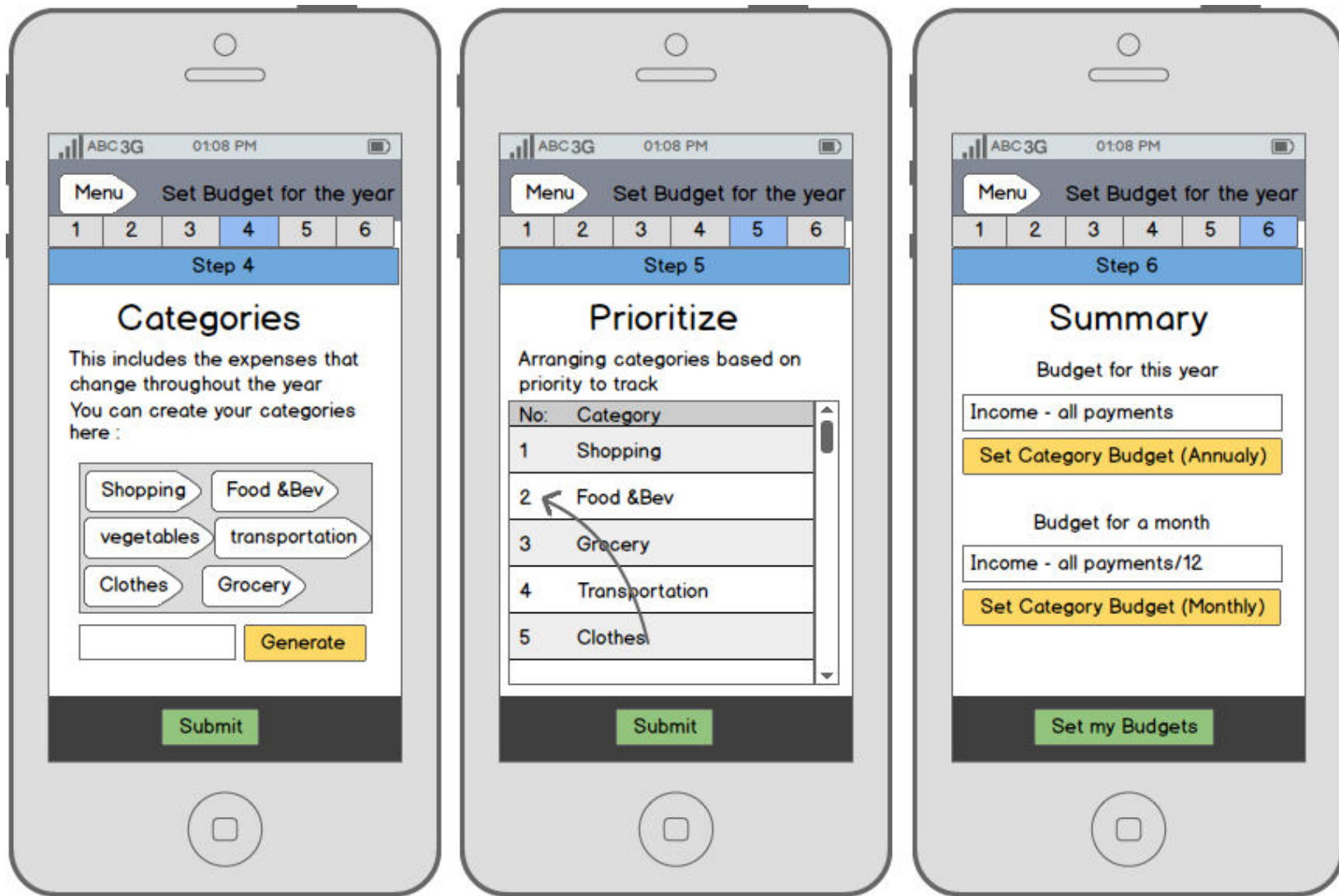


Figure 31: last 3 steps to set up a budget

In step 1, user has to input his monthly income, in step 2 and step 3, user defines his once-in-a-year payments and other fixed payments, add the due dates, and remove them from the annual income. In step 4, user has to define the categories, the variable expenses that change throughout the year. So user can generate category names, the same categories that are displayed on the input page. In step 5, user can prioritize which category should be given more priority; this order will be followed all throughout the application: in visualizations, tag-box etc.

The reason why user needs to prioritize his categories is because, if user wants to keep track of a particular category, he can have a closer check all the time, as when each page gets displayed, the top priority category will be displayed first. Once the priority is set, user can see how much money he has to spend this year and this month. This forms the budget.

3. Saving money

So now, the budget for the month has been set. Now user can start adding his expenses. He can also set category wise budget [**Figure 32**], where he can see how much money he has saved in a particular category. If user wants to handle a huge expense in future and wants to start saving money for a longer period, he can set a target. User can also set a due date i.e. when he has to make the purchase. User can start moving his savings into these targets. Once the due date approaches, the target-tag moves into the tag-box in the input page and user will be alerted.

If user is experiencing financial crisis, he can always delete the target and return the money into any of the categories.



Figure 32: Interface to view category wise budget and create targets to save money

4. Visualizing expenditure

As user starts inputting the expenses, he can also visualize his expenses using the visualization tool **[Figure 33]**. This visualization is in the form of Budget versus Expenses and user can view the visualization in three versions: daily, monthly and yearly. The visualizations used shows where exactly the user is, in a month or a year and how much money he is left with. It also follows retrogression instead of a progressive visualization. User is given a sense of feeling

that he is running out of money to evoke the money saving habit. The visualization will change its color from green to red following an uncontrolled spending. Pie diagrams are also provided for category wise visualization.

It also displays the budget for the day, how much the user has spent and finally what is left at the bottom of the interface. The money left is given more priority to evoke the sense of saving money instead of spending it.

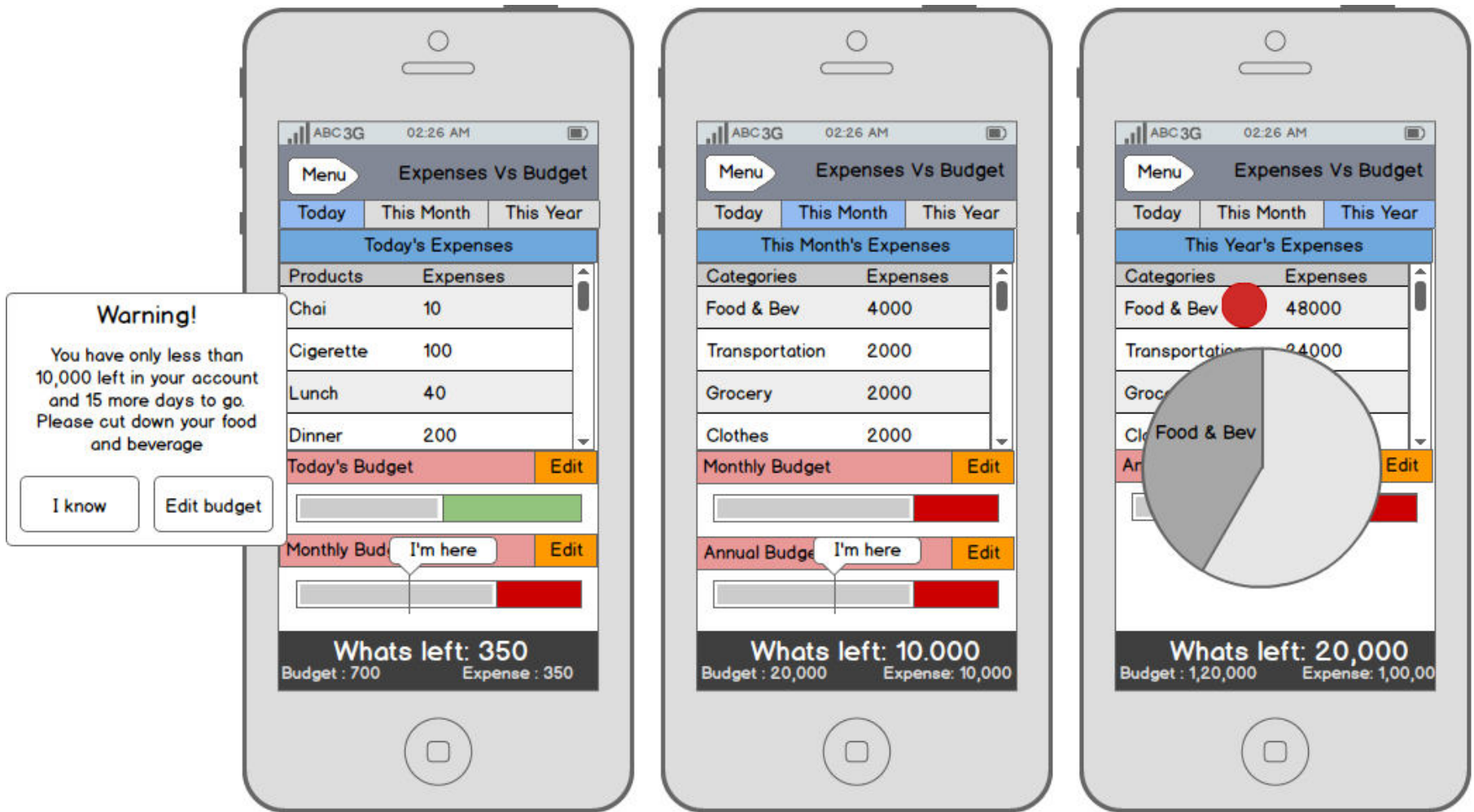


Figure 33: Visualizing expenses: daily, monthly and yearly

Concept 1: A quick evaluation

Advantages	Disadvantages
<ul style="list-style-type: none">• Detailed way of explaining to user how to manage his budget and save money• Provides necessary feedbacks to the user when any category is running out of money• Follows logical way of creating a budget and saving money• It was found from user studies that money is an important factor that influences shopping habits of a user, and thus by saving more money for shopping, it can enhance shopping experience [See section 4.2. Findings/ point 2]	<ul style="list-style-type: none">• It persuades user to spend less money• There are no rewards, it only persuades user to save more money.• Setting up a budget, even though it is for once in a year, user has to do a lot of calculations prior to filling the steps.• A user may not remember how much his insurance installment is or when his installments become due.• If the finance application is less rewarding, then there is less chance for users to use this application

Concept 2: Shopping planner

This concept is mainly aimed at helping user find the best product, find whether user's requirements are satisfied or not, assist user in his shopping process and to make user think twice before he buys.

1. Speech input

Here speech input is used to reduce the effort in inputting expenses [Figure 34]. The reason why manual input was replaced by speech input is because, to unlock the phone and find the application takes a number of steps. Even if user keeps a shortcut on phone's desktop, user has to unlock the

phone. So a speech controlled input mechanism was a better choice at this point. User can just press his headphone's answer button for a second or two to trigger the application. No phone unlocking is required. As the application is triggered, it responds to the user by asking "How can I help you?" User can respond by any product name and application finds a list from which user can choose from.

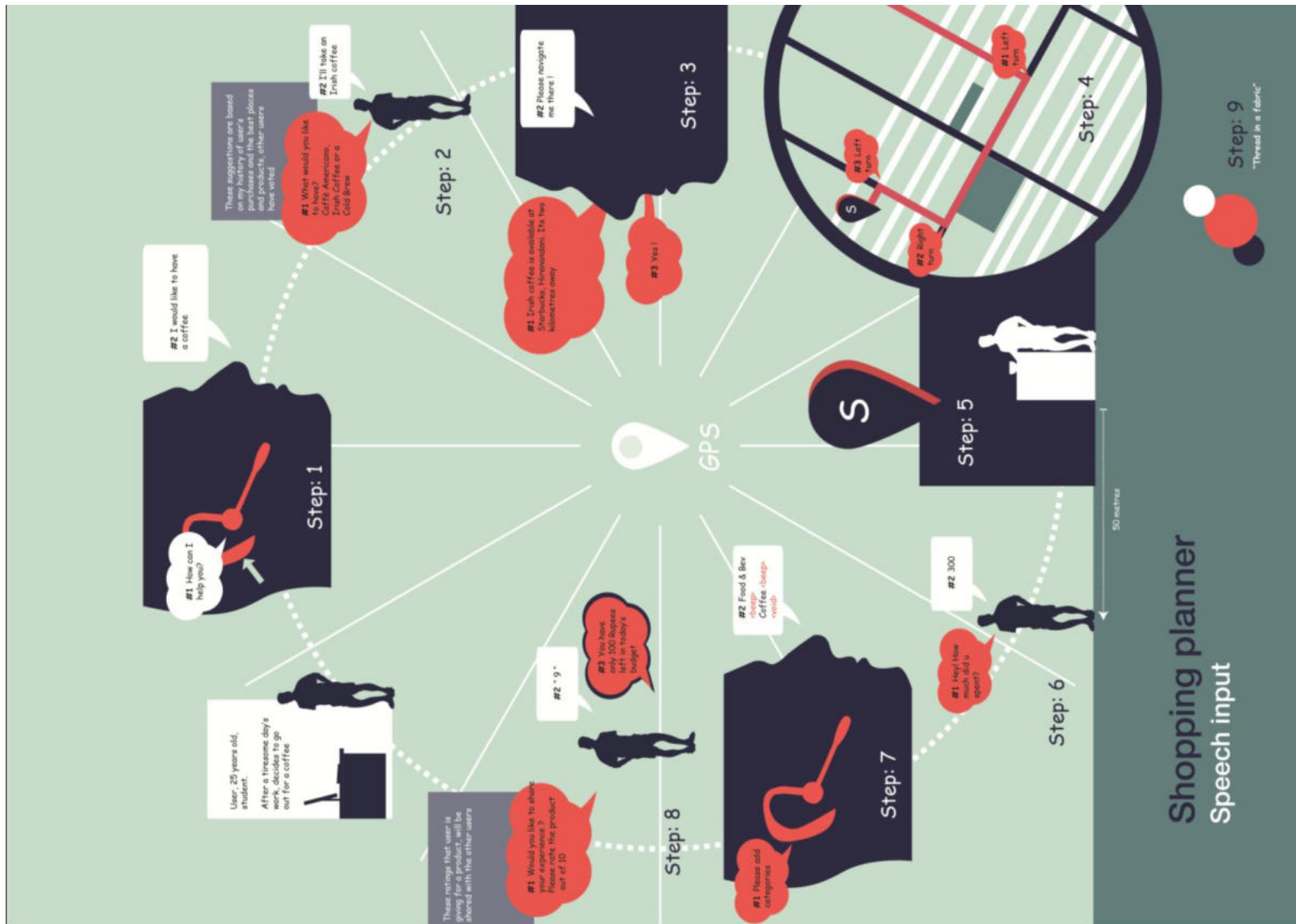


Figure 34: A scenario in which user is using speech input of shopping planner

This prediction is based on the user’s previous history as well as from his friend circle. The speech system can guide user to the place where user’s choice is available. The system tracks user by GPS and confirms user’s geo-location every now and then. Once user leaves the shop and moves away a couple of meters away from the shop, user will get another voice based call that originates from the application. It asks for the expense as well as the categories, followed by a request to rate the shop. This experience will be shared with user’s friend circle and may possible appear time in user’s search results. Next time user visits the place, the application remembers the place via geo-location tracking and add the category automatically. This is mostly a Siri like application. This voice input is a remote feature of the application to input expenses. It also has an interface where user can perform the same tasks manually.

2. Manual input

Here user can search a product by entering the product name, he can refine the search by choosing a particular category (Please note that this category is not related to budget) like brand, sales, place, shop etc. also by his requirements like price, color and other features associated with the product name. Based on the search, user can see the shops plotted in a map within a particular circle of certain radius (in kilometers) from user’s location [Figure 35]. User can change the radius of the circle by gestures. Following the search, user can see a horizontal list generated with the products having maximum number of appreciations and ratings listed first. Now user can move the product into a

shopping cart, compare it with other products generated from similar searches on the basis of its features, ratings etc.



Figure 35: Interface for searching and comparing products using manual input

This process actually help user to narrow down his searches and finally arrive at the best product. As user clicks the button on bottom saying “See the final list”, user moves into

the next page. Here user can view all the products here in this list. User can carry this list for shopping as it acts like a checklist and it also gives the total amount user has to carry for the shopping and it also tells what difference this shopping is going to make to user's budget [Figure 36]. The shopping planner can be connected to an existing budget based application and the data can be shared. As user ticks each product in the checklist, the input will be recorded in the budget application. The list can also be used for future reference. The visualization at the end of the interface gives user a feedback about what difference the following shopping is going to make to user's budget. It can also act as a trigger to evoke this thought in the mind of user "Do I really need to spend this much on shopping?"

User can view the list of the products that he bought as well as move the products he wants to buy into their wish lists [Figure 37]. User can rate the product as well as the shop where he bought the particular product. The application keeps user informed about the offers, sales etc. and user also get in touch with the retailer in case of product failure.

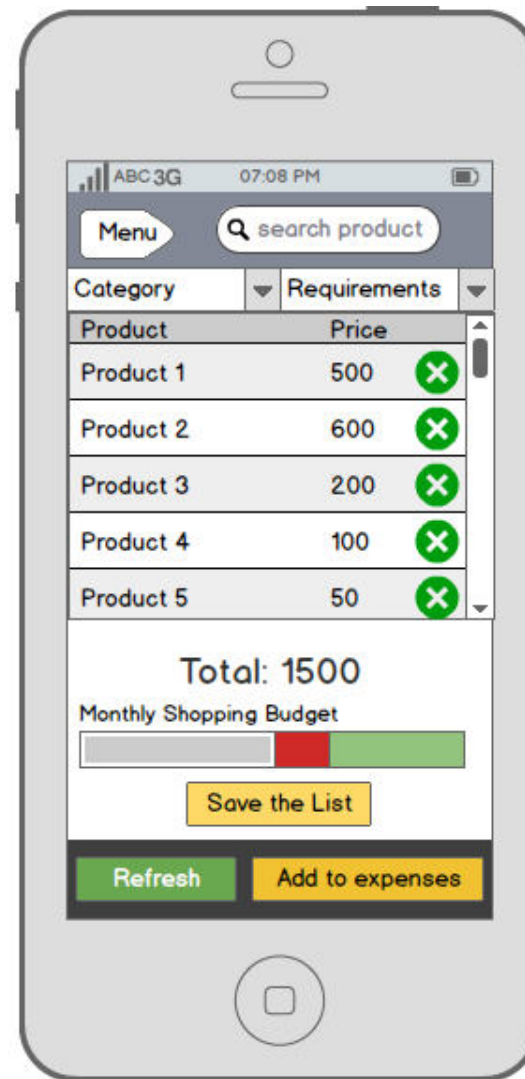


Figure 36: Final list of products accompanied by the visualization that shows what difference this particular shopping is going to make in user's budget



Figure 37: Interface for rating bought products and the shops from where it was bought

Concept 2: A quick evaluation

Advantages	Disadvantages
<ul style="list-style-type: none">• It focuses more on shopping enhancing aspect and leaves the rest to an existing budget application• Shopping planner can work with/ without the help of a finance application• By using this product, users can locate their best product at its best price• User can carry the shopping list like a checklist when he goes for shopping• User can keep track of all his shopping lists for future reference• It enables inputting large number of expenses into a finance application by a click of a button	<ul style="list-style-type: none">• It only focuses on large shopping expenses and not on other daily expenses• The visualization is less persuading than in concept 1 but it doesn't help user save money. It only prompts user to spend• There should be a balance between the amount user has and how much he can spend. If this balance is not maintained, the product fails

Concept 3: Responsive Money Management

This concept is mainly aimed at helping user derive a pattern from his own data and help him predict his future expenses. This prediction can be used for creating a budget for each day. The prediction can also act like a “to buy list” or a checklist of expense that user can later confirm to make an input **[Figure 38]**. User can also have a sense of “safe” as this concept has modes to prevent situations where user can go “broke”.

1. Predicting daily expenses

Here user has to start inputting his daily expenses to begin the process. The application calculates the probability of an expense to happen, based on the occurrences of a particular

expense in user’s daily life. The system also calculates the average amount needed for user to sustain a day. And if user tends to spend more, the application warns the user through an indicator that changes from green to orange to red. These are the different modes. User will have enough money to spend even if the indicator is red. It’s just a warning to the user to spend less. These modes actually try to create a balance in user’s daily spending. The idea was to break free from the traditional visualizations as they persuade user to spend less and create a budget that is responsive to user’s spending habits. User can scroll left or right to see yesterday’s expenses and tomorrow’s possible expenses.



Figure 38: Interface for confirming the expense and adding a new one

2. Visualization

The application also has visualization **[Figure 39]** that gives a clear picture of user's spending habits. It also follows retrogression instead of a progressive visualization to evoke the money saving habit.



Figure 39: Visualizing user's expenses: daily, weekly and monthly

3. Predicting future expenses

From user studies, it was found that most of the users, they don't have the same expenditure for every day, so following up a budget that is made over fixed assumptions like money left-days left is non-responsive. This concept aims at helping user to spend his money based on his needs and follow a logic based budget (a reasonable way of thinking about managing user's money for his day to day activities). User can see how his next day, next month and next year is going to look like. And it is completely dependent on user's spending habits. User can also make expenses for future as it is already planned. This application has a calendar interface [Figure 40] where user can see as well as add future expenses, so that it will be reminded in the prediction list on the particular day.

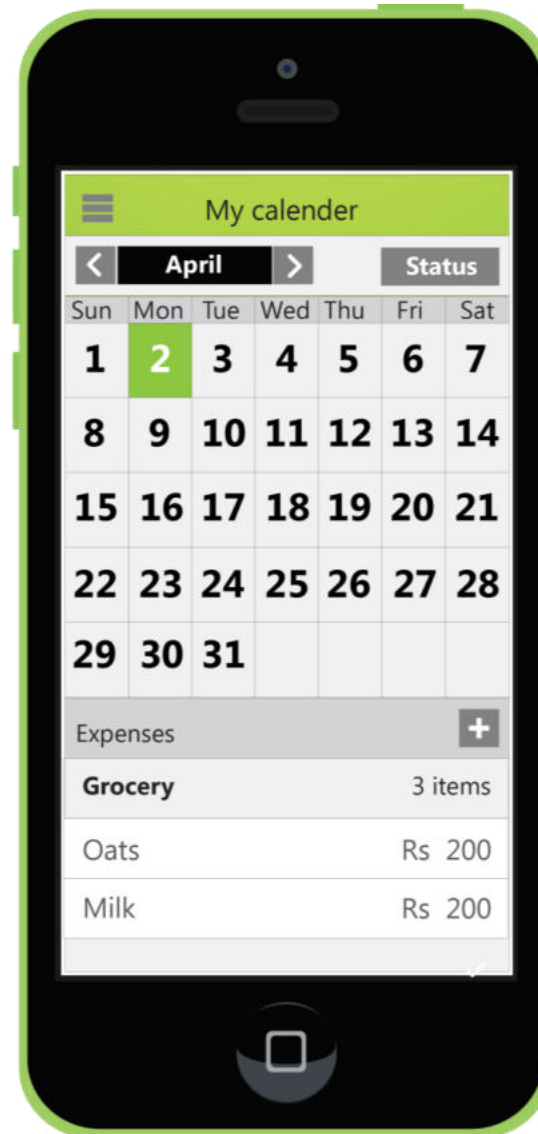


Figure 40: Calendar interface where user can see, and add future expenses

Concept 3: A quick review

Advantages	Disadvantages
<ul style="list-style-type: none">• It is more user friendly• Reduces the input effort and serves as a reminder or a shopping check list.• The visualization is less persuasive than the first concept but more persuasive than the second• Suggestions are given based on what kind of products user buy and what his friend circle has given ratings	<ul style="list-style-type: none">• The application takes time to learn user to predict his daily expenses

8. Final concept

Responsive money management

Responsive money management is chosen as the final concept to be prototyped. As a part of ideation, some of the ideas from concept 1 and two were taken and incorporated with concept 3 and the interface was also redesigned.

1. Today's expenses

The visualization is moved to the top and the key elements like Budget, Expense, and Savings are highlighted. It is followed by the category list showing how many items each category has. User can click the category list to generate a dropdown list containing the entire prediction list [Figure 41].

User has to edit the predicted amount with the actual expense and check the check box to enter the particular expense. If the expense is same as the predicted amount, user doesn't have to edit the amount. User can directly check the check box to confirm the expense in this case [Figure 42].

If there is a new expense that doesn't come in prediction, user can enter it using the "add new expense" button on the bottom [Figure 43]. The button changes its color based on which mode the user is at. User can also view yesterday's expenses as well as tomorrow's predicted list by navigating using the arrows on top of the interface.

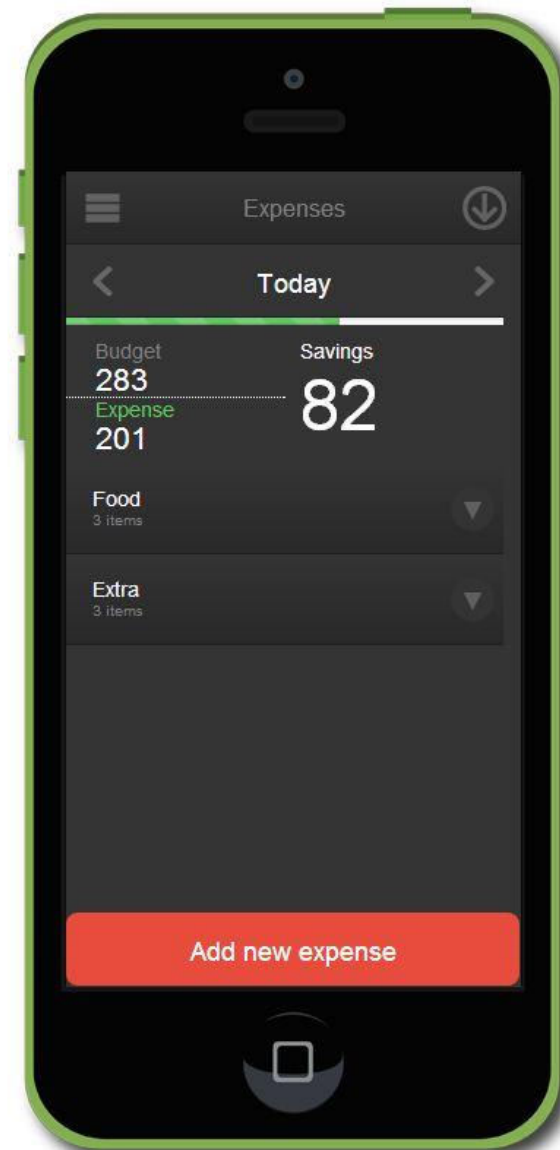


Figure 41: First screen with visualization and prediction list

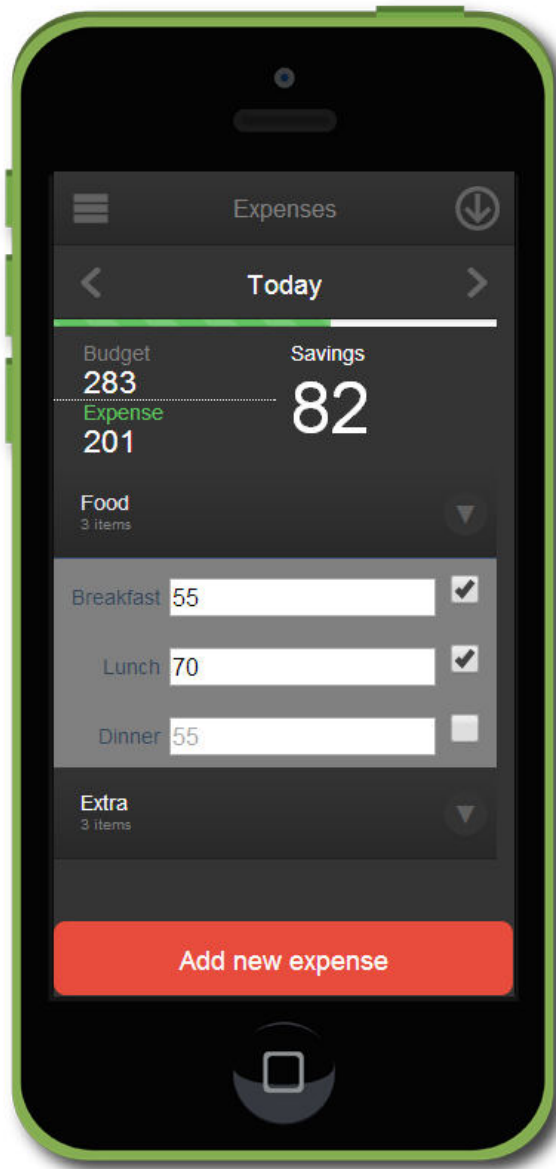


Figure 42: Confirming a predicted expenses using check boxes

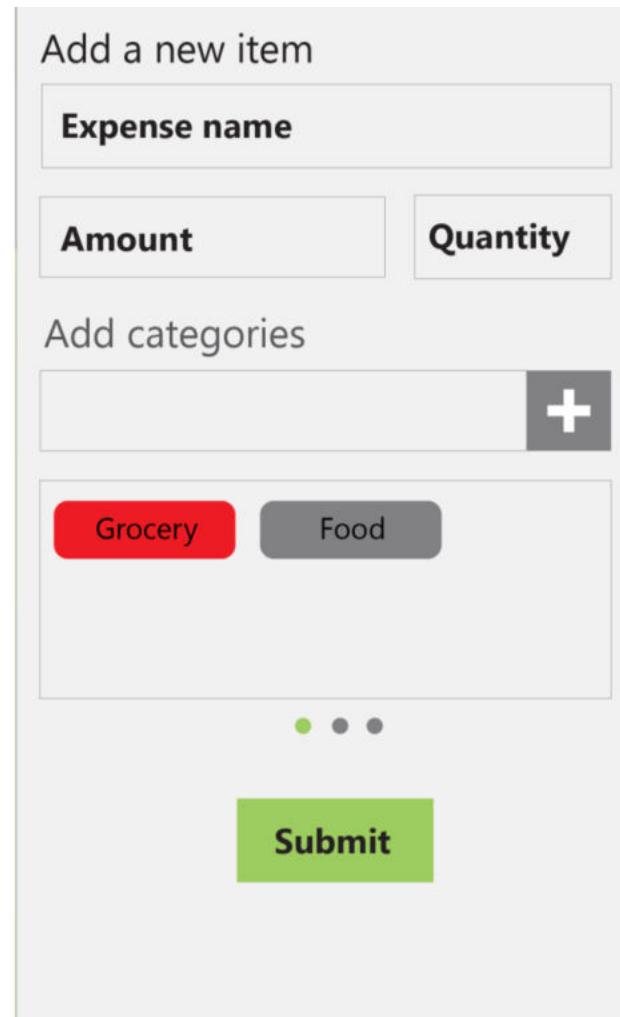


Figure 43: Adding a new expense

2. Visualization

User can also see his status month wise [Figure 44] and year wise. User can add targets for each month if he has to handle a huge expense in future. He can direct his savings into the targets. If user is running out of money, he can always delete the target and send the money back to categories.

3. Saving money

User can make as much targets as he wants. While adding a new target user can set a due date for the target. As the due date comes near, user will be notified. For example, an insurance installment can be made a target. Once the due date appears, user will be notified.

4. Enhancing shopping experience

User gets suggestions about products inside each category, this will be based on the kind of products user normally buys and the ones user's friend circle has reviewed and voted [Figure 45].

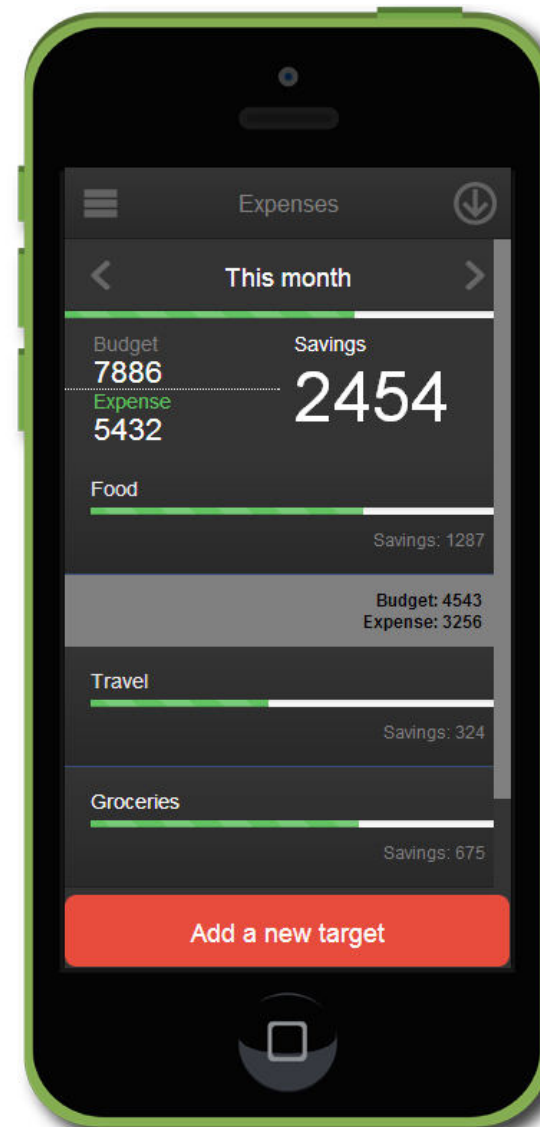


Figure 44: Visualizing monthly expenses

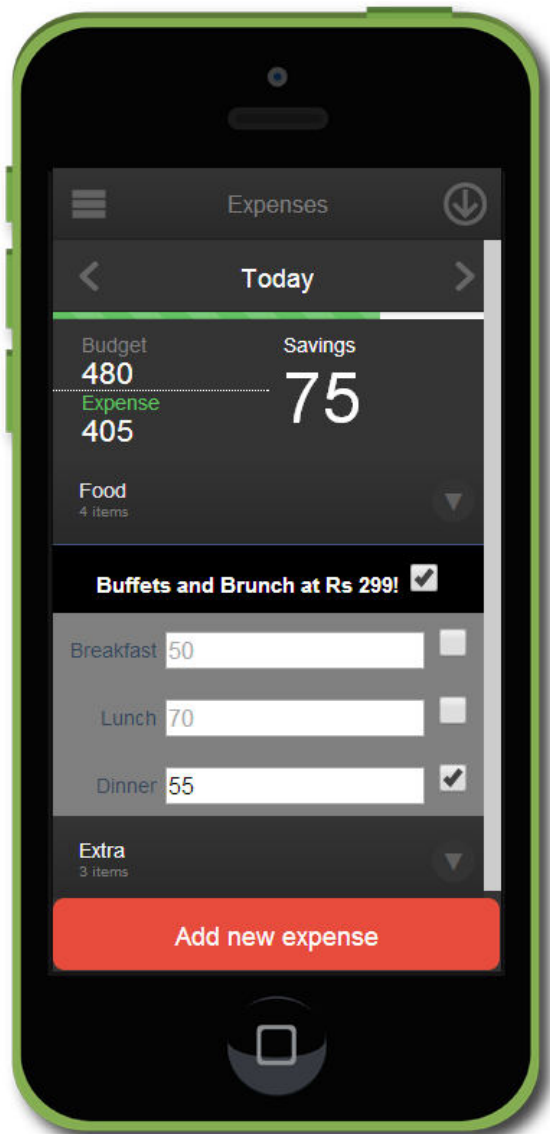
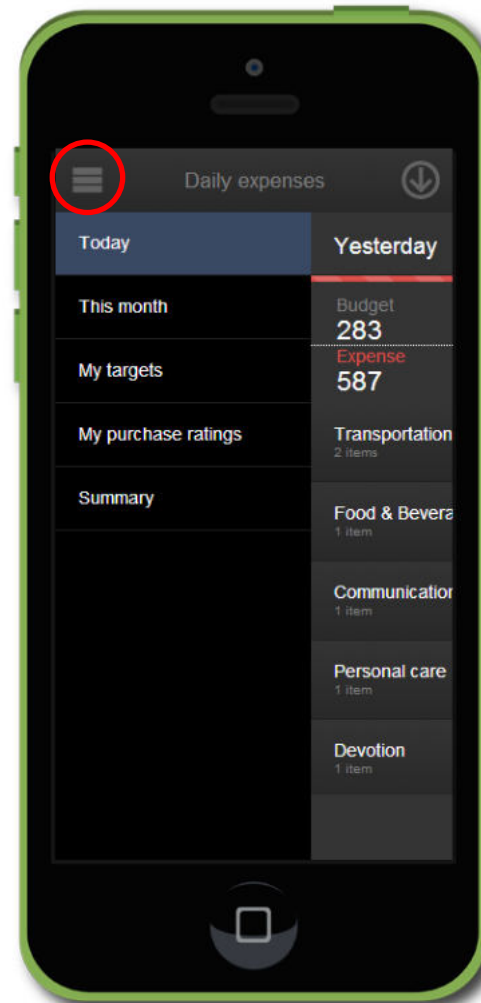
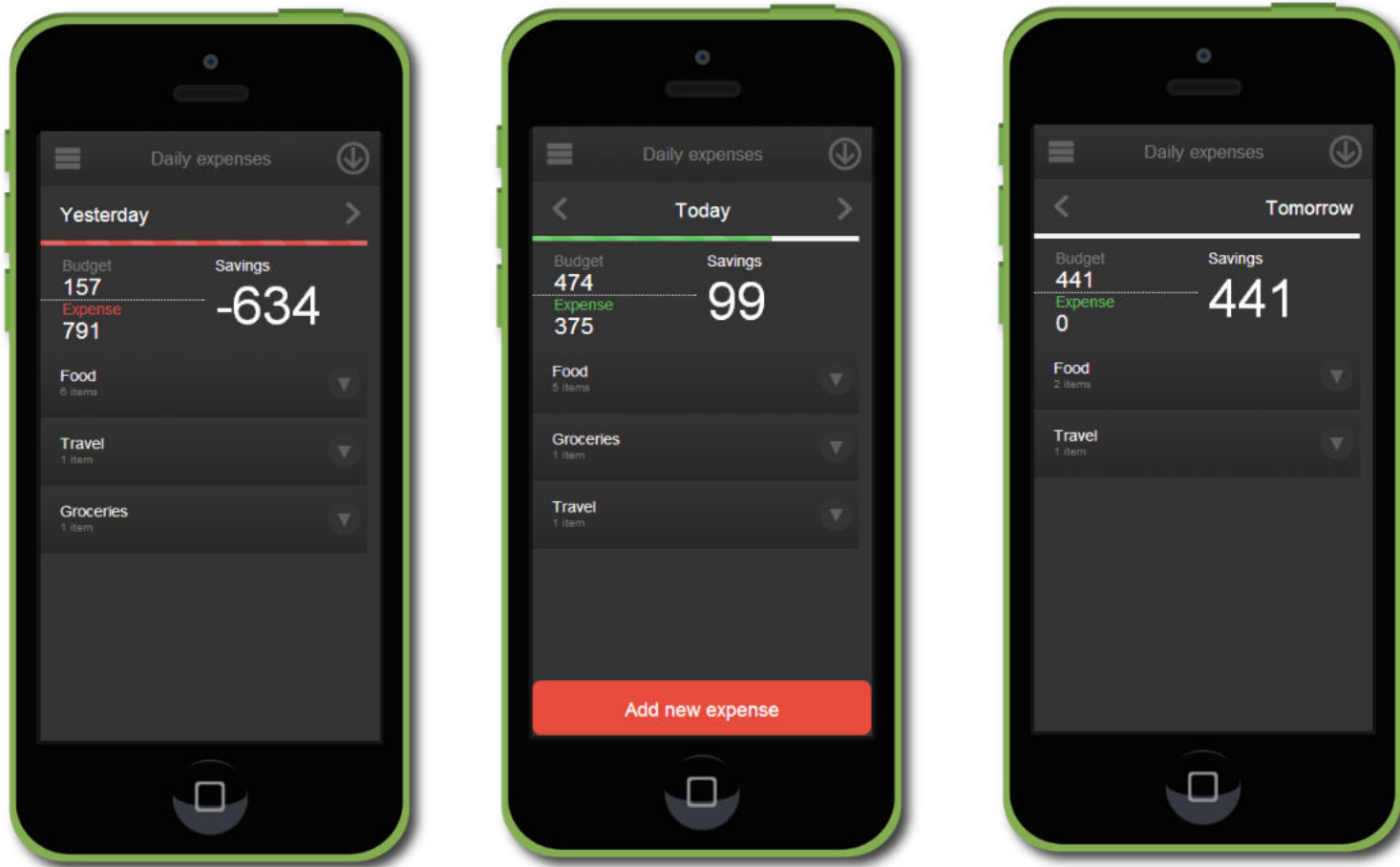


Figure 45: Personalized offers

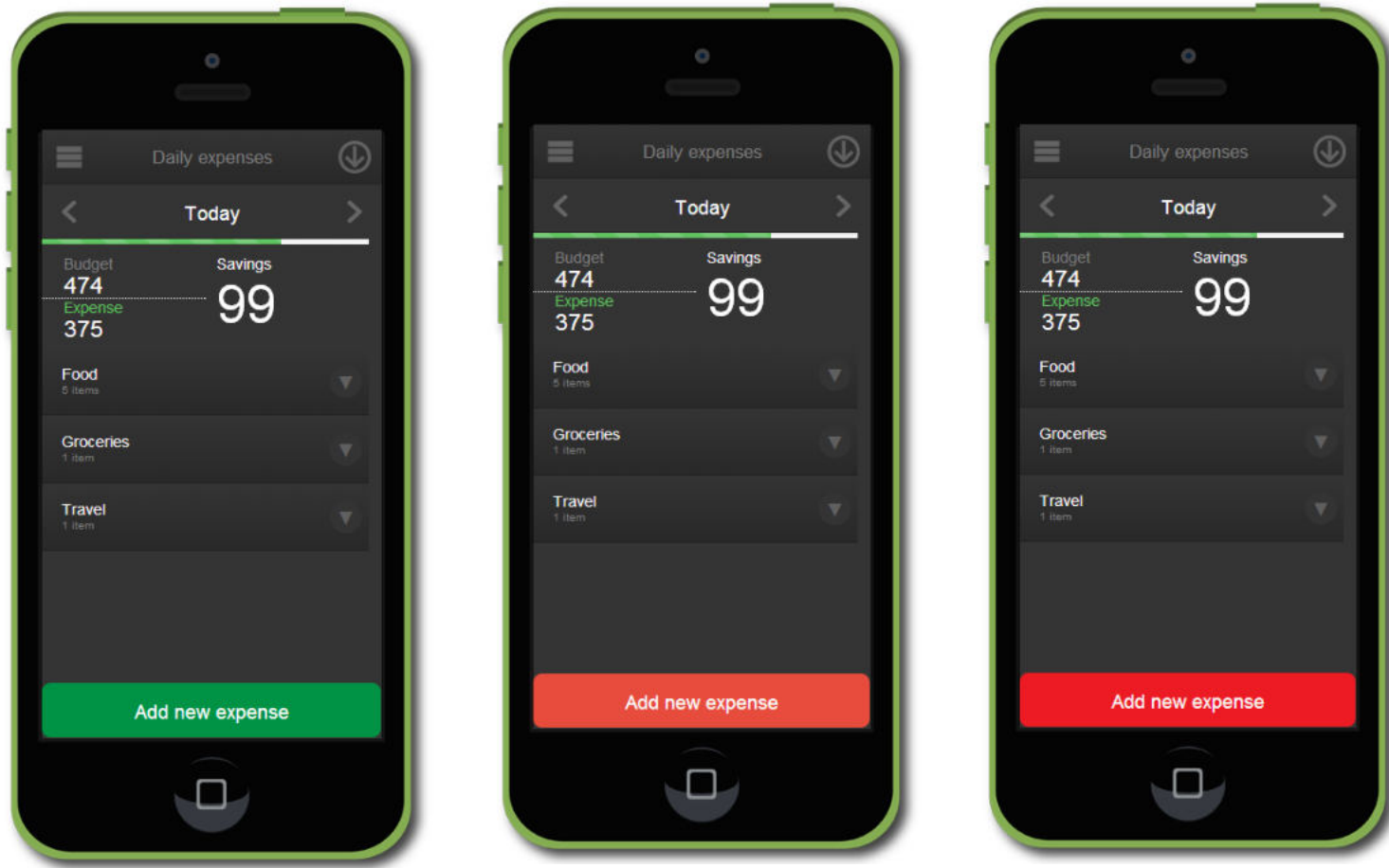
5. Final prototype

'Menu' button can be used for navigating all throughout the app

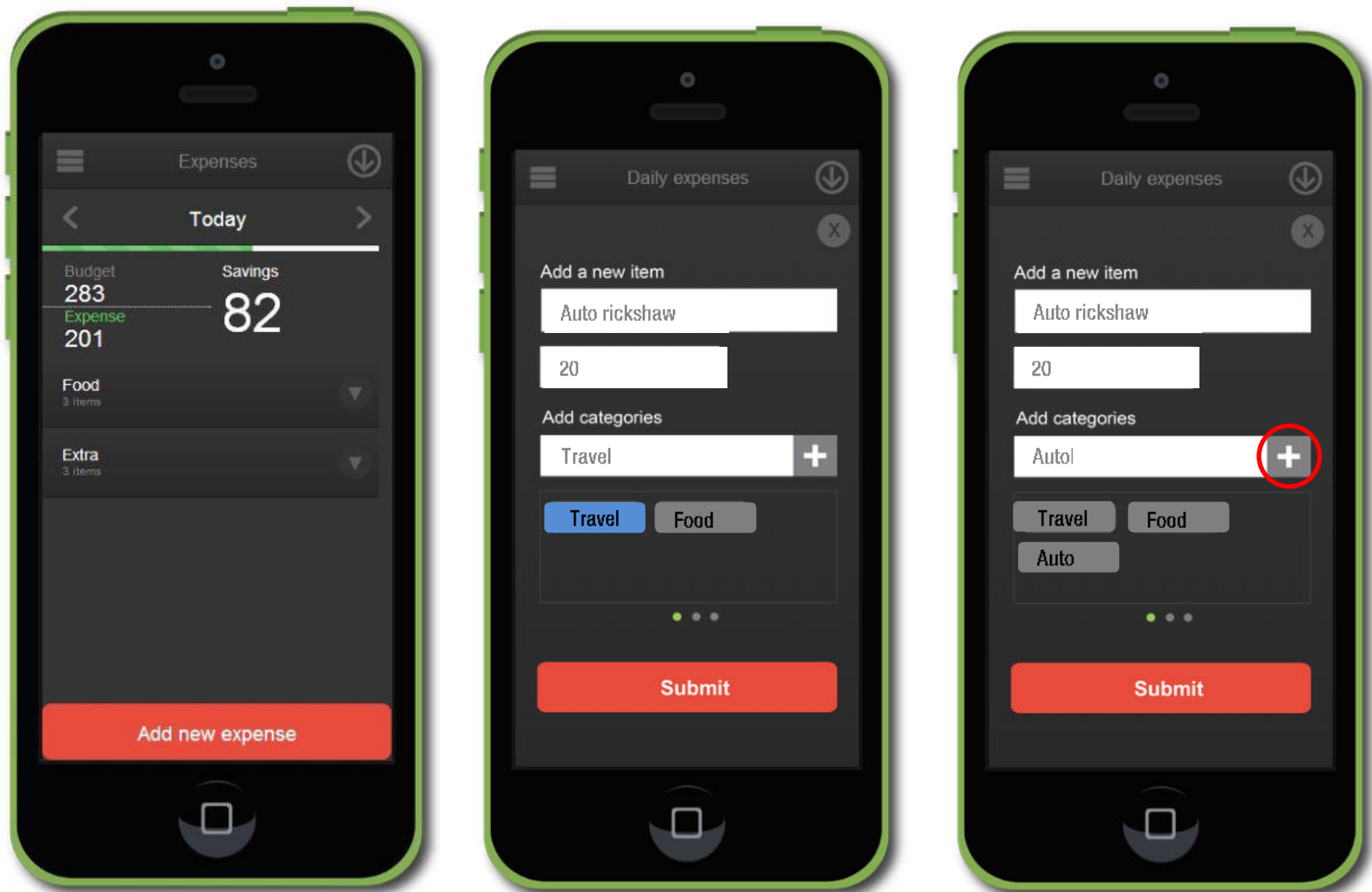




5.1. Today: User can view his today's predicted expense along with yesterday's expense and tomorrow's possible expenses

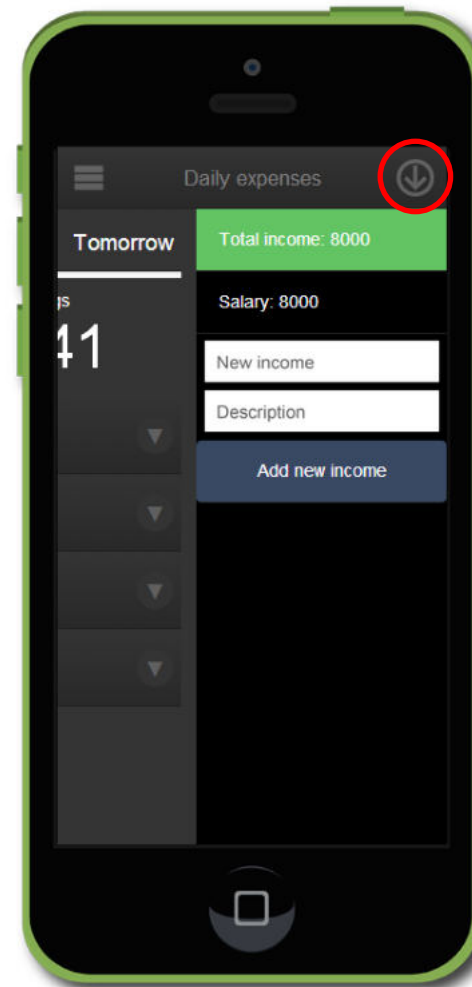


5.1.1.Warning user about dynamic spending habits: The “Add new expense button” changes its color based on the Modes, If it’s green (Mode 1), User can spend as much he wants, If it turns to orange (Mode 2), user have to be alert, he can go back to green if he can control his expense. If it’s red (Mode 3), the user has to strictly follow the budget that is generated by the app.

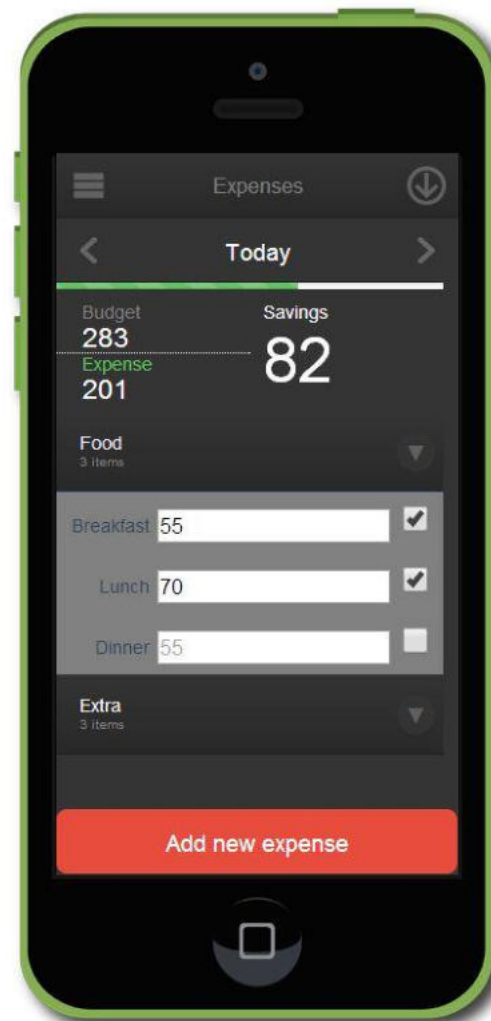
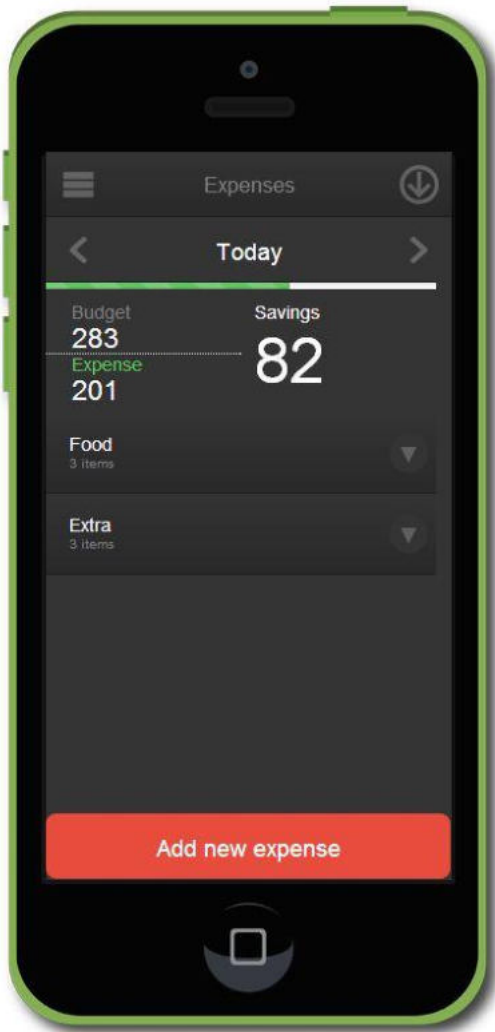


5.1.2. Adding a new expense: The “Add new expense button” can be used to add a new expense to the app. To add categories, user can click on that particular category button from the list and it will be entered. Or if a new

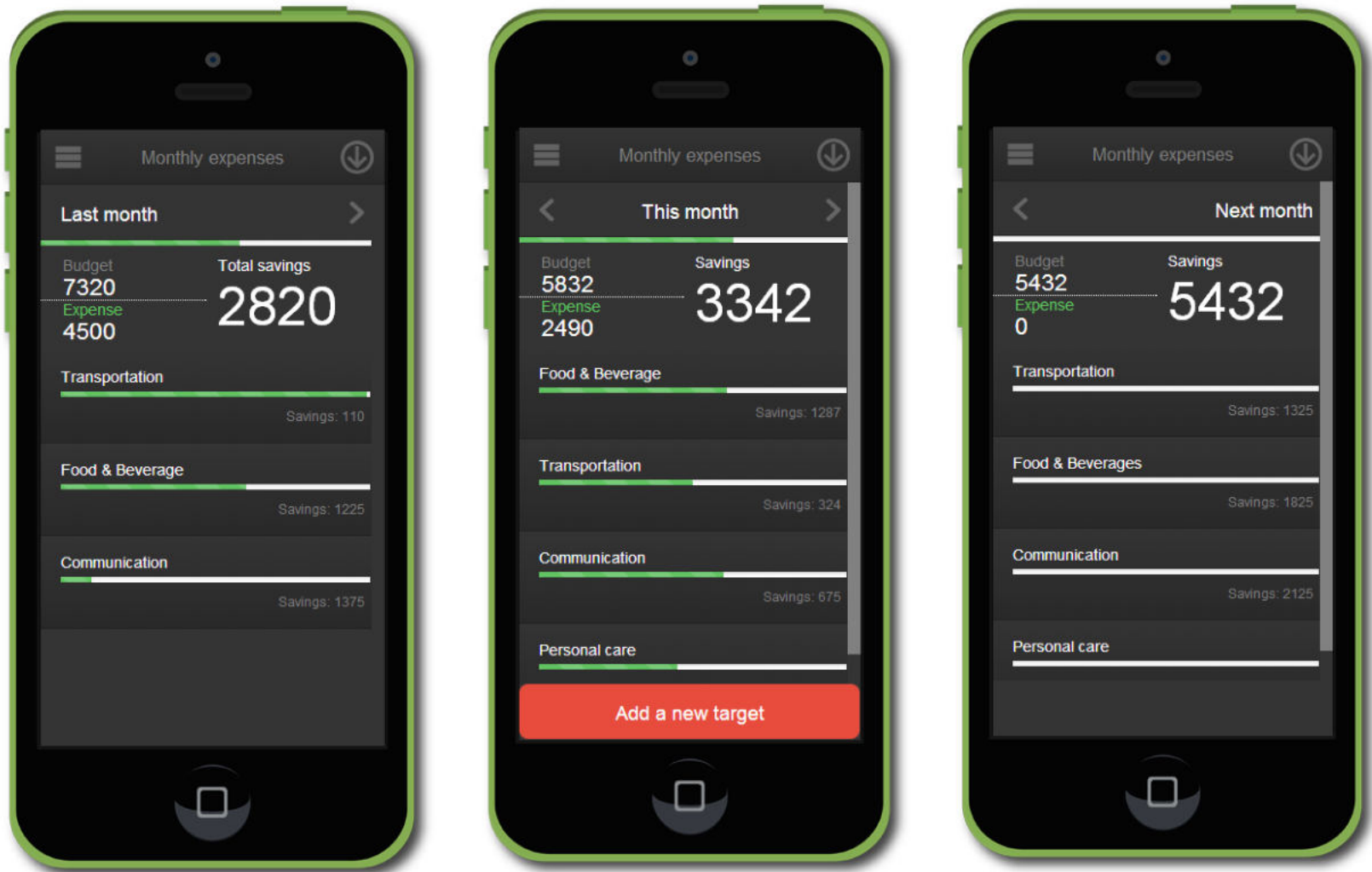
category needs to be added, user can type the category name and press “+” button to create the new category.



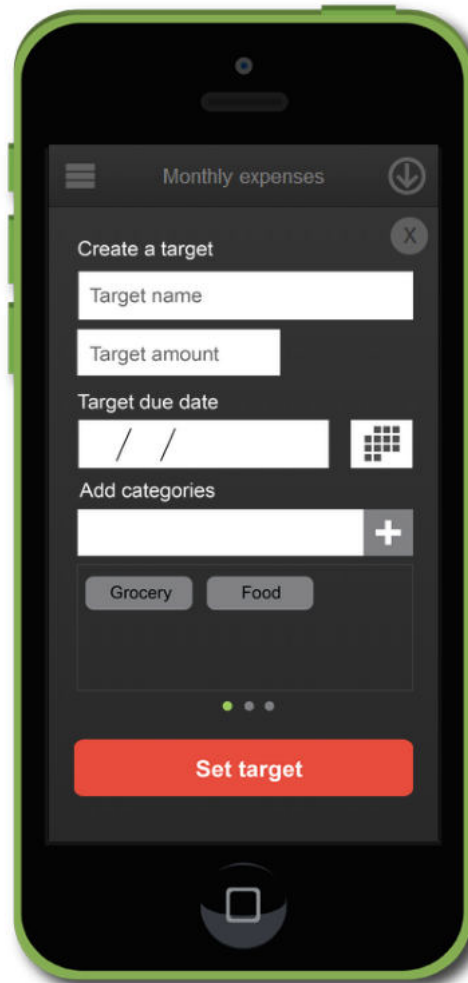
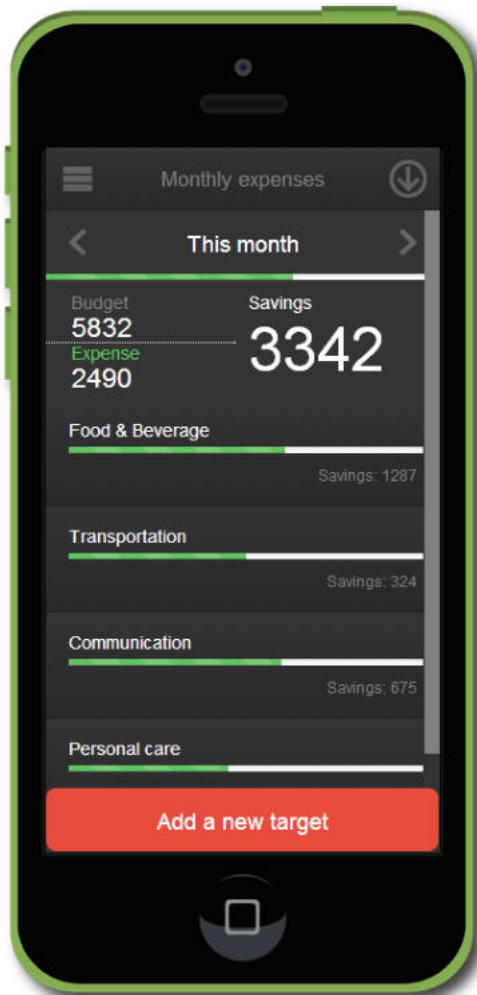
5.1.3.Adding a new income: To add a new income for that particular month, user can click the right button on the top. Here user can view the total income for the month and add a new income with a description as well.



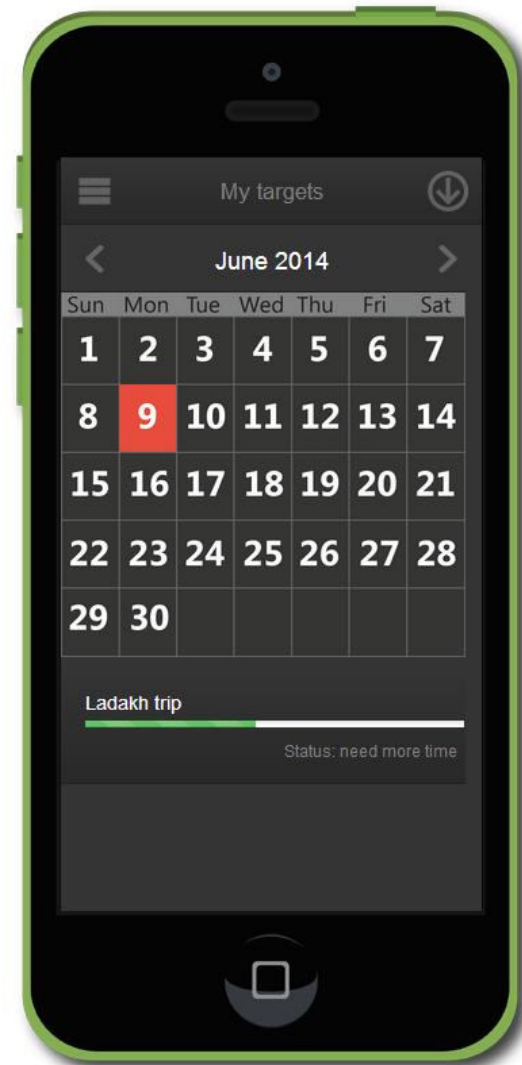
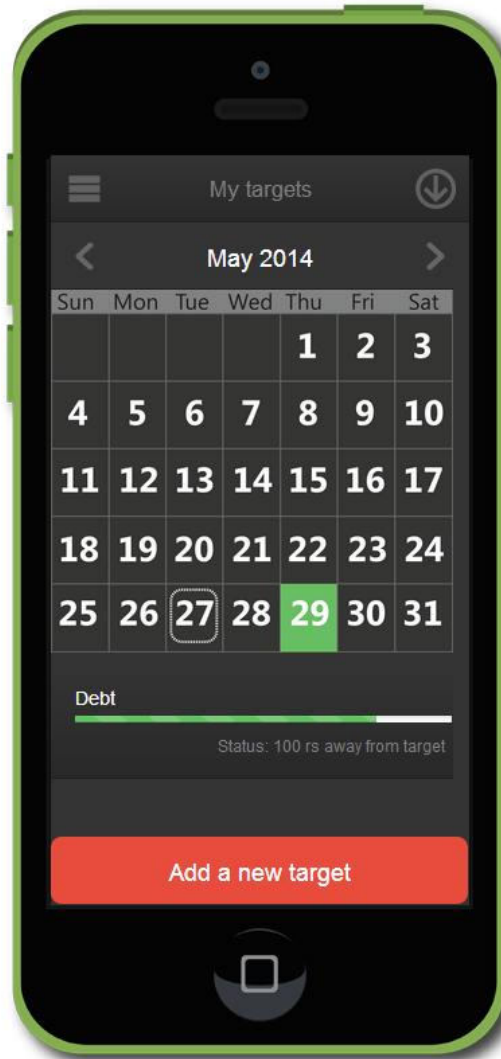
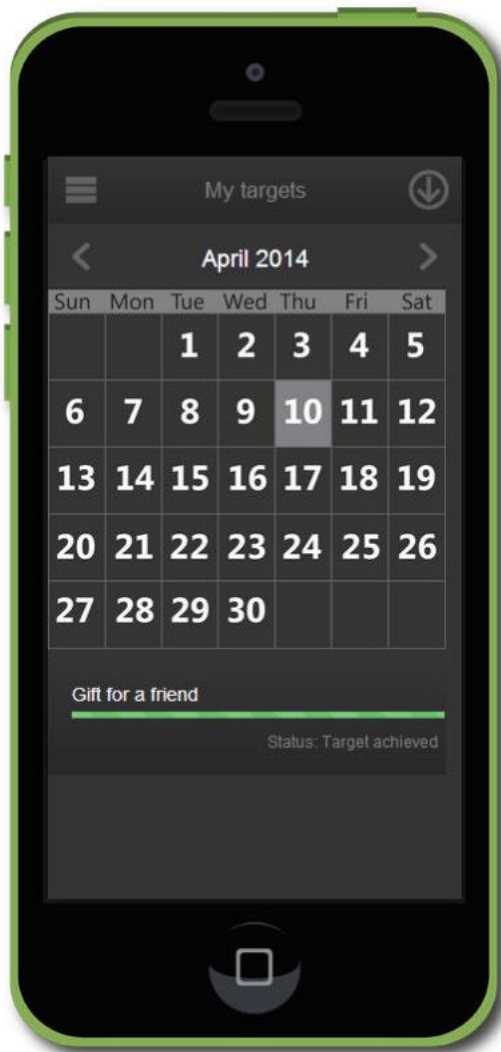
5.1.4. Adding a daily expense: To add a daily expense from a predicted list, user needs to click on the particular category to view the individual expense, and to make an input, user only have to 'check' the checkbox.



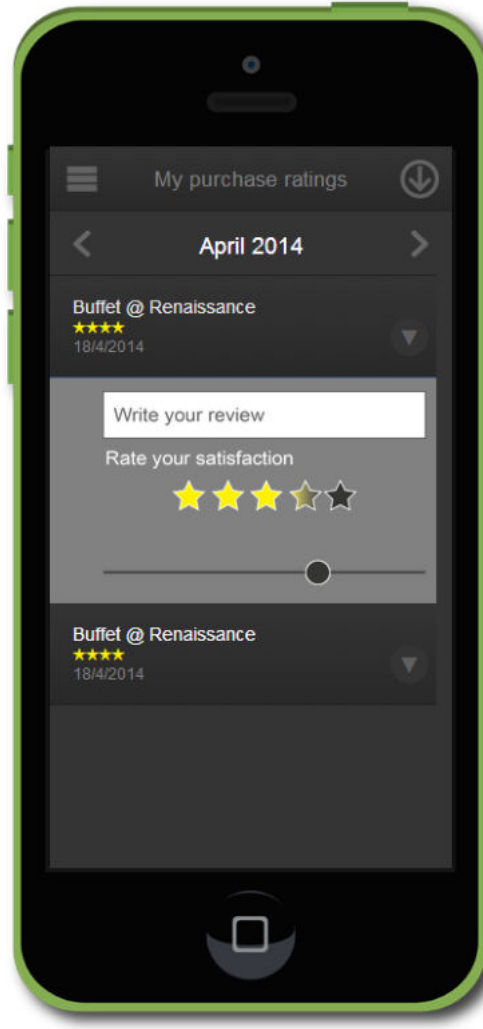
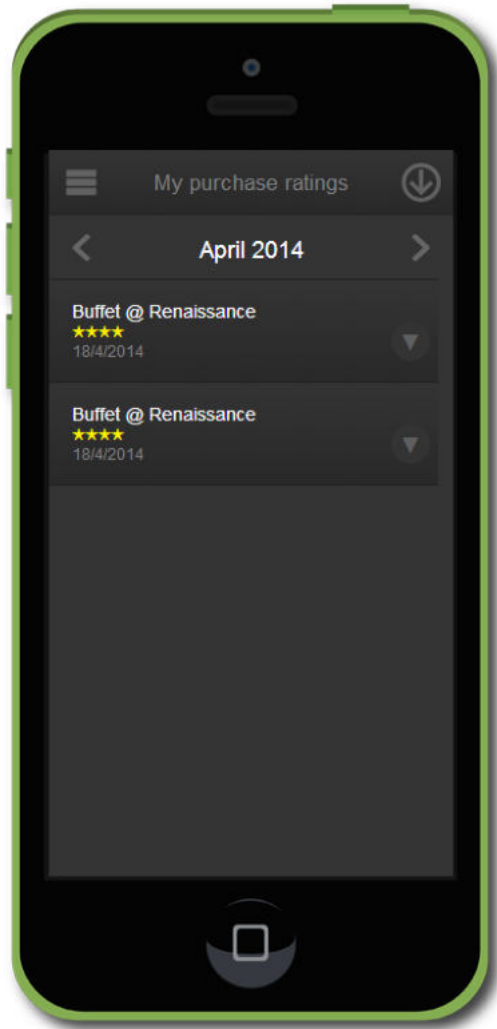
5.2. This Month: The user can also view his monthly expenses. User can also view last month's expense, this month's possible expense and next month's predicted expenses.



5.2.1. Creating a target: If users want to save money, he can create a target with a particular due date. What the application does is, it removes that amount from the income and hides it thereby reducing user's temptation of spending it.



5.3. Targets for the month: Here the user can view the entire targets over a calendar. Status of the targets can also be viewed here.



5.4. Measuring post choice satisfaction: Users can evaluate their personalized offers here and it also makes sure that users are evaluating the product after using it. For example: *"you can rate a meal in 30 minutes, but a*

mobile phone in 30 days". User will be notified by pop-up messages as notification until he fills it. It also serves as a filter for other people in the user's social circle, If user expresses a dissatisfaction on any of the personalized offers, the other people in the circle is less likely to get similar offer.

9. Scenarios

The following scenarios describe the working of the concept and how user adapts the product into his life.

Scenario 1

This scenario describes how a user uses the prediction mechanism to input his expenses.

Scenario 2

A scenario showing how the application can enhance user's shopping experience.

Scenario 3

How the application can help user save money for his future expenses.

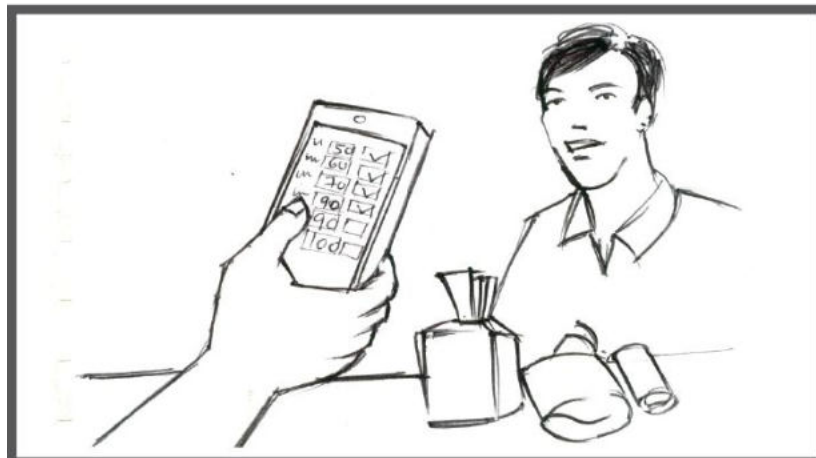
Scenario 1: Scenario describing how a user uses prediction mechanism to input his daily expenses.



Rohit is returning home after a tiresome office work



On the way back home, remembered he has to buy some grocery, but forgot what all things he has to buy



Rohit takes out his new mobile application and reads out today's predicted list for category "grocery". He also enters the expenses meantime

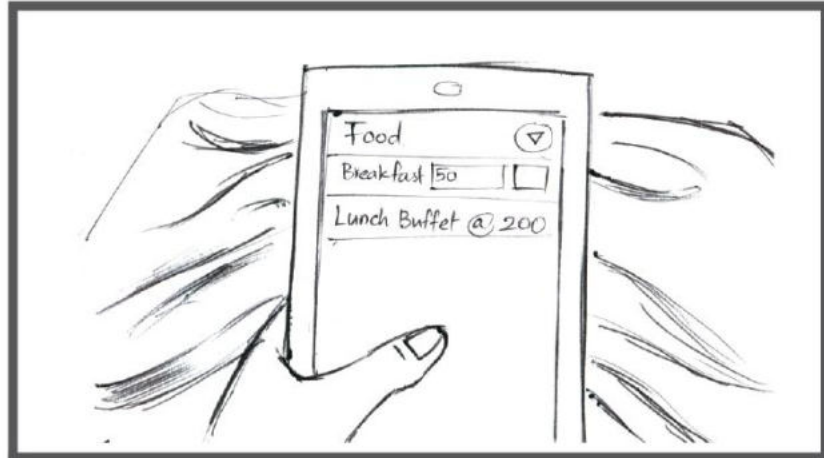


Rohit can see how much did he spend today. Now rohit doesnt have to spend extra time in writing down his shopping list or calculating his daily budget

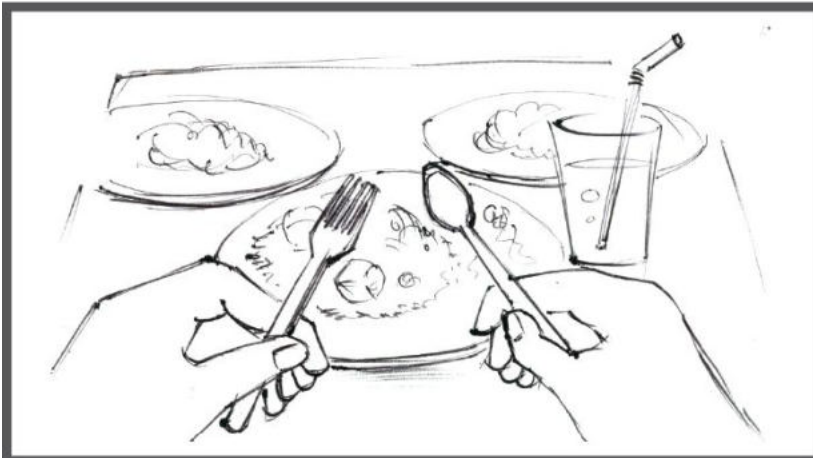
Scenario 2: Scenario showing how the application can enhance user's shopping experience



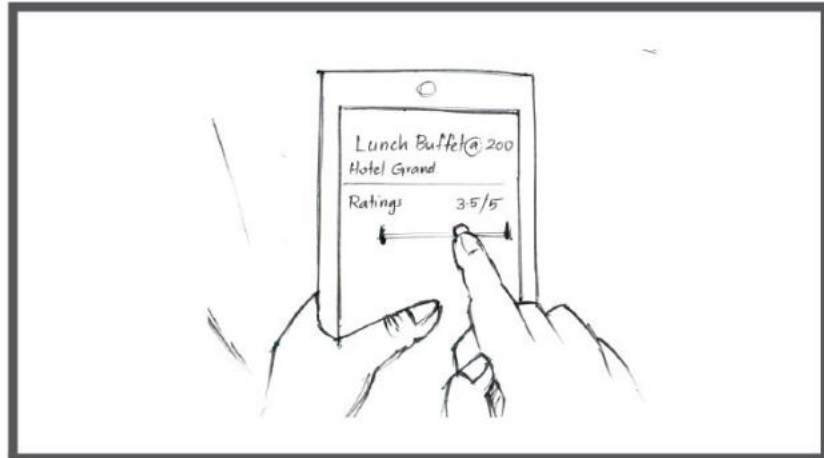
Its Sunday morning, Deepak woke up late. He is hungry and wants to find some place to have his brunch



Deepak opens his new mobile application to see if there are any offers in the locality and finds one



After claiming the offer, Deepak rushes to the restaurant

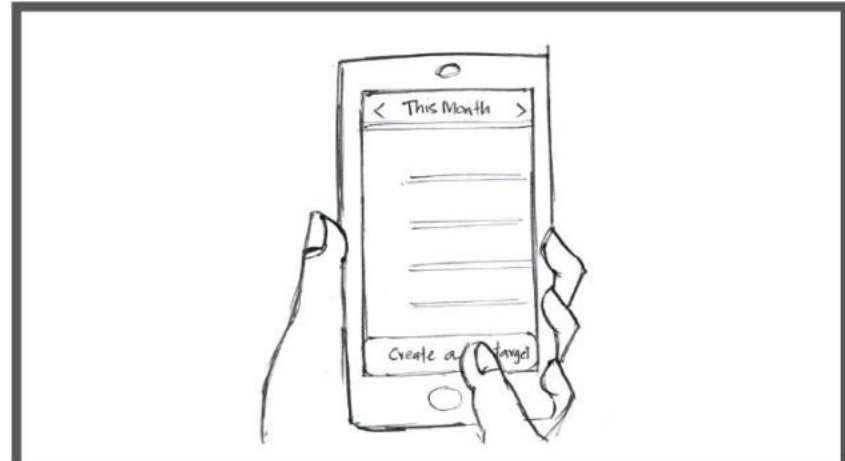


Deepak enjoys his brunch and gives his ratings

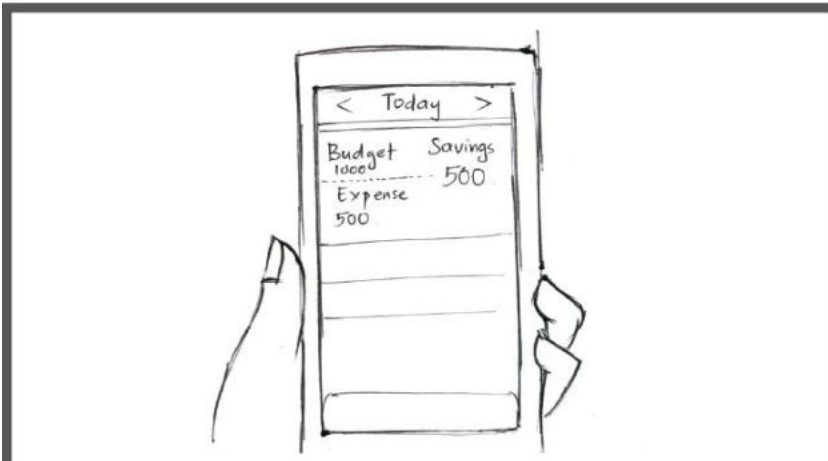
Scenario 3: How the application can help user save money for her future expenses.



Radhika is at her office, she gets a call from her sister reminding her of their parents' wedding anniversary



Radhika realizes that she hasn't saved any money for the event, she opens her new application and creates a new target with due date



Radhika daily makes sure that she saves enough money for the next two months



Finally the due date is reached, now she has enough money to celebrate and buy loads of gifts for her parents

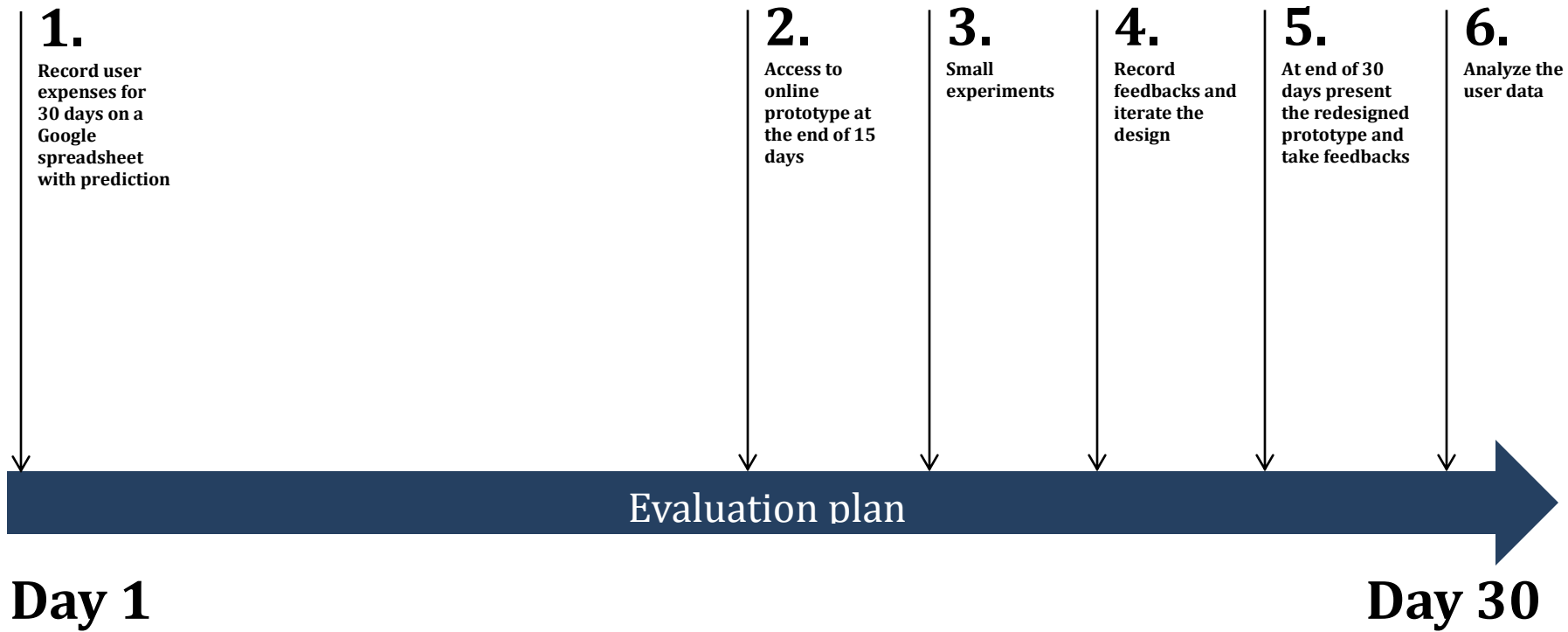
10. Evaluation

10.1. Evaluation plan

6 users between an age group of 16-26 were recruited from different parts of the country and their daily expenses were collected using a Google spreadsheet.

The prediction mechanism is tested separately using the user's original data for a period of 30 days.

The user interface will be tested during the last 15 days. Based on the user feedback, the design will be subjected to further iterations.



10.1.1. Recruiting Users

It was made sure that the users chosen are from different parts of the country, different backgrounds within an age group 16-26.

List of users:

Users	Gender	Age	Designation	Location
User 1	Male	19	UG Student	Kerala
User 2	Female	26	Civil Engineer	Tamil Nadu
User 3	Male	25	Researcher	Maharashtra
User 4	Male	24	PG Student	Karnataka
User 5	Female	25	Researcher	Maharashtra
User 6	Female	26	HR Manager	Kerala

10.1.2. Predicting user's daily expenses

Each user is given a Google spreadsheet [Figure 46] to record their daily expenses, starting from day 1. From day 2, the expenses were predicted based on a simple algorithm that says if the maximum probability of an expense to happen is greater than or equal to 50%; that expense can find its place in a particular day's predicted list.

10.1.3. Predicting user's daily budget

Daily budget was calculated by taking an average of the budget and user's actual expense.

10.1.4. Handling errors

Users are not allowed to edit their previous day's expenses.

10.1.5. Access to prototype

At the end of 15 days, users are given access to the online prototype [Figure 47]. The prototype are fed with the actual user data so that users will get a sense of 'own' feeling. This can help user build an attachment with the prototype on the first use itself. The feedbacks are taken and necessary changes are made for the next stage of testing that happens at the end of next 30 days.

Google Sheets interface showing a spreadsheet for recording daily expenses. The spreadsheet is titled "Day 2 (18/4/14)".

Day 2 (18/4/14)								
Predicted expense			User's original expense			Money left	Days left	
Budget for Day 2: Rs. 157			Actual expense (total expense) for Day 2: Rs 791			(for this month)	(for this month)	
Category of expense	Name of expense	Amount spent	Category of expense	Name of expense	Amount spent			
Food	Tea	30	Food	Lunch	47			
Food	Evening snack at Gullu	77	Groceries	Munchies, stationary, etc.	424			
Dinner	Canteen	50	Travel	Auto to and fro	56			
			Food	Coffee, muffin	264			

Figure 46: Google spreadsheet for recording user's daily expenses

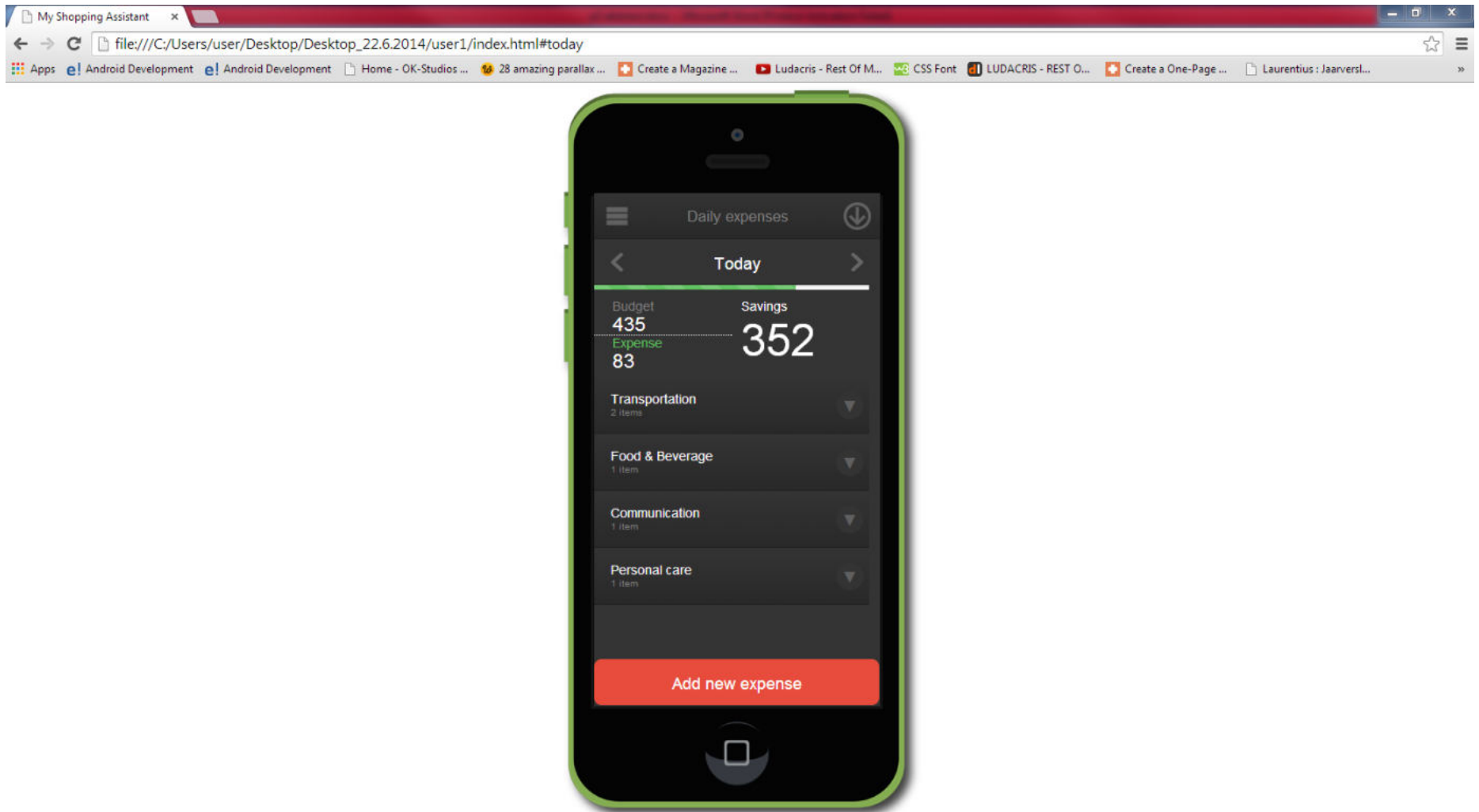
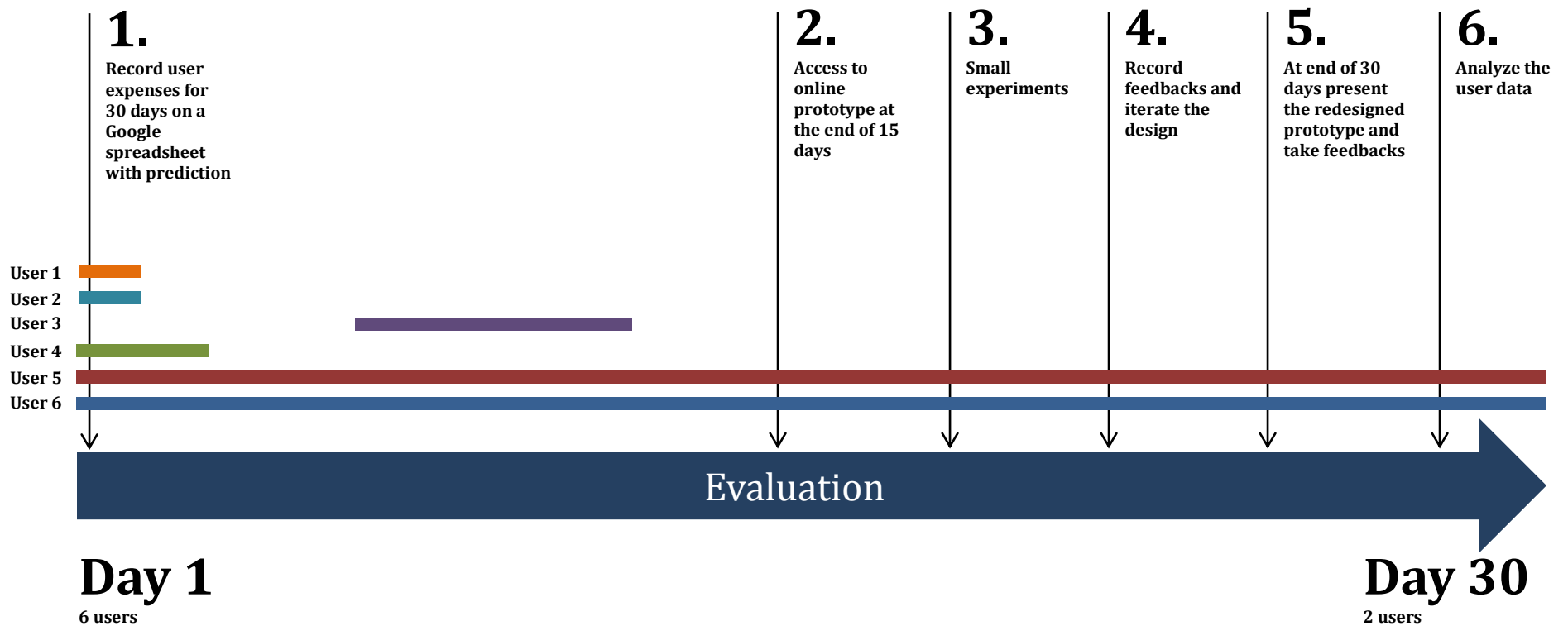


Figure 47: Online prototype for testing

10.2. Evaluation results

At the end of 30 days, only 2 users completed the entire testing process. The prototype is tested for usability and the user data is analyzed for validating the concept and testing the accuracy of the prediction.



10.2.1. Why users left the process

At the end of the evaluation process, Users were asked why they left the process of filling the Google spreadsheet. The feedback wasn't astounding but was same as expected.

- **No reminder:** Users complained that they wanted a reminder to remind them to do the daily tasks
- **Work pressure:** Most people complained that they can't fill the form because of their tight schedule and work pressure.
- ***"I know I won't spend beyond my salary limit"*:** The main reason why people left the process was because; they felt that they don't need an application to keep a check on their daily expenses. They know their limit and they won't spend more than their salary.
- ***"It wasn't rewarding, so I left the process"*:** Some users complained that recording daily expenses are not going to make any difference to the way they are spending. Because, they first make a payment, then they enter the amount. If there was a warning system that can alert user that he doesn't have enough money to spend, the difference would have been much motivating.
- ***"If it was on my phone, it would have been easier to input"*:** Since the form was located on internet, users had trouble accessing the form and filling it. If it was a mobile app that is located on their phone, it would have been easier to input on the go.

Hence the findings from the user studies were validated at this stage.

10.2.2. User feedbacks on the prototype

After giving access to online prototype, feedbacks were collected and based on which, the designs were further iterated.

- ***"How will I know the status of my targets?"*** The 'targets' that could be used by user to save money for future expenses, were actually designed in such a way that the amount will be hidden from the user's income to reduce the temptation to spend it[12]. User will be notified only when the target due date is attained. In most of the cases, user didn't have enough money to create targets. In these cases, user had to consciously control his expenses and make savings to attain the targeted savings. Here the need of having a **status visualization** for visualizing the progress of a targeted saving was inevitable.
- ***"What if I have a sudden expense and I want to know whether it fits my budget?"*** The user should be able to see whether an unexpected expense can fit with the remaining money in user's account. So, there was a need where user should be able to know what difference an unexpected expense could make to a user's monthly budget.
- ***"I want to know my actual expense. This is different"*** The application doesn't follow the common understanding of how much money is left and how many days user have to survive. It relies on the understanding of an average money a user need to live a day, and whether he has enough money to survive this month if he is following this current average spending trend. Hence,

user should not be notified about the actual amount that is left in his account. But, users had a slight disagreement as they wanted an extra option i.e., if they wanted, they should be able to see what the actual expense is and how much money is left in his account.

10.2.3. Analyzing user's spending habits

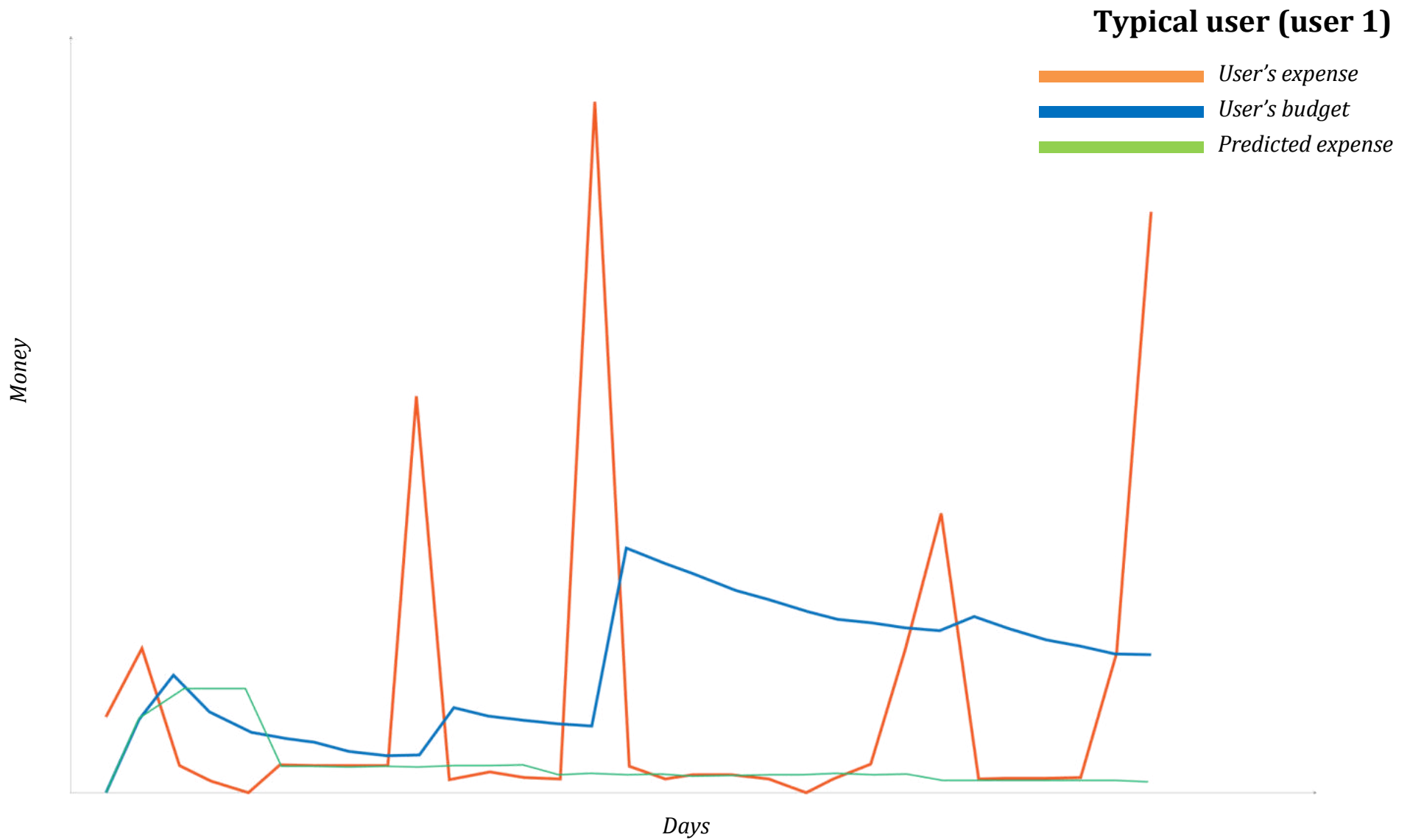
30 days of user data were analyzed to derive patterns in user's spending habits and to check the accuracy of the prediction. One of the important observations from the user data collected over 30 days of evaluation is that, the shopping habits evolve very quickly. It was found that there are two kinds of shopping habits:

- **Strong shopping habits:** For a typical user, the shopping habits tend to stay over a long period of time
- **Weak shopping habits:** For an Atypical user, the shopping habits tends to appear and disappear very quickly

10.2.4. What went wrong?

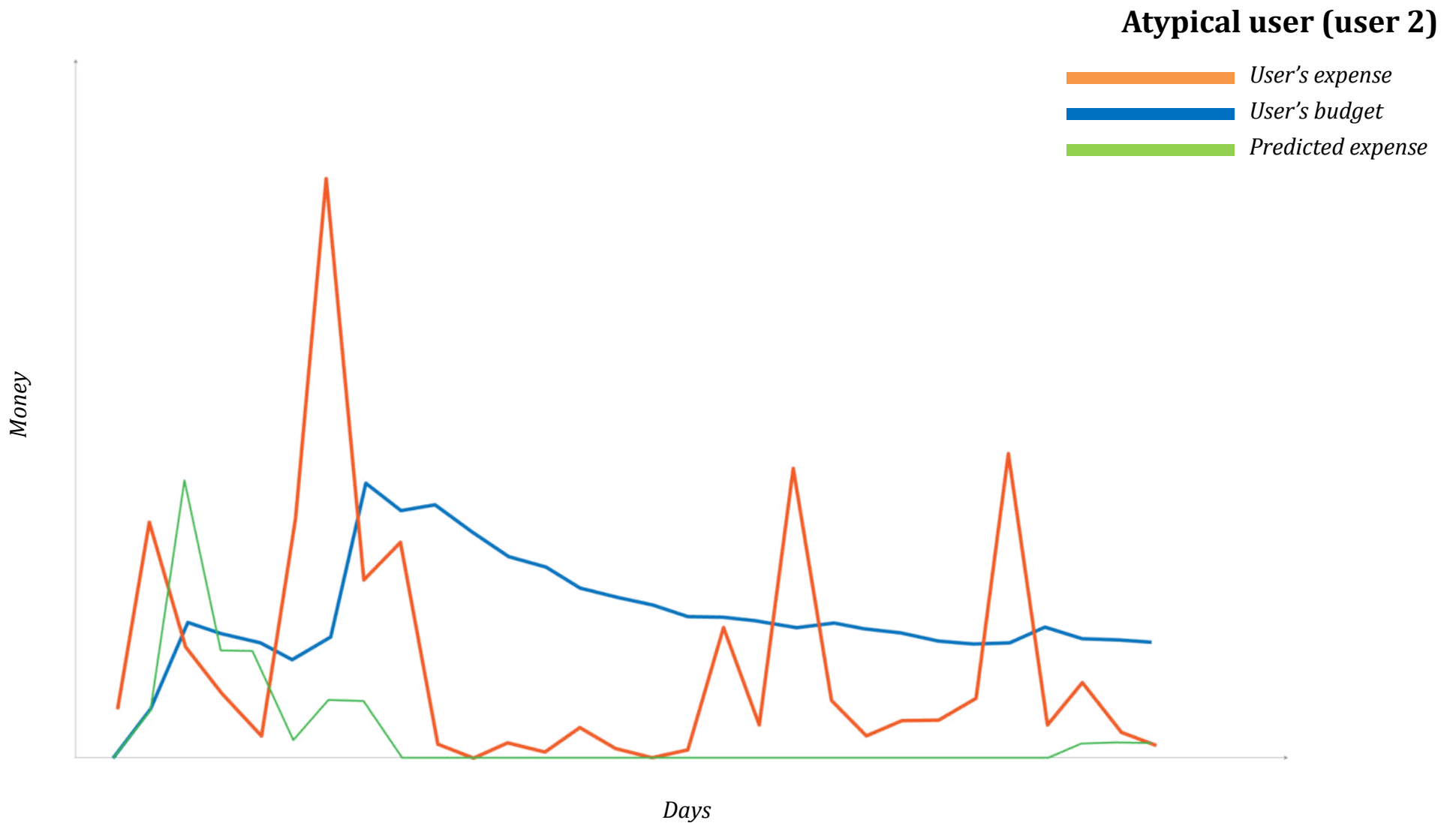
The algorithm that was used to predict the next day's daily expenses wasn't powerful enough to capture the strong and weak shopping habits efficiently. The following assumptions were revisited at the time of data analysis.

- **Taking average of the budget for the day and actual expense of the day to predict next day's budget:** This assumption wasn't efficient enough to come up with a responsive budget. The generated budget failed to adapt quickly to the user's dynamic expenditures. So a new assumption is made where, *the mean of all previous daily expenses are taken to predict the budget for the next day.*
- **Probability for an event to occur was calculated by the number of occurrences an event had in the past:** As habits evolved quickly, the prediction failed to adapt to the dynamic spending habits, A product continued to be in the prediction even after 10 days of disappearance of that habit, just because the probability of that event to happen was still greater than 50%. It was also found that the least time for a shopping habit to change was a weeks' time (Starting with Sunday, ending with Saturday). So instead, 7 days rotating cycle was used to predict the possible daily expenses. i.e., the possibility of an expense to happen is determined by the probability of occurrence of the particular expense in last 7 days is greater than 50%.



The number of intersections between the expense (orange) and the predicted expense (green) shows how strong the shopping

Habits are. It's also clear that budget (blue) actually responds quickly to the user's expense (orange)



The number of times the predicted expense (green) and the user's expense (orange) intersect is very limited; this clearly

implies that the user doesn't have strong shopping habits and it's very hard to capture the weak habits. It's also clear that the budget (blue) is responsive with user's daily expense (orange).

10.2.4. Conclusion

From the above graphs, I conclude that the strong shopping habits are easy to capture and the weak shopping habits are very hard to capture. This directly influences the accuracy of prediction of user's daily expenditures. The more the strong shopping habits, the prediction will be more accurate and vice versa. It was successful that I could achieve a responsive budget.

10.2.5. Final Design

Based on the user feedback, the designs were subjected to further iterations. The following changes were made to the design.

- **Target status:** Whenever a target is set, user keep receiving alert pop-up messages. If money saving is critical at some point of time, It delivers highly personalized pop-up messages that helps user keep a check on the categories where he spends the most [Figure 48].
- **Quick expense checker:** From the evaluation, it was found that there is a need to help user check whether his immediate expense will fit his budget or not. For this reason, a quick expense checker was introduced in "Add new expense" and "Set target". Here user can type any amount, and the corresponding icon will change its color from green-orange-red based on the amount's effect on user's budget [Figure 49].

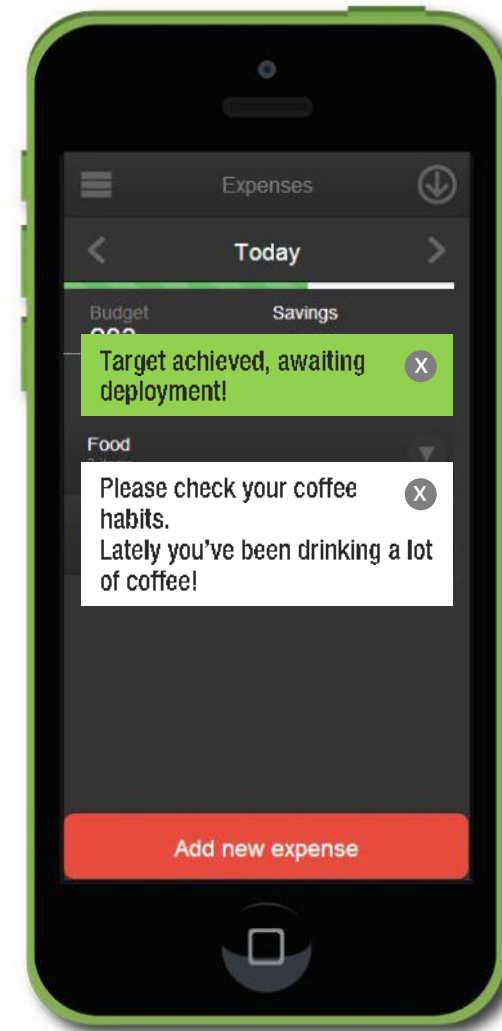


Figure 48: Target status and personalized messages

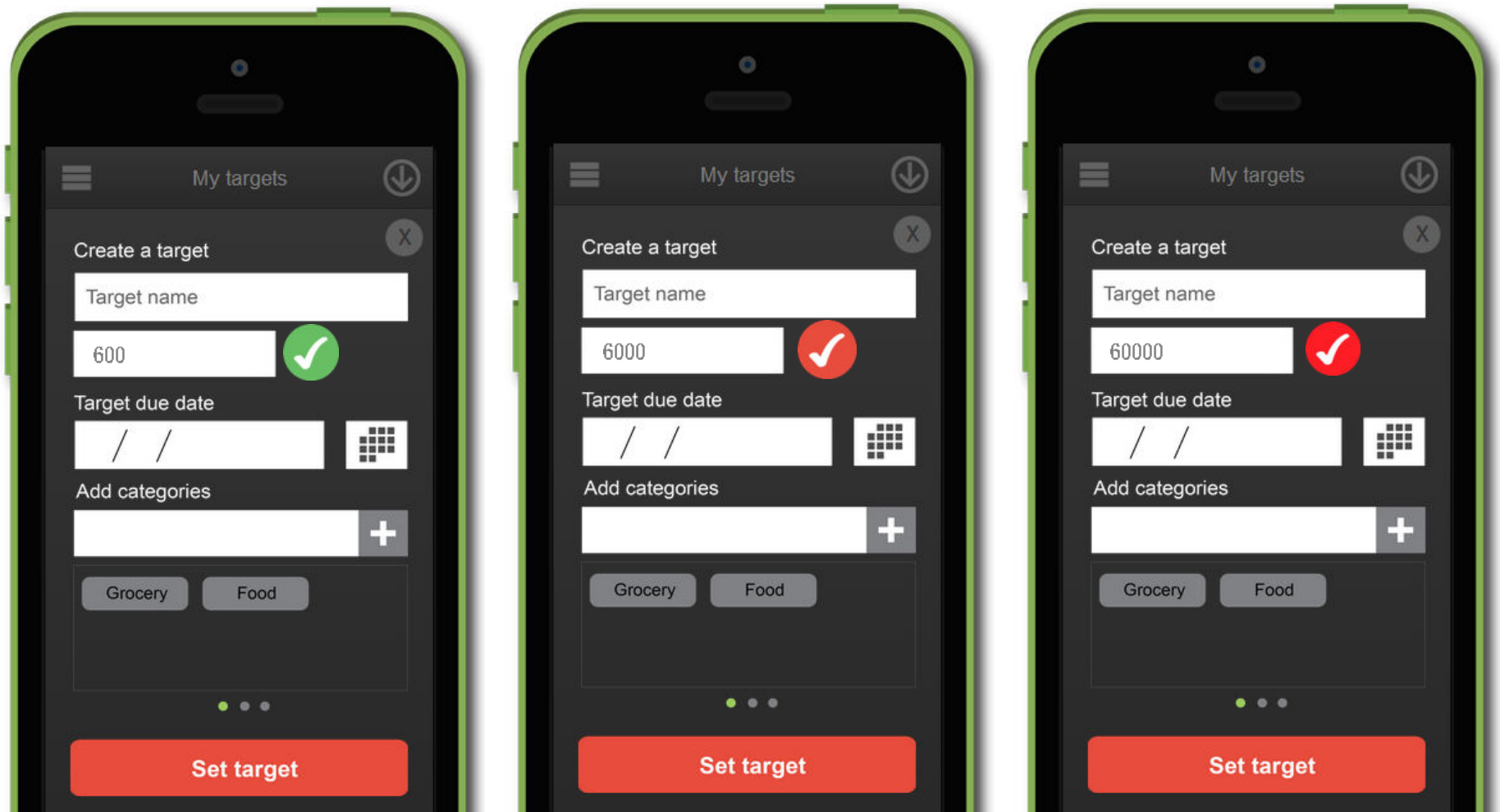


Figure 49: How the expense checker responds to an immediate expense. For e.g. If user enters an amount 600, the checker responds by a green color (that means the expense can fit in the budget). When the amount is 6000, the checker turns into orange (That means, this immediate expense can put users' budget in mode 2 where user has to consciously save money to bring it to a balance). When the amount is 60000, the checker responds by a red color that means, it can such expense will not fit in user's budget.

- **Summary of all the income and expense details:**
Based on user feedback, it was found that the actual account summary of the user should be enabled for the user to view as it would help them understand how much money is left in the account [Figure 50]. This feature is not visible elsewhere as the application doesn't focus on how much money is left and how many days to survive. It focus on enhancing user's shopping habits and warns if he is trying to spend more than what he has in his account.

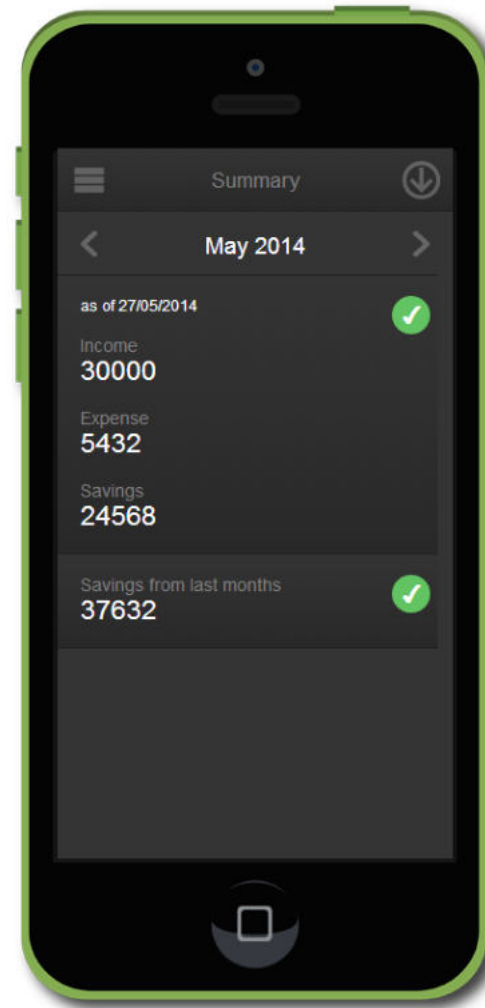


Figure 50: Summary of all the actual income and expense details

11. Future scope

I was successful in creating a budget application that generates budget that is flexible to user's dynamic spending habits but the accuracy but, capturing user's spending habits is not yet precise. It's easy to capture a very strong habit of a user, but not the weak ones. The algorithm that was used in the testing process didn't have any logic behind it as it was only a trial and error method. A good algorithm can only be written by a skilled and experienced statistician or an engineer.

Bringing together two spheres that are very likely to repel: Shopping and Finance management was a herculean task. This is just one way of approaching this problem. As the title of project, "Personalized data visualization" demands a lot of explorations on visualizations that couldn't be achieved within the short span of time but, as I designer I extended my loyalty to the Design brief and made the best design choices in visualizations for the proposed age group.

If a good algorithm can take its place in this application that could precisely capture the weak and strong habits alike, this can be a great tool to help people to spend, save and manage their money without hassle.

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