Smart Cart System with a Portable and Mountable Scanner to Help Reduce Overspending in Stores.

(Technical Report)

Overspending in Superstores by Middle Class American Consumers

(STS Research Paper)

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
School of Engineering and Applied Science
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

by

Mearaf Taffere

May 11, 2017

Preface

The basic design of shopping carts and the way we shop has changed little in the last 50 years. 55% of purchases in grocery stores are unplanned; this number is even higher for consumers who shop at superstores instead of grocery stores because of unplanned spending on things other than groceries.

Researchers have been working on a smart cart system. Most incorporate the smart carts in their design for a smart superstore. These ideas are big and complex and it will take some time until they come to fruition. The proposed smart cart system is a software system that assists shoppers in tracking their grocery expenses and the items in a shopping cart. It has a software application that can be downloaded on a mobile device and a portable scanner that can be mounted on a shopping cart. The application will let consumers create a grocery list, assign it a budget and connect with a portable scanner. This system is simpler and easier to implement.

Why do people overspend? Common behavioral traits put nearly all consumers at risk of overspending, and retailers exploit these traits to increase profit. Application with real-time feedback may diminish overspending.

Smart Cart System with a Portable and Mountable Scanner to Help Reduce Overspending in Stores.

A Technical Report submitted to the Department of Computer Science

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Mearaf Taffere

Spring, 2017

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Signature _____ Date _____

Mearaf Taffere

Approved _____ Date _____

Mary Smith, Department of Computer Science

A Smart Cart System with a Portable and Mountable Scanner to Help Reduce Overspending in Stores.

***Abstract* –** Software systems have changed the way we live, from how we interact with each other to how we shop in stores and online. Most shoppers use their mobile devices during shopping trips. They use different applications to check for discounts, compare prices and/or to create grocery lists. The main purpose of most applications, however, is to encourage shoppers to buy more by informing them of promotions and to also improve their experience at the store (by providing them with aisle numbers of items). The proposed smart cart system is intended to provide shoppers with a tool to create a grocery list, a budget for it and during a shopping trip, to help them keep track of items on the list along with the assigned budget.

Key terms: shopping cart, real-time feedback, portable scanner, shopping apps, stores, smart shopping

1. Introduction

Since its invention, the shopping cart was meant to promote mass-consumption (Grandclémefnt, 2006). In 1936, Sylvan Goldman introduced one of the first shopping carts by placing a dozen of them by the entryway of his Piggily Wiggly store in Oklahoma City. He came about this ingenious idea when he was trying to figure out how to sell more products in his self-service store. Before shopping carts, Piggily Wiggly were using handheld baskets to carry items in and Goldman had noticed that the amount of items they bought was directly proportional to the how much they can carry in the basket before it became too heavy.

In the past 10 years, there has been an interest in making shopping carts smart. A smart cart system that aims to help consumers reduce overspending is presented in this paper and the development process and the usability testing of a high-fidelity prototype developed for this project. Other research that utilize the concept of a smart cart in different ways, including a smart cart system for fast billing and checking out (Gangwal et al., 2013) and as part of a smart grocery store system (Yewatkar et al., 2016) are presented. These designs are big and complex and it will take a fair amount of time until they come to fruition.

The proposed smart cart system is a software application that assists shoppers in tracking their grocery expenses and the items in their shopping cart during a shopping trip. The software application can be downloaded on a mobile device and it comes with a portable scanner that can be mounted on the shopping cart. Either the phone's camera or the portable scanner can be used to scan items on and off the grocery list. The application will let consumers create a grocery list, assign it a budget and use the portable scanner or the device's camera to utilize some of its functionalities.

The main purpose of this research is to introduce the smart cart software system, that is designed to help consumers reduce overspending. One of the contributions of the smart cart system will be to reduce the shoppers' need to constantly check which items are in the cart and which are still on the list.

2. Related Work

The idea of a smart cart is not new. Yewatkar et al., (2016) presented a smart cart that is a part of a larger system. In their version, every product in the smart cart had a radio frequency identification (RFID) attached to it. A RFID tag is a small transponder that respond to "queries from a reader by wirelessly transmitting a serial number or similar identifier" (Jechlitschek, 2006

para. 1) The paper proposed a system that automated a billing system by scanning the RFID tags with a RFID tag reader and using ZigBee to communicate with a centralized server. ZigBee is a wireless personal area network (WPAN) technology that "provides short range, low power and low data rate communication, and supports mesh networking and multi-hopping" (Dagtas et al., 2007 para 1).

Gangwal et al., (2013) presented a system that aimed to reduce customers' dissatisfaction caused by long waiting time for check-out. In their design, customers used the system to calculate and update their total bill and track the details of the purchased items using a monitor attached to the cart. The system also handled some special situations, for instance, when customers forgot to put scanned item into the cart or if they wanted to take items already placed in the cart.

Wang and Yang (2016) designed a 3S-cart system, that is similar to the ones described. The 3S-Cart system used a shopping cart to infer its customer's behavior and provided prompt interaction. In this version, the system "consist[ed] of wireless routers, shopping carts (with 3S-cart modules), and a control server" (Wang & Yang 2016 para. 13). More specifically, they used an Arduino "to integrate with multiple sensors on a cart to detect its movement and action from the customer" (Wang & Yang 2016 para. 3), an LCD touch panel to show real-time information and allow the customer to interact with the system and each shelf in the store is equipped with a wireless router, which organizes a wireless mesh network that allows the carts to connect with the control server and help with estimating the position of the cart.

These days there seems to be an application for just about anything. As of 2012, there was more than 500 iPhone grocery list making apps. (Hui et al., 2013). A 2014 NinthDecimal

survey revealed that out of the 59% of shoppers who use their phones to create shopping list, 32% use applications.

The free shopping list ease app (2017) is one of the highly rated free grocery list creator apps that is available for both Android and iOS users. Users can create, share and organize a list and add groceries from history. The app has been reviewed by more than 300 people and one reviewer wrote “It's [free shopping list ease app] a lifesaver if you're working within a budget… No more manually adding up each item as I shop to make sure I don't go over the budgeted amount!” (iTunes/Customer Reviews, 2017 para. 2) and other reviewers share this view.

Grocery IQ app (2017) is another grocery list creator application that lets users create a list and arrange categories within the list to make it easier for users to check off items.

Most of the existing research that focuses on technologically enhancing the in-store shopping experience generally use a software system in the retail business to improve the shopping experience for the consumer and to find ways to increase revenue for the stores. For instance, Satish et al (2014) designed a very simple software system that improves the checking out process at a store, which is achieved by keeping track of items in the cart and automating the bill payment process.

3. Design Description of the Smart Cart System

The idea of a smart cart system is not new. Some use it to encourage shoppers to buy more and others improve the customer’s experience in the store. The smart cart system pulls ideas from both the free shopping list apps (Free Shopping List Ease) and the smart carts described by Yewatkar et al., (2016), Gangwal et al., (2013) and Wang and Yang, (2016) which are mentioned in the Related Work section. The main objective of the smart cart system is to

ease consumers' stress that might be caused by using a grocery list written on paper or by using a list-maker application to try and reduce overspending.

3.1 Concept

The basic idea behind the proposed smart cart system is to design a software system to help consumers reduce overspending at stores by providing an easy way to create grocery lists, keep track of items in their carts and on their lists and provide them with a real-time feedback to control their budget.

3.2 Design Decision

The basic elements of the smart cart system are a scanning device, which can be a portable scanner or a phone camera, and a software application that receives and analyzes the data from the scanning device. The portable scanner will be mounted on a shopping cart (see Figure 2 and Figure 3) or carried in hand. That choice is left to the user but it would be most beneficial if he or she mounts the scanner on the cart during shopping, especially if the shopping list has a lot of items on it.

3.2.1 Why use a Portable Barcode Scanner?

In January 2011, a market research study of more than 1,400 U.S. consumers found that over half of the consumers surveyed use smartphones to enhance their shopping experience and that 44% of those use barcode scanning applications (Cruz and McKenna, 2011). Therefore, its recommended for shopping list applications to have a scanning feature.

One Grocery IQ app (2017) user wrote: “I found it cumbersome to have to hold my phone the entire time and scroll up and down. Eventually, I switched back to good old pen and paper, and that's what I still use.” (Shreeves, 2015 para. 3) and other users agree. The proposed system described in this research gives the consumer the option of using a portable scanner to add and remove items from the list, which in turn relieves consumers from having to constantly scroll up and down searching for items to take off their list.

The smart cart uses a portable barcode scanner that can be mounted on the shopping cart to capture an image of the barcode and communicate it to the application. There are not many portable barcode scanners that suit the needs of this project but one that comes close is zebra’s RS507 cordless ring imager (see Figure 1). This scanner was not intended for shoppers but it has features that make it suitable for this project, that is, it is omnidirectional, cordless (Bluetooth), easy to integrate with mobile devices, comes with the Scanner SDK (available for Windows, Android and iOS) and is used in hands-free mode (Zebra, 2017). Zebra also provides scanner SDK for iOS and Android developer.

3.2.2 Real-time Feedback

Most consumers, even those who use a grocery list, overspend because it is hard to keep track of items in their carts. A POPAI (2014) research found that 82% of all shopping decisions are made in the store. Furthermore, Kalnikaitė et al. (2013) found that real-time feedback was effective at “supporting the ‘fast and frugal’ decision-making that shoppers employ[ed]” (Kalnikaitė et al., 2013 para 62). The system proposed in this paper includes a real-time feedback feature that gives consumers an instant update on items in their shopping carts and on their shopping lists.

3.2.3 Store product Information

The application will communicate with a product information database containing the barcode and other information about the products. Specifically, the application uses the UPC number to identify products. The application can use Semantics's product database, which can be queried by either category, UPC, name, site or even specific features (Semantics, 2017). For the proposed system, the database can be queried by name, UPC, category and the name of the website, which would return a visual and a JSON file containing detailed information on the requested item (see Appendix G). There are also open source barcode scanner libraries, which the application can use and can be found on GitHub.

3.2.4 User Accounts

Users have the option of creating an account and logging in every time they want to use the application, but they also have full access to the features of the app without having to create an account. This was intentionally done because research has found that, "demanding that users register or log in before they can use an app or see website information has high interaction cost and defies the reciprocity principle" (Budiu, 2014 para. 1). The reciprocal principle says give your users something before you ask for anything from them.

4. User Distribution

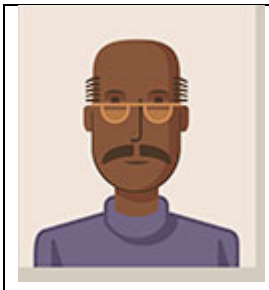
Given this application does not exist yet, existing user distribution statistic was used to estimate the user base for the application. Malmi and Weber (2016) used a dataset with 3,760 users to get the following demographic prediction on different applications. Out of the 3,760 users 400 used shopping list applications, where

- 258 were females
- 142 were males.
- 81% were between the ages of 33-100
- 19% were between the ages of 18-32

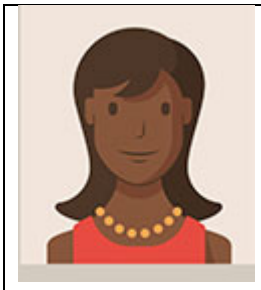
Overall, the distribution for the smart cart system will likely be different than the one predicted by Malmi and Weber (2016).

5. User Personas

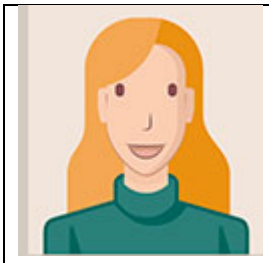
The user distribution for the smart cart system is divided into four age groups and the following are sample user sof the application.

<table>
<tr><td rowspan="6">  </td><td>Name:</td><td>John Roberts</td></tr>
<tr><td>Persona:</td><td>Business owner</td></tr>
<tr><td>Gender:</td><td>Male</td></tr>
<tr><td>Demographics:</td><td>• 52 years old
• Married
• Father of 1</td></tr>
<tr><td>Goals and Tasks:</td><td>John is not the main shopper for his family. He might go to the store once every three weeks to buy a couple of items but ends up spending more and going overbudget.</td></tr>
<tr><td>Computer Skill Level:</td><td>Intermediate</td></tr>
</table>

	Name:	Maggie James
	Persona:	House wife
	Gender:	Female
	Demographics:	• 46 years old • Married • Mother of 3
	Goals and Tasks	Maggie is the main shopper for her household. She does not use a list when shopping. She kind of has an idea of what she needs to buy and strolls around the store until she believes she has got everything.
	Computer Skill Level:	Novice

	Name:	Nardos Daniel
	Persona:	Youth Development Professional
	Gender:	Female
	Demographics:	• 34 years old • Single • No children
	Goals and Tasks:	Nardos is the main shopper of her household. She goes to the store every two weeks. She uses a list to keep track of her spending and does her best to stay on a budget.
	Computer Skill Level:	Intermediate

	Name:	John Thomas
	Persona:	IT specialist
	Gender:	Male
	Demographics:	• 29 years old • Single • No kids
	Goals and Tasks:	John is the main shopper for his household. He goes to the store every two weeks and uses a list to keep track of his spending. He sometimes goes overbudget.
	Computer Skill Level:	Expert

	Name:	Julie Hess
	Persona:	Student
	Demographics:	• 22 years old • Single • No kids
	Goals and Tasks:	Julie is a full-time student at the University of Virginia. She lives in the dorms and has a meal plan. She goes to the store once a month to get essentials but does not use a list to keep track of her spending.
	Computer Skill Level:	Intermediate

6. Tasks

The smart cart system includes some of the basic features of grocery list creator app. Shoppers who use the smart cart system can:

1. Register (optional)
2. Use the scanner to create a list
3. Use the camera to create a list
4. Use the scanner or the camera while shopping to take items off the list
5. View spending history

For details on the application's interface, see Appendix A.

7. Description of Prototype

For this project, two high fidelity prototypes were developed, one for an iOS environment and the other for an Android (see Figure 6 and Figure 7). Both prototypes use common GUI controls and provides the same feedbacks to the user. Except for the menu display, the two prototypes look the same and have the same functionalities. Therefore, the usability testing was done only on the iOS high fidelity prototype.

The prototype was developed using the Justinmind mockup tool. The tool has a desktop application as well as a mobile application, however, prototypes can only be created on the desktop and application. The Justinmind mobile application was downloaded on an iPhone and the prototype was loaded onto it. This application allowed the participants of the usability testing to interact with the prototype as if it was a fully functioning phone application. The prototype included all the features mentioned in the Tasks section and the overall layout of the user interface and functionalities can be found in Appendix A.

The prototype has a burger menu, which reduces users' memory load by displaying most of the functionalities of the application in one place. When a user taps on the menu, the Home, Create a List, History, Settings, About and Logout options are displayed (See Figure 6). The

home page contains a table of previously created list, a select checkbox, and an add and delete icon (See Figure 9).

Before a shopping trip, a user will create a grocery list by tapping on the add icon on the home page or using the Create a List option in the menu, add items to it and assign it a budget. The user has the option of using either the camera on his or her device or the portable scanner to add items on the list. To add items using the device's camera, the user taps the "Use Camera" option on the Create List page (see Figure 8), then use the camera to scan each item's barcode one by one. To use the portable scanner, the user taps the "Use Scanner" option on the Create List page (see Figure 8), then use the scanner to scan each item's barcode one by one. If the consumer tries to add an item and the application cannot find a UPC number for it in the product database, it will ask for the price of the item and adds it to the list (see Figure 14).

When the user is ready to shop, he or she opens the application, navigates to the home page and taps on one of the rows in the table containing the previously created lists. They can then use the device's camera or the portable scanner to scan and take items off the list. If the user decides to use the device's camera, he or she will tap the "Use Camera" option and proceed to scanning the item's barcode; if the user chooses to use the portable scanner, he or she will place the scanner on the cart, then scan the items and place them into the cart (see Figure 4).

After the scanner or the camera scans each item's barcode, it sends a signal to the application, which will take the item off the list (see Figure 12). When the scanner or the camera encounter an item that is not on the list, it sends a signal to the application, which asks the user if he or she wants to add the item to the list. If the answer is yes, then it adds the item to the list and updates the budget (see Figure 14).

8. Evaluation

8.1 Prototype Test Design

The usability testing was performed in a Kroger grocery store at Barracks Road Shopping Center in Charlottesville, Virginia. The intended use of the application was explained to the participants before they started performing the task. Other mobile devices were used to keep track of the time it took them to perform the tasks and to make the scanner sound effect. The five items they were asked to scan were provided.

All the features described in usability requirement were included in the iOS high fidelity prototype developed for this research. The portable scanner was simulated using a Febreze car air freshener (see Figure 2 and Figure 3). Its size, shape and vent clip made the Febreze car air freshener better suited for this project than using a paper prototype.

Prior to the usability testing, participants were asked some questions, including:

1. Are you married?
2. Do you have kids?
3. How often do you grocery shop?
4. Are you the main grocery shopper of your household?
5. Do you use apps to help you with grocery shopping?
6. Do you overspend? If so, how often?

The full questionnaire for the pre-testing question can be found in Appendix B.

The pre-test questionnaire revealed that 7 of the 15 participants were between the ages of 46 and 65 and all were the main shoppers for their household, 5 of the 15 were between the ages 31 and 45 and out of those 3 were the main shopper for their household, and 3 out of the 15

were between the ages of 20 and 30 and were all full-time students. See Appendix C for more detailed information on the participants.

8.2 Tasks

The aim of the usability testing was to measure the task success, time on task, errors, learnability, satisfaction, and number of taps. To get more insight into these quality components, participants were asked to perform the following tasks:

Task 1: Create an account. On the first page, there is a sign-up button. The users clicked on this link and they were redirected to a sign-up page where they were asked to provide their name, email and password. When they were finished, they hit the sign-up button which took them to the home page (see Figure 5).

Task 2: Create a grocery list using device's camera to scan the items. Users were instructed to create a new grocery list, give it a name and to add 5 items by using the device's camera to scan them (see Figure 8).

Task 3: Create a grocery list using the portable scanner to scan the items. Users were instructed to create a new grocery list, give it a name and add 5 items using the portable scanner (see Figure 8).

Task 4: Shop while using a previously created grocery list and the portable scanner. Users were instructed to shop using the grocery list they created and the portable scanner to take items off the list. To accomplish this task, the users navigated to the home page, where the previously created grocery lists were displayed, then users selected one and clicked on a button to use the "use scanner" option (see Figure 11). After they finished scanning the 5 items that were on the list, a pop-up box was displayed informing them of the total price of the items in their cart.

Task 5: Shop while using a previously created grocery list and device's camera. Users were instructed to perform Task 5 again but this time they were told to use the "use camera" option (see Figure 11).

During testing, some problems with the "use scanner" button page links were identified and participants were given hints to continue their interaction with the prototype. The task time, and number of taps were collected and the results are discussed in the Discussion section.

The participants were asked to fill a post-test questionnaire (see Appendix E), which indicated that the participants liked the idea of the smart cart system and believed it could help them reduce overspending. They also liked having the option of scanning items with device's camera or portable scanner. The questionnaire for the post-testing questions can be found in Appendix E.

The feedback obtained from users helped evaluate the usability and appearance of the prototype and the analysis is given in the next section. The questions were specific enough to get detailed feedback on each functionality and page.

9. Results

Every participant performed the five tasks and the analysis was performed based on age demographics, computer skill and frequency of shopping.

Table 1 depicts the total time the participants spend performing the given tasks. Time is in seconds.

Table 1: Total time on tasks

Users	Task1	Task 2	Task 3	Task 4	Task 5	**Total Time**
User 1	48	57	41	48	51	245
User 2	30	38	37	30	37	172
User 3	32	39	38	34	36	179

User 4	50	45	49	38	44	226
User 5	45	51	41	41	45	223
User 6	35	37	38	34	39	183
User 7	44	58	45	43	50	240
User 8	28	47	32	24	21	152
User 9	33	51	37	32	39	192
User 10	36	49	40	32	36	193
User 11	33	50	41	34	40	198
User 12	30	46	33	26	25	160
User 13	27	44	35	25	23	154
User 14	32	48	39	30	37	186
User 15	31	45	33	23	20	152

The total time in Table 1 shows that there is some relationship between participants' computer skill and the time it took them to complete the five tasks, which is expected.

Table 2 presents the number of error made by the participants during usability testing. Those that didn't make any errors are not included in the table.

Table 2: Errors committed by the participants

Tasks	User 1	User 5	User 6	User 7	User 9	User 10	User 11
Task 1 Error	0	0	0	0	0	0	0
Task 2 Error	1	1	1	1	0	1	0
Task 3 Error	1	1	1	1	0	1	0
Task 4 Error	3	1	0	1	0	0	0
Task 5 Error	1	1	0	1	1	1	1
Total Errors	7	4	2	4	1	3	1

Most of the errors made by the participants were due to the size of fonts, buttons and menu. Some participants were having a hard time locating the “Create List” button on the home page.

After completing of the tasks, users were asked to rate and describe their interaction with the prototype and the results are shown in Table 4. They were asked to rate the following design functions on the scale of 1 to 5, with 1 being the lowest and 5 being the highest:

Q1. Rate the appearance of the user interface.

Q2. Rate the type of menu used.

Q3. Rate visual appeal of the buttons.

Q4. Rate the ease with which you were able to navigate between pages.

Q5. Rate the ease of understanding the functionalities of the prototype.

Table 3: Satisfaction Rate

Users	Q1	Q2	Q3	Q4	Q5	Total Rating
User 1	4	3	3	4	3	17
User 2	5	4	2	4	4	19
User 3	5	4	3	3	5	20
User 4	3	4	3	4	3	17
User 5	3	3	4	3	3	16
User 6	4	4	1	4	4	17
User 7	4	2	2	5	3	16
User 8	4	3	2	3	5	17
User 9	3	3	4	3	3	16
User 10	4	4	3	4	4	19
User 11	5	5	4	5	5	24
User 12	3	4	5	3	3	18
User 13	4	3	3	3	4	17
User 14	4	4	3	4	4	19

User 15	5	5	4	5	5	24

9.1 Discussion

Participants did not have any problem performing task 1 (Create an account) and is confirmed by Table 2. For the second and third tasks, which were creating a new list, some participants were having trouble locating the add button on the home page. And when they tried to use the "Use Scanner" option, it redirected them to the wrong page. This problem also occurred during tasks 4 and 5. For task 5, some participants forgot to use the portable scanner to scan the items they were adding to their carts.

The usability testing uncovered several problems with the design. Participants indicated that some button were too small and that made it hard for them to navigate through pages and made creating a list complicated; they also said the user interface was too plain and needs more colors, and one participants suggested using a hand-held scanner instead of a mountable scanner.

9.2 Recommended Revisions

The feedback from the usability testing was used to modify some aspects of the application. Table 4 shows the feedback from the participants along with the modifications made to the prototype based on them. The modified version of the prototype can be found in Appendix B.

Table 4: Recommended Revision

Problem with the design	**Recommendation on how to fix it**	**Priority**
Hard to find where the menu button	Improve visibility of the menu button by increasing the size	High

Buttons too small and hard to tap on	Improve the size of the buttons	High
The fonts are too small	Make the fonts bigger, and remove some of the buttons to make room for this change	Medium
The prototype is too dull	Make it more colorful by changing the background	Low
The second sign up button redirected to home page instead of sign in page	Fix the link	Low
Confusion about how to use a previously created list while shopping and how to get to the Create a List page	Along with changing the appearance of buttons, add feedbacks for new users.	Medium
"Use Scanner" button redirects to the wrong page	Fix the link	Medium

10. Conclusions

Having a shopping list can be an effective way to reduce overspending as in-store decisions are highly and systematically malleable. The smart cart system may help consumers stay on their budget by letting them keep track of their spending and giving them real-time feedback on their activities in stores.

Most shoppers use their mobile devices while shopping and that opens up an opportunity to combat the issue of overspending through applications that utilizes the mobility of these devices. The findings of this research suggest for the smart cart system to succeed in reducing overspending, it must not heavily depend on consumer memory to keep track of items on the list and in the cart. However, it also recognizes that total prevention of overspending is not realistic but using real-time feedback can reduce it.

The feedback from the participants of the usability tasting was encouraging. Even though there were some technical issues with the high-fidelity prototype, the participants found the idea of using a smart cart to reduce overspending feasible and beneficial.

There is not a lot of documentation on integrating a portable scanner with a mobile application. While it is presented in this research, there is much more to learn. For instance, further research should be perform an in-depth analysis of users' perception of such systems, which would make a difference in the success of future applications that use portable scanners.

References

Avatars (2017). https://www.thirdandgrove.com/content-strategy-creating-user-personas-to-test-your-business-hypotheses

Budiu, R. (2014). *Login Walls Stop Users in Their Tracks*. *Nngroup.com*. https://www.nngroup.com/articles/login-walls/

Cruz, B and McKenna, J. (2011) Smartphones Leading to Greater Transparency in the Shopping Experience. http://blog.cmbinfo. com/smartphones-in-the-shopping-experience

Dagtas, S., Pekhteryev, G., & Sahinoglu, Z. (2007). *Multi-stage Real Time Health Monitoring via ZigBee in Smart Homes*. http://www.merl.com/publications/docs/TR2007-056.pdf

Gangwal, U., Roy, S., Bapat, J. (2013) Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks.

Grandcl´ement, C. (2006). Wheeling food products around the store... and away: the invention of the shopping cart, 1936-1953. http://docshare01.docshare.tips/files/9648/96489219.pdf

Grocery IQ, Grocery Shopping Made Simple | GroceryiQ.com. (2017). Groceryiq.com. http://www.groceryiq.com/Default.aspx?home=true

iTunes/Customer Reviews. (2017). Free Shopping List Ease - Grocery List + Coupons on the App Store. App Store. https://itunes.apple.com/us/app/free-shopping-list-ease-grocery-list-coupons/id507605066?mt=8

Jechlitschek, C. (2006). A Survey Paper on Radio Frequency IDentification. http://www.cse.wustl.edu

Kalnikaitė, V., Bird, J. & Rogers, Y. (2013). Decision-making in the aisles: informing, overwhelming or nudging supermarket shoppers? 17: 1247. doi:10.1007/s00779-012-0589-z

ListEase - Create lists now! It's free and easy. (2017). Shoppinglistapp.com. https://www.shoppinglistapp.com/

Malmi, E., & Weber, I. (2016). You Are What Apps You Use: Demographic Prediction Based on User's Apps.https://arxiv.org/pdf/1603.00059.pdf

NinthDecimal (2014) *Mobile Audience Insights Report*. https://www.ninthdecimal.com/wp-ontent/uploads/2015/01/ND_Insights_CPG_2014.pdf

POPAI (2014) *POPAI's 2014 Mass Merchant Shopper Engagement Study*.

http://cdn2.hubspot.net/hub/73834/file-1640923392-pdf/docs/popai_-_2014_mass_merchant_shopper_engagement_study.pdf

Satish K, Sachin M, Rahul T, Roshan G (2014). Developing a Multitasking Shopping Trolley Based on RFID Technology, *International Journal of Soft Computing and Engineering (IJSCE)* ISSN: 2231-2307, Volume-3, Issue-6

Shreeves, R. (2015). Is your grocery list handwritten or digital? *MNN - Mother Nature Network*. http://www.mnn.com/green-tech/gadgets-electronics/blogs/your-grocery-list-handwritten-digital

Semantics3(2017).https://www.semantics3.com/

Wang, Y., & Yang, C. (2016). 3S-Cart: A Lightweight, Interactive Sensor-Based Cart for Smart Shopping in Supermarkets. *IEEE Sensors Journal*, 16(17), 6774 - 6781.

Yewatkar, A., Inamdar, F., Singh, R., Ayushya, & Bandal, A. (2016). *Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft*. ScienceDirect

ZebraRS507 Cordless Ring Imager.(2017) https://www.zebra.com/us/en/products/mobile-computers/wearable-computers/rs507.htm

Appendix A

Figure 1- RS507 Cordless Ring Imager

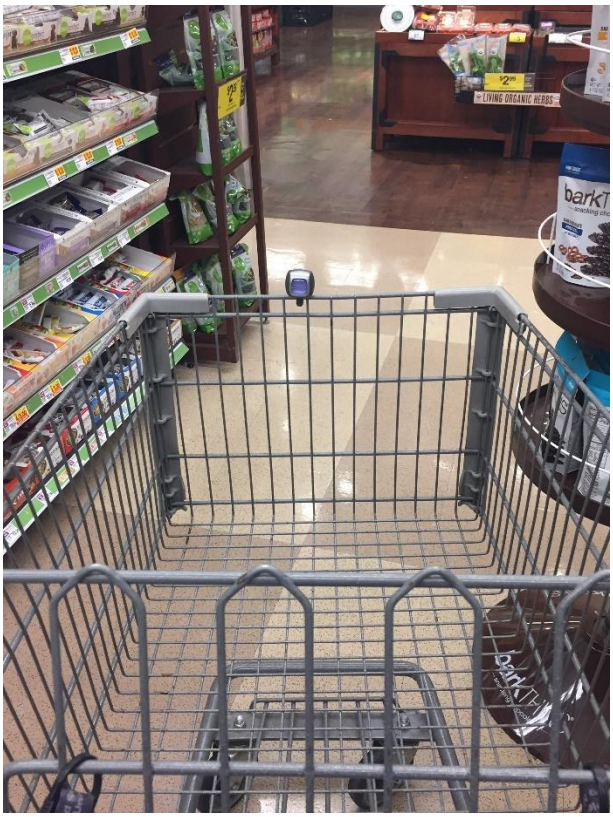


Figure 2-Scanner mounted on a cart

Figure 3-Scanning an item using the "portable scanner"

Figure 4- Sign in page

Figure 5- Sign up page

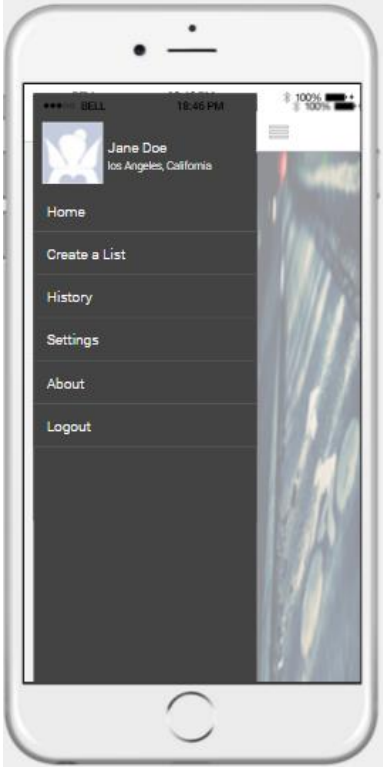


Figure 6- Menu option for iOS

Figure 7- Menu option for Android

Figure 8- Create a new list

Figure 9- Home page

Figure 10- Home page after deleting 2 lists

Figure 11- view contents of a list

Figure 12- Scanning in progress

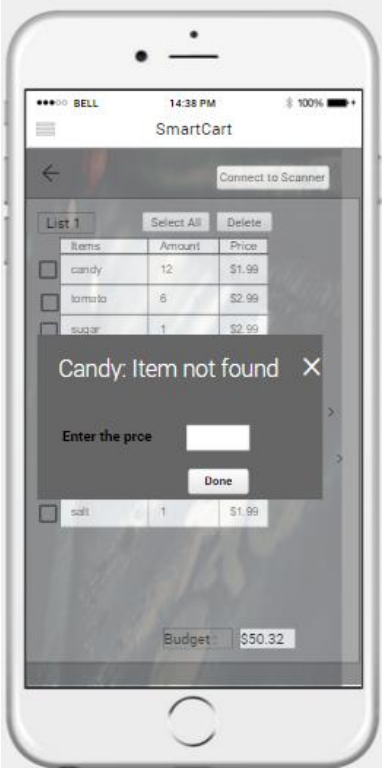


Figure 13- Barcode for item not recognized

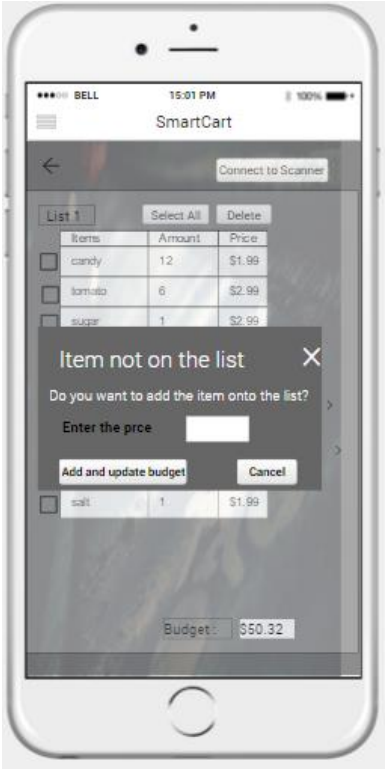


Figure 14- Adding an item not on the list

Figure 15- Scanning done (list completed)

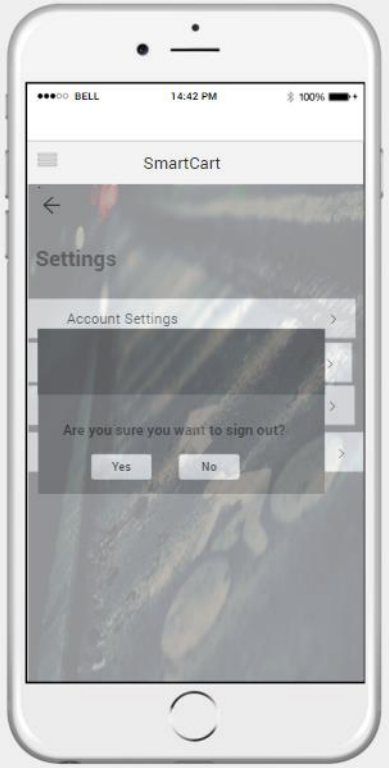


Figure 16- Sign out

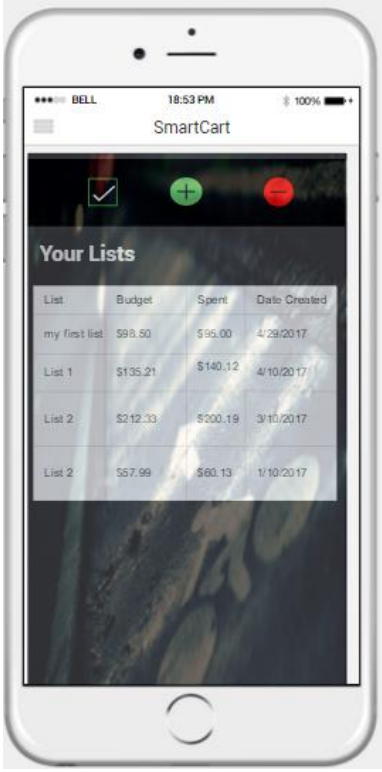


Figure 17- View history

Appendix B

Figure 18- Improved Home Page

Figure 19- Improved Create List Page

Figure 20- Improved List Details Page

Figure 21- Improved Create List Page

Appendix C

Table 5: Collected information about participants

participant	Gender	Age group(between)	Married?	Have Kids?	Main shopper for household?	Overspend?	Have used a shopping app before?	Tech skill
1	F	46 and 65	Yes	Yes	Yes	yes	No	Novice
2	F	46 and 65	Yes	Yes	Yes	Yes	No	Intermediate
3	F	46 and 65	Yes	Yes	Yes	No	No	Intermediate
4	F	46 and 65	Yes	Yes	Yes	No	No	Novice
5	F	46 and 65	Yes	Yes	Yes	Yes	No	Novice
6	M	46 and 65	Yes	Yes	Yes	No	No	Intermediate
7	M	46 and 65	Yes	Yes	Yes	No	No	Novice
8	F	31 and 45	No	Yes	Yes	Yes	No	Expert
9	M	31 and 45	No	Yes	No	Yes	No	Intermediate
10	F	31 and 45	Yes	No	No	Yes	No	Intermediate
11	F	31 and 45	No	No	Yes	Yes	No	Intermediate
12	M	31 and 45	Yes	No	Yes	No	No	Expert
13	F	20 and 30	No	No	No	Yes	No	Expert
14	F	20 and 30	No	No	No	Yes	Yes	Intermediate
15	M	20 and 30	No	No	No	Yes	No	Expert

Appendix D

Pre-testing questionnaire

1. Select your age group
    - 20-30
    - 31-45
    - 46-65
    - Above 65
2. Are you married?
    - Yes
    - No
3. Do you have kids?
    - Yes
    - No
4. Are you the main shopper of your household?
    - Yes
    - No
5. How often do your shopping? Every:
    - Week
    - Two weeks
    - Month
    - I rarely shop
    - Never
6. Do you use apps to help you with shopping?
    - Yes
    - No
7. Do you overspend?
    - Yes
    - No
8. If so, how often?
    - Very often
    - Sometimes
    - All the time
    - Rarely
    - Never
9. How much experience do you have with computes:
    - Novice
    - Intermediate
    - Expert

Appendix E

Post-testing questionnaire

Rate the following questions on the scale of 1 to 5, with 1 being low and 5 being high

1. Rate the appearance of the user interface.

   1 2 3 4 5

2. Rate the type of menu used.

   1 2 3 4 5

3. Rate visual appeal of the buttons.

   1 2 3 4 5

4. Rate the ease with which you were able to navigate between pages.

   1 2 3 4 5

5. Rate the ease of understanding the functionalities of the prototype.

   1 2 3 4 5

6. List any changes you would make to the button

   _____

7. List any changes you would make to the menu

   _____

8. List any changes you would make

   _____

9. List anything you would add and/or remove

   _____

10. List any change you would make to the overall appearance

    _____

Appendix F

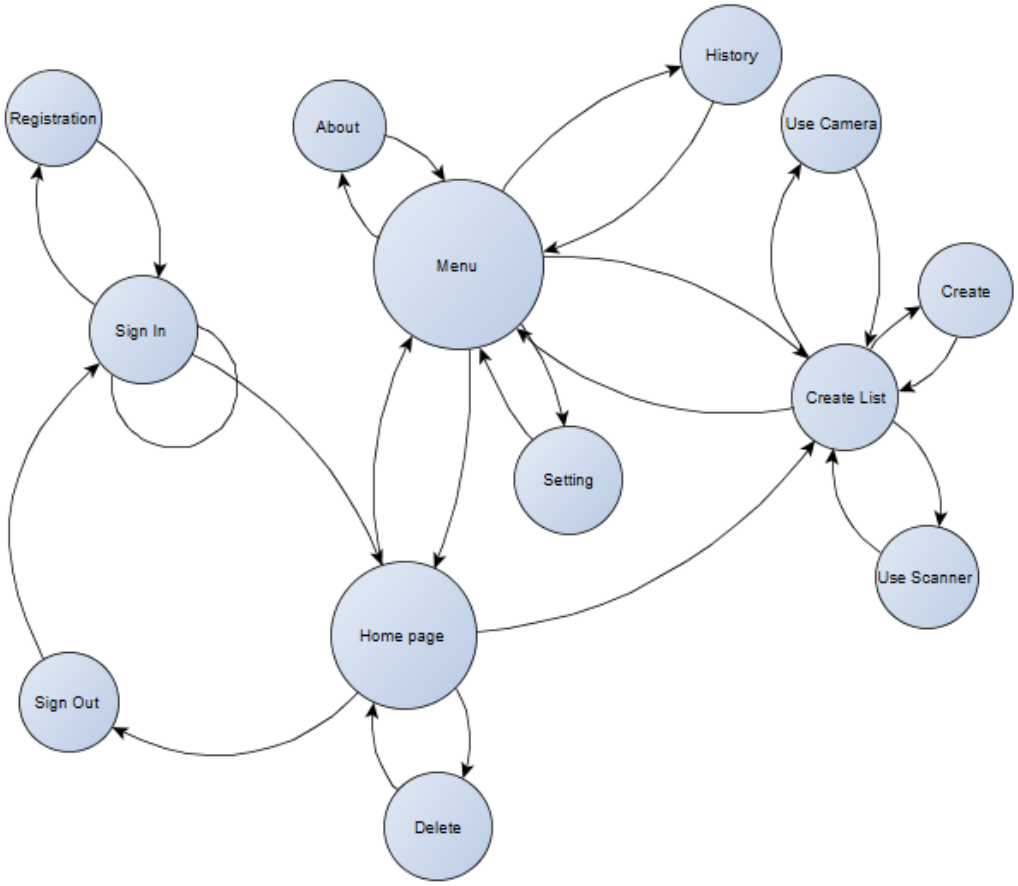


Figure 22 -Page Transitions

Appendix G


```
{
  "search": "Oatmeal Squares Brown Sugar Cereal",
  "UPC": "300000643062",
  "catagory": "breakfast & cereal",
  "site": "target.com"
}
```


Figure 23- Sample query

Quaker Oatmeal Squares Brown Sugar Cereal 14.5 oz

Main Ingredient: grain. Package Type: individual i... (visit site URLs for full description)

Price	USD 2.50
Category	Cereal (ID 18210)
Brand	Oatmeal Squares
Color	-
Physical	*weight* 453592.37mg
GTINs	00030000064306, 00300000643062
Sites	target.com sku: target_13304765 USD 2.50 Target • Active USD 2.75 Target • Inactive target.com sku: 13304765 USD 3.49 Target • Inactive USD 3.04 Target • Inactive USD 2.75 target.com • Inactive
Sem3ID	67MQihZ21oWGkOeK2QqGUW
Last updated at	29 Apr 2017 5:18:58 am

Figure 24: Sample visual response of a query

Figure 25: Sample JSON response of a query

Overspending in Superstores by Middle Class American Consumers

An STS Research Paper

presented to the faculty of the

School of Engineering and Applied Science

University of Virginia

by

Mearaf Taffere

May 12, 2017

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Signed: _____

Approved: _____ Date _____

1. Introduction

The average American family of four spends from $131.20 to $300.40 on groceries (USDA, 2015) and makes an average of 1.5 grocery shopping trips per week (Statista, 2016). According to POPAI's 2014 mass merchant shopper engagement study, 55% of purchases in grocery stores are unplanned; this number is even higher for consumers who shop at superstores instead of grocery stores because of unplanned spending on things other than groceries.

By 2000, more than 70 percent of U.S. households had at least one general-purpose credit card (Boorstin, 2004). A 2014 TSYS online survey of 1,000 consumers found that only 9% of Americans preferred to use cash, while 78% preferred to pay for things with a credit or debit card. Americans spend $1.33 for every dollar earned (Census Bureau, 2009) and carry average of $8,700 in credit card debt per household (Federal Reserve, 2008).

According to a 2010 Deloitte/Grocery Manufacturers Association report, retailers' shopper marketing budgets are growing at 26% CAGR (compound annual growth rate), and budgets are expected to increase. To increase their revenue, superstores also offer deals, bigger carts, use product placement, and advertise. Such techniques entice consumers, especially those without a grocery list. Bell, Corsten, and Knox (2011) studied "how pre-shopping factors drive unplanned buying" and concluded: "even though stores of all types benefit when the shopper enters with an abstract goal, full-service supermarkets [superstores] receive an extra positive lift in unplanned buying… revenue increases of up to 10% per shopping trip are possible." According to Lee, Ahn and Park (2015), "Yankelovich, market research firm, estimated that a consumer living in a city saw up to 5000 ad messages a day in 2007, compared with up to 2000 ad messages 30 years ago" and according to Dehghani et al. (2016): "The percentage of companies using social media for

advertising is purposes approximately 88% in 2014." Advertising expenditures on social media are anticipated to double in 2018.

Dizzie, a wife and a mother of two, writes: "I understand the fundamentals – I use coupons faithfully, dutifully purchase items on sale, and lovingly care for my stockpile. But I will still overspend" (Money Saving Mom, 2013). She is far from alone.

In a 2016 the Facebook page SOML posted a skit of a woman's failed attempt to leave Target store without making any unplanned purchases. The video has over 7 million view and 61 thousand comments, most left by women (SOML, 2016). Its clear overspending is a problem, but why do people overspend? This STS research looks deeper into other research that explain why consumers overspend (Beatty, 1998, CreditCards.com, 2016, Yarrow, 2014).

2. Review of Research

Research confirms that consumers are having a hard time staying on a budget. For instance, one study found that "approximately 65% of all supermarket purchase decisions were made in-store with over 50% of these being unplanned" (Abratt and Goodey, 1990). One simple solution is to use grocery list and 55% of shoppers do use a shoppinglists (Rickard, 1995). On average, they spend significantly less than non-list holders. But of those who do use a list, most use it to "ensure requirements" (Thomas & Gerald, 1993) and only 15% use it to "control expenditure" (Thomas & Gerald, 1993).

Shopping with a list is not enough to prevent overspending. Almost all shoppers shop with "flexibility" (Thomas & Garland, 2004). Shoppers use list more as a memory aid than as a strict guide to their shopping. Researchers found that "on average, purchases by list shoppers exceeded the categories on their shopping lists by about 2.5 times" (Thomas & Garland, 2004).

As of 2012, there were more than 500 iPhone grocery list making apps. (Hui et al., 2013). Some researchers believe such of apps have made consumers smarter because these consumers tend to pay close attention to their budget and manage to get items on their list. Real-time feedback make apps even more effective.

Researchers have found that consumers focused on staying on a budget might end up overspending. According to Van Ittersum et al. (2010): "Those who try to calculate the exact total price of their basket [shopping cart] appear to be at the greatest risk of underestimating the total price, by up to $8.98 (18.9%)" which they say leads to going over budget. Assuming shoppers with budgets are knowledgeable about the total price of their shopping carts as they shop is problematic because "although budgets stimulate budget shoppers to track their in-store spending, the task complexity and spending uncertainty cause estimation biases that directly influence their spending" (Van Ittersum et al., 2010).

3. Why do consumers overspend?

There are several sociological and psychological reasons that contribute to consumer overspending. One is, shopping has become more about achieving status or "keeping up with the Joneses." and less about staying alive and healthy. In their paper "Impulse purchasing: a qualitative exploration of the phenomenon", Bayley & Nancarrow (1998) include low prices and mass advertising as the factors that contribute to impulse buying.

3.1 Target advertising

Over $245 billion was spent on advertising in the United States in 2003 (Advertising Age, 2005). Participants like TracyLocke (Buy Design), an ad agency with the motto

"Everything we do at TracyLocke is designed to motivate people to buy and act" (TracyLocke, 2016) work to get consumers to spend money. On the other hand, the national foundation for credit counseling, a nonprofit organization "dedicated to improving people's financial well-being" (NFCC, 2016) work to help consumers mitigate overspending.

A study by Walker Reczek et al. (2016), conducted with 188 participants found that the participants were more interested in buying a Groupon for a restaurant advertised as sophisticated when they thought the ad had been targeted to them based on specific websites they had visited during an earlier task they were asked to perform. Lewis and Reiley (2014) also found that 93% of the online targeted ads' total effect was on offline sales.

3.2 Using Credit cards instead of Cash

Raghubir and Srivastava (2008) found that there are significant differences in spending based on how shoppers pay for things. According to Raghubir and Srivastava (2008): "the more transparent the payment outflow, the greater the aversion to spending or higher the 'pain of paying' …leading to less transparent payment modes such as credit cards and gift cards (vs. cash) being more easily spent or treated as play or 'monopoly money." They argued that using credit cards dulls the 'pain of paying' for two important reasons: (1) there is a separation in time between when the credit card is used to buy something and when the bill has to be paid; and (2) using a credit card allows different purchases to be mixed together. When the bill is actually paid, the shopper is not able to attribute the payment to any one particular purchase. Because of these two reasons, people overspend when using credit cards.

3.3 Impulse Buying

One of the oldest reason to why consumers overspend is impulse buying: “a sudden and immediate purchase with no pre-shopping intentions” (Beatty, 1998). People buy products not to fulfill their basic needs only, but to also their psychological needs. They buy things for their esthetic value, symbolic meaning or as a reward for themselves. Retailers take advantage of impulse buyers by offering promotions, bargains and sales and it seems to work because 79% of consumers admit to making impulse purchases in stores (CreditCards.com, 2016). Promotions and sales drive sales by instilling a fear of missing out. Stores that offer more clearance attract more consumers who have “the Ben Franklin syndrome,” that is, shoppers that overlook the money they spend and emphasis on how much they’ve saved (Yarrow, 2014).

The effects of impulse buying go hand in hand with shopping without a list. In their 1996 study, Thomas and Garland found that consumers without a list are more likely to purchase items that were on promotion. They also found that 93% of list shoppers do not shop to their specified lists, suggesting some amount of divergence. buying “spontaneously, unreflectively, immediately, and kinetically.” might be a good news for retailers but not so much for shopper, because it means they need to take more precaution to avoid overspending.

Pew research center found that 68% of U.S. adults have a smartphone (Anderson, 2015). So, it’s not surprising that most consumers use their phone before and during a shopping trip. Data collected by Booz & Company for FMI’s 2012 report showed that out of the 52% consumers who used technology in their grocery shopping, 19% used it for making shopping lists and 16% used it to track their list. (FMI, 2012). Smartphones are now among the primary source of Internet connectivity (Anderson & Rainie, 2012) and when a software system harness this and the mobility aspect of these devices, it usability sky rockets.

Ironically POPAI's 2014 study revealed that "Shoppers who were texting, chatting, and emailing in the store increased their unplanned purchases." Bu this has more to do with being distracted with other activities than just using their phone. And other research still suggests that the use of mobile device during a shopping trip plays a big role in influencing consumer decision-making (Kalnikaitė et al. 2013).

4. Can technology help?

Most of the existing research in this area is on using a software system in the retail business to mainly better the shopping experience for the consumer and to find ways to increase revenue for the stores. For instance, one of the outcome of the research by Statish et al (2014) is a very simple software system design to make checking out at a store, it does that by keeping track of items in the cart and automating the bill payment process.

A shopping list can prevent overspending by guiding in-store decision. According to Rottenstreich et al. (2006): "Those shopping with lists had a concrete mechanism guiding them toward choices they were supposed to make. The shopping lists facilitated reliance on system 2 [controlled and deliberate mode of thought]. In contrast, participants without lists were vulnerable to the influence of system 1[automatic and affective mode of though]. Without a system 2 facilitators, they often relied on affective reactions and made some relatively impulsive decisions."

As of 2012, there was more than 500 iPhone grocery list making apps (Hui et al., 2013). Some researchers believe such apps have made consumers smarter because these consumers tend to pay attention to their budget and manage to get items on their list. A 2014 NinthDecimal

survey revealed that out of the 59% of shoppers who use their phones to create shopping list, 32% use applications. Real- time feedback could make apps even more effective.

The free shopping list ease app (2017) is one of the highly rated free grocery list creator apps that are available for both android and IOS users. Users can create, share and organize a list and add groceries from history. The app has been reviewed by more than 300 people. One reviewer wrote: “It's [free shopping list ease app] a lifesaver if you're working within a budget… No more manually adding up each item as I shop to make sure I don't go over the budgeted amount!” (iTunes/Customer Reviews, 2017) and other reviewers share this view.

One Grocery IQ app (2017) user wrote: “I found it cumbersome to have to hold my phone the entire time and scroll up and down. Eventually, I switched back to good old pen and paper, and that's what I still use.” (Shreeves, 2015). Other users agree. This research suggests the use of portable scanner to relieve the consumers of the problem stated in the product review.

Most consumers overspend because it’s hard to keep track of items they put in the cart, even when they are using shopping list. According to POPIA (2014): “2014 results show that the in-store decision rate continues to climb with 82% of all shopping decisions made in the store. Compared to the 2012 results, unplanned purchases took the biggest jump increasing from 55% to 62%.” Consumers who use an app with a real-time feedback to create a grocery list and a budget and to track spending in the store are less likely to overspend.

Ittersum et al. (2013), concluded, “Real-time spending feedback alleviates spending uncertainty, stimulating budget shoppers to spend almost 95% of their budget” they also concluded the reduction in mental stress associated with mentally tracking total spending improves the shopping experience of budget shoppers. Kalnikaitė et al. (2013) confirms this

result: “simple and immediate feedback can be effective at supporting the ‘fast and frugal’ decision-making that shoppers employ.”

There are several tools consumers can use to protect themselves from targeted advertising. One is, Adfender, an ad blocking company that promises to “block all types of ads” (Adfender, 2016).

5. Conclusion

Consumer overspending is a problem with many causes. Retailers promote it for their gain. Consumers are bombarded with ads, sales and promotions almost everywhere they go and to stay on a budget, it’s important to recognize their effects and not give into them. Consumers use different methods to prevent overspending, the most common being using a shopping list.

Most shoppers use their mobile devices while shopping and that opens a great opportunity to combat the issue of overspending through applications that utilizes the mobility of these devices. Such a system must not heavily depend on the memory of the consumer to keep track of items on the list and in the cart and recognizes total prevention of overspending is unrealistic. Real-time feedback may greatly diminish overspending.

References

Abratt, R., & Goodey, S. D. (1990). Unplanned Buying and In-store Stimuli in Supermarkets. Managerial & Decision Economics, 11(2), 111-121.

AdFender | Annoyance free web browsing. Adfendercom. 2016. http://www.adfender.com/

Advertising Age (2005), Fact Pack: 3rd Annual Guide to Advertising and Marketing, February 28, Crain Communications, Inc.

Anderson, J., & Rainie, L. (2012). The Future of Apps and Web. Pew Research Center: Internet, Science & Tech. http://www.pewinternet.org/2012/03/23/the-future-of-apps-and-web/

Anderson, M. (2015). Technology Device Ownership: 2015. *Pew Research Center: Internet, Science & Tech*. http://www.pewinternet.org/2015/10/29/technology-device-ownership-2015/

Bayley, G and Nancarrow, C (1998) "Impulse purchasing: a qualitative exploration of the phenomenon", Qualitative Market Research: An International Journal, Vol. 1 Issue: 2, pp.99-114, doi: 10.1108/13522759810214271

Beales, H. (2010). The Value of Behavioral Targeting. Retrieved 11 May 2017, from http://www.networkadvertising.org/pdfs/Beales_NAI_Study.pdf

Beatty, S. E. and Ferrell M. E. (1998). Impulsive Buying: Modeling Its Precursors. *Journal of Retailing*, Vol. 74 No. 2, pp. 169–191.

Bell, D. R., Corsten, D., & Knox, G. (2011). From Point of Purchase to Path to Purchase: How Preshopping Factors Drive Unplanned Buying. *Journal of Marketing*,*75*(1), 31-45. doi:10.1509/jmkg.75.1.31. EBSCOhost Web

Boorstin, D. (2004). Credit History: The Evolution of Consumer Credit in America. https://www.bostonfed.org/-/media/Documents/ledger/spring.../credhistory.pdf

Census Bureau (2009). www.Census.gov. https://www.census.gov/prod/2011pubs/acs-15.pdf

CreditCards.com. (2016). Survey: 5 in 6 Americans admit to impulse buys. http://www.creditcards.com/credit-card-news/impulse-buy-survey.php

Confessions of a Secret Spender. (2013). Money Saving Mom http://moneysavingmom.com/2013/09/confessions-of-a-secret-spender.html

Dehghani, Milad; Niaki, Mojtaba Khorram; Ramezani, Iman; Sali, Rasoul (June 2016). Full length article: Evaluating the influence of YouTube advertising for attraction of young customers. *Computers in Human Behavior, 59* (), 165-172. Virgo

Deloitte/Grocery Manufacturers Association (2007) Shopper Marketing: Capturing a Shopper's Mind, Heart and Wallet. https://www.gmaonline.org/downloads/research-and-reports/shoppermarketing.pdf

Federal Reserve (2008). Federal Reserve Releases: Consumer Credit. https://www.federalreserve.gov/releases/g19/20081007/g19.pdf

FMI (2012) U.S. Grocery Shopper Trends 2012 Executive Summary. http://www.icn-net.com/docs/12086_FMIN_Trends2012_v5.pdf

Grocery IQ Grocery Shopping Made Simple | GroceryiQ.com. (2017). Groceryiq.com. http://www.groceryiq.com/Default.aspx?home=true

Hui, S. K., Inman, J. J., Yanliu, H., & Suher, J. (2013). The Effect of In-Store Travel Distance on Unplanned Spending: Applications to Mobile Promotion Strategies. *Journal of Marketing*, *77*(2), 1-16.

iTunes/Customer Reviews. (2017). Free Shopping List Ease - Grocery List + Coupons on the App Store. App Store. https://itunes.apple.com/us/app/free-shopping-list-ease-grocery-list-coupons/id507605066?mt=8

Kalnikaitė, V., Bird, J. & Rogers, Y. (2013). Decision-making in the aisles: informing, overwhelming or nudging supermarket shoppers? 17: 1247. doi:10.1007/s00779-012-0589-z

Lee, J., Ahn, J., & Park, B. (2015). The effect of repetition in Internet banner ads and the moderating role of animation. *Computers in Human Behavior*. ScienceDirect

Lewis R., Reiley D. (2014) Online ads and offline sales: Measuring the effects of retail advertising via a controlled experiment on Yahoo! Quant. Mark. Econ. doi: 10.1007/s11129-014-9146-6

ListEase - Create lists now! It's free and easy. (2017). Shoppinglistapp.com. https://www.shoppinglistapp.com/

NFCC (2016) National Foundation for Credit Counseling. Credit and Debt Advice | NFCC. NFCC. https://www.nfcc.org/

POPAI (2014) POPAI's 2014 Mass Merchant Shopper Engagement Study. http://cdn2.hubspot.net/hub/73834/file-1640923392-pdf/docs/popai_-_2014_mass_merchant_shopper_engagement_study.pdf

Purcell, K., Brenner, J., & Rainie, L. (2012). *Search Engine Use 2012*. *Pew Research Center: Internet, Science & Tech*. http://www.pewinternet.org/2012/03/09/search-engine-use-2012/

Raghubir, P., & Srivastava, J. (2008). Monopoly money: The effect of payment coupling and form on spending behavior. Journal of Experimental Psychology: Applied, 14(3), 213-225. doi:10.1037/1076-898X.14.3.213

Rottenstreich, Y., Sood, S., & Brenner, L. (2006). Feeling and Thinking in Memory-Based versus Stimulus-Based Choices.

Rickard, L. (1995). Shopping lists tell just half the real story. Advertising Age, pp. 9,20

Satish K, Sachin M, Rahul T, Roshan G (2014). Developing a Multitasking Shopping Trolley Based on RFID Technology, *International Journal of Soft Computing and Engineering (IJSCE)* ISSN: 2231-2307, Volume-3, Issue-6

Shreeves, R. (2015). Is your grocery list handwritten or digital? *MNN - Mother Nature Network*. http://www.mnn.com/green-tech/gadgets-electronics/blogs/your-grocery-list-handwritten-digital

SOML (2016). 33 Thoughts Every Woman has At Target. Facebook. https://www.facebook.com/SOML/videos/vb.571035253040893/815040281973721/?type=2&theater

Statista (2016) Weekly Number of U.S. Grocery Shopping Trips per Household. https://www.statista.com/statistics/251728/weekly-number-of-us-grocery-shopping-trips-per-household/

Thomas, A. and Garland, R. (1993), "Supermarket shopping lists: their effect on consumer expenditure", International Journal of Retail & Distribution Management, Vol. 21 No. 2, pp. 8-14.

Thomas, A. and Garland, R. (1996), "Susceptibility to goods on promotion in supermarkets", Journal of Retailing and Consumer Services, Vol. 3 No. 4, pp. 233-9.

Thomas, A. and Garland, R. (2004). Grocery shopping: list and non-list usage, Marketing Intelligence & Planning, Vol. 22 Issue: 6, pp.623-635, doi: 10.1108/02634500410559015

TracyLcke. HOME. *TracyLocke*. 2016. http://tracylocke.com/

USDA (2017) Official USDA Food Plans: Cost of Food at Home at Four Levels, U.S. Average. https://www.cnpp.usda.gov/sites/default/files/CostofFoodFeb2016.pdf

Van Ittersum, K., Pennings, J. M., & Wansink, B. (2010). Trying Harder and Doing Worse: How Grocery Shoppers Track In-Store Spending. *Journal of Marketing*, *74*(2), 90-104. doi:10.1509/jmkg.74.2.90

Van Ittersum, K., Wansink, B., Pennings, J. E., & Sheehan, D. (2013). Smart Shopping Carts:

How Real-Time Feedback Influences Spending. *Journal of Marketing*, *77*(6), 21-36.

Walker Reczek, R., Summers, C., & Smith, R. (2016). Targeted Ads Don't Just Make You More Likely to Buy — They Can Change How You Think About Yourself. Harvard Business https://hbr.org/2016/04/targeted-ads-dont-just-make-you-more-likely-to-buy-they-can-change-how-you-think-about-yourself

Yarrow, K. (2014). Decoding the New Consumer Mind: How and Why We Shop and Buy. San Francisco, CA: Jossey-Bass, A wiley Brand.