Design and Development of Smart List: A Mobile App for Creating and Managing Grocery Lists

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Abstract:

Research in consumer science has proven that grocery shopping is a complex and distressing process. Further, the task of generating the grocery lists for the grocery shopping is always undervalued as the effort and time took to create and manage the grocery lists are unseen and unrecognized. Even though grocery lists represent consumers' purchase intention, research pertaining the grocery lists does not get much attention from researchers; therefore, limited studies about the topic are found in the literature. Hence, this study aims at bridging the gap by designing and developing a mobile app (application) for creating and managing grocery lists using modern smartphones. Smartphones are pervasive and become a necessity for everyone today. Hence, a smartphone app that can facilitate the process of creating and managing grocery lists for busy and working people is beneficial. The design and development of the app followed the rapid application development methodology. First, the functional requirements were gathered through interviews and content analysis. Then, a prototype named SMART LIST has been developed based on the gathered requirements, and a field study was carried out to evaluate the usability of the prototype. The results of the evaluation suggested that SMART LIST is useful and easy to use. The respondents also satisfied with the functions for managing grocery lists offered by SMART LIST. The study contributes towards an understanding the system requirements and user interface of a mobile app for managing grocery list. It can be a reference model for developers and researchers in the area to develop similar apps or enhancing the capabilities in creating and managing grocery lists.

Key words: Consumer science, Grocery shopping, Grocery shopping list, Reminder systems.

Introduction:

Grocery shopping is one of the fundamental human activities performed regularly at a constant interval such as weekly, fortnightly or monthly (1). Research in consumer science has reported that a correlation exists between grocery shopping behaviour and sales (2). Further, grocery shopping is considered a complex life skill that involves a person to learn and experience the few steps including planning, do the shopping, and evaluate the post-shopping activities. Before the grocery shopping takes place at the grocery stores, one should identify the grocery items to purchase.

It is an essential step during the planning where consumers will create a grocery list, either a physical or mental list. The grocery lists act as a memory aid that facilitates the grocery shopping process. Further, it can assist consumers in locating grocery items at the grocery store aisle and controlling users from making impulsive purchases. Consequently, helping in maintaining the household expenditure, thus saving money.

Past studies have reported that women are the primary creator of grocery shopping and they are more than men doing grocery shopping. Creating and managing a grocery list is a tedious routine especially for working mothers which causes a distressing situation to them. The situation does not only occur to working mothers, but to anyone who does the grocery shopping for the household. This is where the grocery lists play their role. Regardless of physical or mental lists, they are not efficient

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enough to facilitate grocery shopping. For example, the hand-written grocery list could be lost, contaminated by water or dirt, and unable to cater expended list when the paper is too small. On the other hand, the mental list could be forgotten because human memory is limited in its space and time to remember a long list. Hence, consumers will most likely not to purchase essential grocery items for the household which may need to repeat a trip to the grocery store, or even changing the whole meal plan for the household. It requires more time to re-plan the trip or the meal plan which consequently may lead to unorganized life activities and a distressing situation. Research on grocery lists has not received much attention from researchers as people regarded that the lists and the efforts of creating the tasks are not relevant; although the piece of papers provide information on consumer purchase intention and a tool that makes people be more organized in managing their daily life and expenditure (3).

Due to this problem, there is an urgent need for mechanisms that can create and manage grocery lists efficiently. The emergence of smartphone technology in human life may open an opportunity towards providing an effective way of creating and managing grocery lists. As the smartphone became pervasive and integrated into our lives (4,5); hence, a mobile application (app) could be a useful tool for facilitating the creation and maintenance of grocery lists. Therefore, this paper bridges the gap by investigating the potential of smartphone as a tool for creating and managing grocery list electronically. This study aims to design and develop a mobile app for managing grocery list. As a result, SMART LIST, a prototype of a mobile app for managing grocery lists was developed and evaluated. The study contributes towards an understanding the system requirements for such apps and could be a reference model for developers and researchers to improve an electronic process for creating and managing grocery lists. The next section describes the background and related studies. Next, the section describes the design and development of SMART LIST. The subsequent section explains the usability evaluation of SMART LIST. The last section in this paper concludes the study and lists the future works.

Background and Related Studies:

This section describes the background of grocery lists and related studies investigating the effects of grocery lists for grocery shopping from the perspective of consumer science research. Later, this section discusses the role of information

technology in facilitating the creation and management of a grocery list. Although consumers found that grocery shopping is a regular task, however, it is considered a stressful and challenging task for many people. The grocery shopping involves a few steps that consumers must perform including generating and maintaining a grocery list. The grocery lists play a central role in managing the grocery shopping process and controlling the household expenditure (1). Further, the roles of grocery list expend towards maintaining a healthy food intake for the household that is consequently keeping the household in good health. However, the process of creating and managing a grocery list is always unseen, unrecognized and undervalued. Consumers usually have a physical list where they write the grocery items on a piece of paper or a mental list where the grocery items are simply remembered. The modern way of creating a grocery list could make use of smartphones where users use mobile apps for generating a grocery list. The detail discussion of the concept and related studies are presented in the following paragraphs of this section.

Grocery shopping is a consumer behaviour characterized by two aspects that are various purchase goals that must be achieved and repetition at a fixed interval such as once every week) (6). It is the most fundamental everyday activity that a human performs on a frequent and regular basis (7,8,9). Grocery shopping is considered a tedious and less attractive task by many but an essential activity in human life (2). The task ensures that food and household items meet an individual or a family's different need. Some people found the activity is enjoyable. However, many others find it mundane and even stressful (10). Research has proof that grocery shopping is a complex and distressing process (11) especially for individuals with a developmental disability in which it is a complex independent living skill (12). Nevertheless, a normal person also needs to acquire the skill to maintain a quality life. Due to this reason, the everyday task of grocery shopping has been studied extensively in the consumer science community (8).

Berndt, Angstmann, and Strauch (13) described grocery shopping in three stages namely planning, fulfilment, and post-purchase stages as shown in Fig. 1. Similarly, Arnaud et al. (6) also suggested three phases of grocery shopping namely pre-planning, usage, and outcome that is corresponding to the three stages of Berndt's grocery shopping process. On the other hand, Douglas et al. (12) specified that grocery shopping consists of three

main steps that are writing a grocery list, locating items on a list in the grocery store aisles, and purchasing the grocery items. The first step in grocery shopping is planning where consumers will identify grocery items needed for the household and prepare a grocery list. Planning is a crucial step in managing grocery shopping as it will affect one's expenditure, time spent in the grocery store, and unplanned purchases (14). The planning phase in grocery shopping requires an individual to prepare grocery lists in the process using paper, electronic device or mentally managed (8). Identifying the list

of grocery items including food to purchase before going to the grocery store can be a strategy to maintain good health (15). The consumers adopted the planning stage as a self-control strategy to avoid impulsive purchases at the grocery store (16). Research has reported that the majority of consumers plan for their grocery shopping the time they arrived at the grocery store; nevertheless less than 15% of consumers come into a grocery store with no purchase plan (13).

Figure 1. Grocery shopping process (13).

The consumer science studies reported that most consumers used a grocery list on their shopping trip (14), either written or mental grocery lists (11). The grocery list is an aid for grocery shopping at both planning and fulfilment stages. The grocery list provides a degree of comfort to the consumers in a way that it ensures the requirements are obtained and hence avoid the need for impulsive purchases (10). Researchers have little interest to study grocery list as an object of investigation (14). Consumers who use a grocery list are more engaged in more effective shopping than consumers without a list (14). A grocery list is prepared either by a person responsible for the household management or collaboratively with other members of the household (8). In preparing the grocery list, the person must have knowledge of family and household inventory as well as the knowledge about the grocery store (14). Although a grocery list does not represent the consumer's accomplished purchase behaviour, it is valuable to show the consumers' purchase intentions (17). A grocery list can be defined as a tangible note written on a piece of paper (e.g., sticky note, bill, envelope, and napkin) or a mental note where the grocery items are being memorized, or a digital note or app which records household items to be purchased (6). A grocery list; either physical or mental, could reduce the stress or pressure that consumers frequently experience in managing their daily life activities (13). It has resulted in an investigation into ways to increase human efficiency, including how we undertake routine activities including grocery

shopping. However, limited studies on the use of grocery lists exist in the literature (10) which shows the gap in consumer science research and other multidisciplinary areas such as information technology.

The grocery lists have many roles in the whole process of the grocery shopping. The written grocery lists serve as an external memory aid and a way to communicate the grocery needs to other household members where they are hand over to the person who does the actual shopping (8). Apart from being used as memory aids, grocery lists act as a tool for budgeting to organize routine shopping visits efficiently (7). Thomas and Garland (10) highlighted three essential roles of the grocery list in grocery shopping; 1. ensure the household requirements 2. controls the grocery shopping process, and 3. controls shopping expenditure. A consumer with a grocery list is seen as being more efficient than consumers without a grocery list when they are at the grocery store (14). A grocery list serves as a tool to keep track of the items to be purchased in physical stores, consequently has been a subject for scientific studies (18). Studies have shown that the existence of a written grocery list increases the probability of purchasing the planned grocery items (16).

Research on consumer science reported that the use of grocery lists while grocery shopping correlates with a lower body mass index (BMI) (19). In addition, past studies using various designs and measures provide evidence on the link between the grocery list and improved dietary quality (20).

Dubowitz et al. (20) analysed households that used a grocery list for shopping were more likely to meet daily recommended American dietary guidelines. Further, consumers who shopped according to the grocery list were associated with a lower BMI of 1 unit. The findings of Dubowitz et al.'s study also found that respondents who always use a grocery list during shopping had better dietary quality and lower body weight. Grocery lists act as a shield against the availability of unhealthy foods and could limit impulsive choices. Their finding of the study may also be interpreted in the other way in which the respondents with healthy eating habits and weight used grocery lists for their shopping.

Studies have reported that women are the primary creators of a grocery list as they are mostly responsible for grocery shopping (13). Further, research has also proven that women prepare and use a grocery list more than men (14). Previous research has been conducted into the use of grocery lists in various countries including New Zealand, the USA, Denmark, and Canada which suggested a widespread development of lists in grocery shopping (13). Heinrichs et al. (8) highlighted that creating and managing grocery lists is an essential aspect of grocery shopping; however, the lists do not show the consumers' activities that are incorporated, unseen and unrecognized during its' creation. Simple techniques are used in creating a shopping list where consumers are taking note of the items to be purchased on a piece of paper or on the type the grocery items on the mobile device or creating a mental list (2). A mental list is stored in human memory, while a physical list is a written paper or typed on the smartphone apps (13). Jain (9) suggested steps in preparing a grocery list. Consumers usually start with checking the grocery inventory available in their fridge or pantry, then planning meals for a few days or weeks. The meal plan and ingredients will be the basis for creating a grocery. Consumers will also look for deals or offers at their grocery stores nearby. Berndt et al. (13) proposed four factors that influence customers in preparing their grocery list as illustrated in Fig. 2. These factors are product and brand decision, list design, sales leaflets, and grocery store knowledge. The steps in creating a grocery list can be repetitive and involve manual effort which needs a considerable amount of time to carry out effectively. The creation of a grocery list is difficult to accomplish when considering the current busy modern lifestyle (9).

Figure 2. The factors influencing the creation of a grocery list (13).

The grocery list, either physical or mental, shows undertaken activities that are undervalued as those activities are unseen (14). The common grocery lists are mostly handwritten on a piece of paper, sticky note, envelope, or napkin as shown in Fig. 3. Water or dirt could contaminate the handwritten grocery list. In the case of collaborative grocery shopping, the grocery list could be difficult or impossible to read due to messy hand-written (17). Ludford, Frankowski, Reily, Wilms, and Terveen (21) argued that handwritten lists are easily lost due to small paper size. Further, the small paper limits the number of items that can be listed. As lists expand, consumers tend to mess up the list and write the grocery items in any available space. Ludford et al.'s study on a handwritten grocery list found that the respondents cross out purchased items and make a list messy in which unpurchased items may not be noticed. The respondents of the study also reported that handwritten grocery lists cause a frequent problem where they can only be used in one place at a time.

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Figure 3. An example of a hand-written grocery list.

Figure 4. An example of a grocery list created using ColorNote App.

The emergence of digital devices such as handphone and computer tablets have shed light on a more flexible and easier way of generating grocery lists. Digital grocery lists gain much attention as the devices are penetrating every aspect of daily human life (3). Many people are now creating grocery lists on their smartphones or tablets by typing the grocery items they plan to purchase. Figure 4 shows an example of a grocery list created using ColorNote on Samsung smartphone. Some mobile apps allow users to select grocery items they want to purchase from a database of a predefined list. Recent studies also reported that smartphone users create a grocery list on their smart devices using Notes app on iPhones or other similar apps such as myShopi, Wunderlist, OneNote, Grocery IQ, and OurGroceries (3). Managing grocery lists digitally offers many advantages for example; a digital grocery list can be shared via e-mail (8). Schopfer and Keller (18) highlighted that many mobile apps offer different functionality and available in most of the smartphone platform. However, a fundamental function of a grocery list is the ability to list grocery items which can be displayed and modified by the users according to one of the states that are to be purchased, purchased or deleted from the list as rendered in Fig. 5. Purchased grocery items are represented by 0, grocery items deleted from the list are marked as -1 and new grocery items to be purchased and included in the list are marked as 1. These three states of grocery lists are the fundamental of developing related mobile apps.
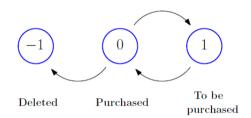

Figure 5. The states of grocery list for mobile apps (18).

A recent study by Bellini and Aiolfi (22) found that consumers who use smartphones for preparing the grocery list made a fewer purchase than consumers who do not use mobile devices. The smartphones were found to facilitate the consumers in grocery shopping and keep them on track during the shopping trip. In the literature, researchers began to propose mobile apps that assist consumers in their grocery shopping as summarized in Table 1. Interestingly, the apps (or systems) can generate a grocery list based on the selected menu plan for specific intervals such as found in Smart Grocer (9) and MyNutriCart (23). The apps also aim at promoting healthy food intake by having a pre-plan menu. Other apps work as a recommender system that could suggest the grocery stores on sale that offers a reasonable price for the grocery items in the list such as the Smart Shopping List (2). The augmented reality (AR) technology was embedded in a system named AR-Assisted Mobile Grocery Shopping (24) to assist users in locating healthy foods at the grocery store aisles.

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Table 1. List of apps for creating grocery list found in academic databases.

Related Studies	Description
Smart Grocer (9)	Smart Grocer provides a personalized grocery list system by collecting users' purchase history and budget and keeping grocery inventory information including items that will expire soon and items on sale at the preferred grocery store. The system can generate a grocery list automatically based on the recipe that users' chose after creating a weekly meal plan.
MyNutriCart (23)	MyNutriCart is a system that aims at improving food purchased at the grocery stores by considering the user's budget while achieving a healthy diet recommended by the Dietary Guidelines for Americans. The system can generate a grocery list of healthy foods that meet the users' and family members' health condition.
The Smart Shopping List (19)	The Smart Shopping List facilitates the creation of a grocery list by proving the basic functionality of adding, removing or crossing items from a grocery list. It also works as a recommender system that suggested to the users the grocery store that could have the best offers based on the grocery items listed in the list. It is also providing a reminder of possible missing or forgotten items.
AR-Assisted Mobile Grocery Shopping (24)	AR-Assisted Mobile Grocery Shopping app provides users with navigation support while moving around at the grocery store aisle. The augmented reality technology is used to label foods at the aisle with color tagging to show healthy and unhealthy food. The app reduces the users' time in finding healthy and unhealthy food during grocery shopping.

Although many apps are available at the App Store and Google Play Store; there is little research on the use of electronic shopping lists (6). Arnaud et al. (6) found that young generation consumers are comfortable with using the electronic grocery list because the electronic list can be easily generated using their smartphones in which the devices are always with them. Over the past decades, the central role of grocery lists has been widely recognized in the consumer science research; nevertheless, little attention has been paid to facilitating grocery list creation and management (11). There is an opportunity to improve the overall process of creating and managing grocery lists using smartphones and mobile apps; thus, bridging the existing gap presence in the consumer science research. Therefore, there is a need for research and development of automation in creating the grocery list that could minimize the effort and time especially for busy and working consumers (9). The study presented in this paper aims at designing and developing a mobile app that could facilitate the users in creating and managing grocery lists.

Methodology of the Study:

The study was conducted following the Rapid Application Development (RAD) methodology proposed by Martin (25). RAD is an adaptive software development approach which involves prototyping in gathering the requirements for the systems of apps. Although software development methodology transformed continuously (26), RAD is still relevant and being used widely by software developers. It consists of four main phases namely requirements planning, user design, construction, and cutover. The flow of the phases is illustrated in Fig. 6.
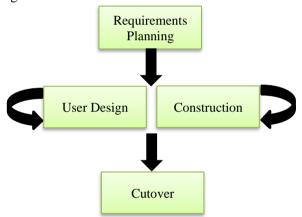

Figure 6. The phases of RAD.

The requirements planning phase involves acquiring the requirements of a mobile app for managing grocery lists. The requirements are documented and visualized using Unified Modelling Language (UML) diagrams including the use case, activity and class diagrams. UML diagrams are commonly used to presents the requirements of a system as found in Adediran and Al-Bazi (27) and Hussain, Mutalib, and Yasin (28). The user design and construction phases are performed concurrently where the user interface of the mobile app is designed. Users are involved during the design and construction process where they provide feedback for improving the user interface and information flow of the mobile app for managing grocery list. Finally, during the cutover phase, an evaluation is conducted to measure the

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usability of the mobile app. The detail implementation of the phases is explained in the following sections. The requirements planning, user design, and construction phases are covered in the Design and Development of SMART LIST section, while the cutover phase is explained in Evaluation of SMART LIST section.

Design and Development of Smart List:

This section describes the design and development of a mobile app for creating and managing grocery lists following the first three phases of RAD. The section is divided into two sub-sections; first, the requirements of the mobile app for creating and managing grocery lists and second, the prototype development of SMART LIST; a mobile app developed to demonstrate the gathered requirements.

The Requirements of The Mobile App for Creating and Managing Grocery Lists

A requirement gathering process was carried out using two methods that are, interviewing selected women who performed grocery shopping in a regular basis, and analysing documents and apps from the Internet that are related to grocery shopping and grocery list. The interview was conducted informal on five working women at the authors' and the respondents' convenient. Most of them were the authors' colleagues and relatives. They were asked a few open-ended questions primarily on the features of the mobile app. The example of the questions are; what are the features of a mobile app for grocery list management that you would like to have, how would you like to have the list rendered in your smartphone, how would you like to choose the grocery items from the list?, how would you like to add new items in the existing lists, do you think that a reminder and notification is necessary. Their opinion was recorded, and the requirements were elicited. The respondents actively involved during the construction (development) phase where the interface of the prototype was shown to them to get their feedback and comments.

For the secondary requirements gathering process, the documents were searched using Google searching engine by providing keywords primarily "grocery list," "grocery shopping list," "shopping list," "grocery management," "household management," "fridge management," and "pantry management." The documents were analysed to elicit the requirements for a mobile app that can create and manage grocery lists. Table 2 lists four significant requirements (and their priority) produced from the requirements gathering process. The requirements include new user registration, login to the app, manage the shopping (grocery list), and manage reminder for an item running out-of-stock.

Table 2. List of requirements for creating and managing grocery lists.

ID	Requirement Description	Priority
1	NEW USER REGISTRATION	
1.1	A user shall be able to register to the app by entering their username, password and confirmation password.	High
1.2	If compulsory fields are not completed, an error message, "Please complete" will be displayed on a pop-up window.	Medium
2	LOGIN TO THE SYSTEM	
2.1	The app shall be able to allow the user to log in the system.	High
2.2	The app shall be able to display the main interface if the username and password are valid.	Medium
2.3	An error message will be displayed if the user entered an invalid username or password on a pop-up window.	Medium
2.4	The app shall be able to allow the user to choose "REMEMBER PASSWORD" checkbox for the system to remember the username and password.	Optional
3	CREATE MY SHOPPING LIST	
3.1	The app shall be able to allow the user to touch the menu "SHOPPING LIST" on the menu bar rendered on the smartphone screen.	Medium
3.2	The app shall be able to allow the user to select a menu from the selection of cooking items, home cleaning items, and baby stuff.	High
3.3	The app shall be able to allow the user to search the grocery items based on the icon (cooking items, home cleaning items and baby stuff) or keywords of an item.	High
3.4	The app shall be able to allow the user to touch (+) floating button on the smartphone screen to add a grocery item in MY Shopping List.	High
3.5	The app shall be able to allow the user to add a quantity of an item.	High
3.6	The app shall be able to store the items and quantity which have been selected by the user in the database.	High

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3.7	The app shall be able to allow the user to view the items in MY Shopping List.	Medium
3.8	A user shall be allowed to select an item and touch "DELETE" button to remove an item from MY Shopping List.	High
3.9	The app shall be able to remove the items selected by the user from MY Shopping List.	High
4	MANAGE REMINDER FOR AN ITEM RUNNING OUT OF STOCK	
4.1	The user shall be able to set a reminder for grocery items that are almost running out of stock.	High
4.2	The app shall be able to allow the user to touch the menu "SET REMINDER" on the menu bar rendered on the smartphone screen.	Medium
4.3	The user shall be able to select the date and time from the date picker.	Medium
4.4	The app shall be able to store the date and time set for the reminder of grocery items that are almost running out of stock.	Medium
4.5	The app shall be able to activate smartphone alarm for the date reminder set by the user.	Medium

The requirements presented in Table 2 were translated into the computer system functionality. The next process is visualizing and modelling the requirements of the app using the appropriate modelling method and tools. In this work, the Unified Modelling Language (UML) was used to visualize and model the requirements. The models used in this work are two behavioural diagrams namely use case and activity diagrams, and a class diagram that represents the structural components of the app. The diagrams were drawn using Microsoft Visio. Fig. 7 illustrates the use case diagram and the communications between the use cases and the actor for a mobile app that can be used to create and manage grocery lists. Four major use cases are register, login, manage My Shopping List, and Manage Reminder. The use case of Manage My Shopping List allows users to perform subfunctions including "Search Grocery Items," "Delete items," "Add Grocery Items," and "Add the Quantity of a Grocery Items." The Manage Reminder allows users to "Add Date."
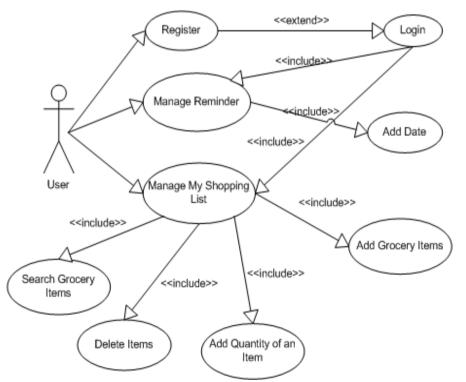

Figure 7. The use case diagram of a mobile app for creating and managing grocery lists.

The use case diagram is detailed out to show the dynamic behaviour of the app. Hence, the operations involved in using the mobile app for creating and managing grocery lists are illustrated in an activity diagram of Fig. 8 which is self-explanatory.

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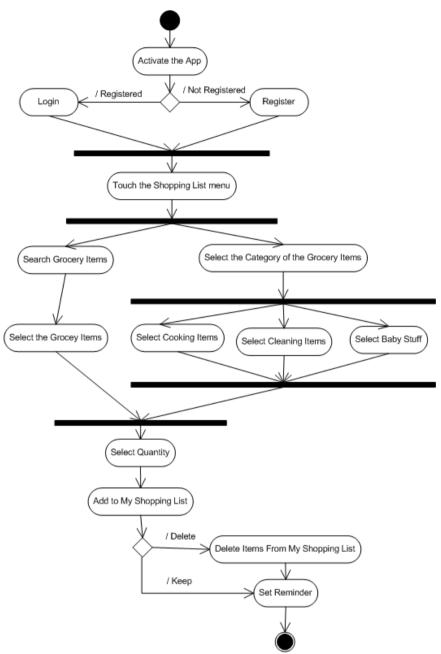
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Figure 8. The activity diagram of a mobile app for creating and managing grocery lists.

classes were identified namely user, grocery items, shopping list, and reminder. The interactions between the classes are illustrated clearly in the diagram.

The structural components of a mobile app for creating and managing grocery lists are represented in a class diagram as illustrated in Fig. 9. The class diagram in Fig. 8 shows the attributes and operations of the app. In this work, four main
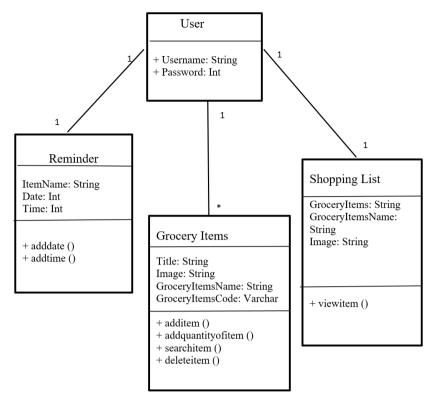
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Figure 9. The class diagram of a mobile app for creating and managing grocery lists.

on their experience in interacting with the prototype. The Android Studio was used as the main integrated development environment (IDE) tool. Further, the Firebase development platform was used to facilitate crucial functions like user authentication, and database for data storage. Screenshots in Fig. 10, 11, and 12 show the selected interfaces of SMART LIST.

The SMART LIST Prototype Development

A prototype of a mobile app for creating and managing grocery list named SMART LIST was developed. It represents the requirements explained in the previous subsection. Software prototyping is a standard way of demonstrating the software requirements so that further comments and suggestions could be obtained from the users based
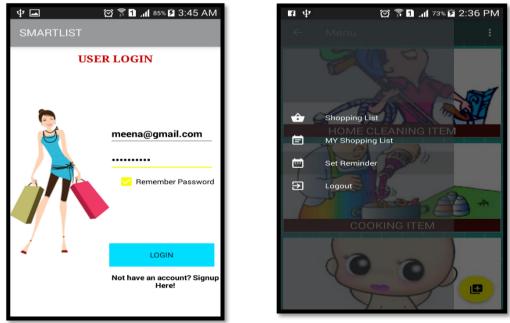

Figure 10. The interface for login (left) and the main menu (right).

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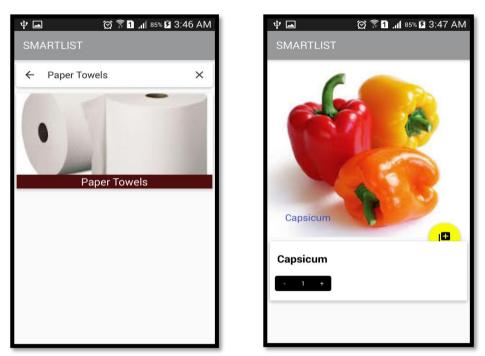
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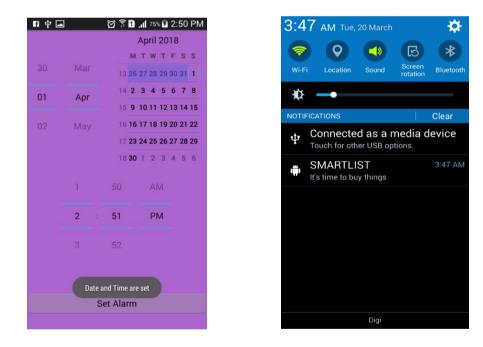**Figure 11. The interface for searching (left) and add grocery item (right).**

Figure 12. The interface for setting a reminder (left) and the triggered reminder (right).

Evaluation of Smart List:
The Evaluation Setting

A usability evaluation was conducted on 30 respondents, consist of working mothers in a north district in Malaysia. The respondents were approached randomly at the supermarkets and participated in the study on a voluntary basis. The instruments used for the evaluation were the SMART LIST app and a post-task questionnaire.

The post-task questionnaire was adapted from (29) which consists of 33 items in two sections. Section A asked the respondents' demographic information while Section B asked the respondents opinion about SMART LIST app in a five-point Likert scale where one represents strongly disagree, and five represents strongly agree. The respondents performed the following step-by-step procedure for the evaluation: 1. read

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and signed a consent form; 2. interacted with SMART LIST app as stated in the experiment procedure, and 3. answered the post-task questionnaire.

The Respondents' Demographic Information

Analysis of the respondents' demographic information revealed that 73% of them aged between 30 and 50. 43% of them completed high school, 17% had college certificates, 20% held a bachelor's degree, and 20% possessed a master's degree. 17% among them were single, 6% were separated (divorced), and 77% were married. Regarding household members, 64% of the respondents had 4 to 7 people in their household. Only 3% had more than 8 people in their household; while the rest had less than 4 people. The respondents also reported that 26% of them were employed, 17% were self-employed, 27% (8 were fulltime housewife, and 30% were students. In terms of grocery shopping behaviour, 37% of the respondents do grocery shopping fortnightly. Only 23% had grocery shopping once a week; while the rest had it once a month. 54% of the respondents reported that they bought their

grocery from the supermarket and hypermarket, 23% bought them from the local fresh markets, 20% bought their grocery from the nearby retail shops, and only 3% had online grocery shopping. Most of the respondents (i.e., 90%) did not install any app on their mobile phone; while the rest had apps installed on their mobile phone for managing grocery. 33% of them listed the grocery items on a paper, 30% kept a list in their smartphone notepad, 7% bought things using grocery shopping pamphlet, and 30% had not prepared a list at all.

The Usability of SMART LIST

An analysis was conducted on the respondents' responses in Section B of the post-task questionnaire. The section measures the respondents' perception towards SMART LIST usefulness and ease of use. It also measured the respondents' satisfaction towards SMART LIST. Tables 3, 4, and 5 reported the frequency and average of the responses. The respondents rated four or five of the post-task scales for the three aspects of the usability. None of the respondents rated one or two. Only a few rated neutral.

Table 3. The respondents' responses on the USEFULNESS OF SMART LIST.

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
SMART LIST enhances my effectiveness on managing grocery.	0 (0.00)	0 (0.00)	1 (3.33)	22 (73.33)	7 (23.33)	4.20
I can register an account in SMART LIST without any error.	0 (0.00)	0 (0.00)	3 (10.00)	12 (40.00)	15 (50.00)	4.40
I can login the app with registered email and password.	0 (0.00)	0 (0.00)	1 (3.33)	16 (53.33)	13 (43.33)	4.40
The search button can function well.	0 (0.00)	0 (0.00)	0 (0.00)	14 (46.67)	16 (53.33)	4.53
I can choose time and date to set reminder.	0 (0.00)	0 (0.00)	0 (0.00)	16 (53.33)	14 (46.67)	4.47
The reminder functions according to set date and time.	0 (0.00)	0 (0.00)	3 (10.00)	11 (36.67)	16 (53.33)	4.43
It saves my time when I use this app to manage my grocery.	0 (0.00)	0 (0.00)	5 (16.67)	10 (33.33)	15 (50.00)	4.33
SMART LIST meets my needs.	0 (0.00)	0 (0.00)	5 (16.67)	17 (56.67)	8 (26.67)	4.10
SMART LIST does everything I would expect it to do.	0 (0.00)	0 (0.00)	2 (6.67)	23 (76.67)	5 (16.67)	4.10
SMART LIST is useful in overall.	0 (0.00)	0 (0.00)	0 (0.00)	19 (63.33)	11 (36.67)	4.37

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Table 4. The respondents' responses on the EASE OF USE OF SMART LIST.

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
SMART LIST is easy to use.	0 (0.00)	0 (0.00)	1 (3.33)	22 (73.33)	7 (23.33)	4.20
SMART LIST is user friendly.	0 (0.00)	0 (0.00)	1 (3.33)	21 (70.00)	8 (26.67)	4.23
SMART LIST is flexible.	0 (0.00)	0 (0.00)	1 (3.33)	20 (66.67)	9 (30.00)	4.27
SMART LIST is easy to learn how to use it.	0 (0.00)	0 (0.00)	3 (10.00)	12 (40.00)	15 (50.00)	4.40
I can use SMART LIST without written instructions.	0 (0.00)	0 (0.00)	7 (23.33)	6 (20.00)	17 (56.67)	4.33
I can easily remember how to use SMART LIST.	0 (0.00)	0 (0.00)	3 (10.00)	17 (56.67)	10 (33.33)	4.23
I don't notice any inconsistencies as I use SMART LIST.	0 (0.00)	0 (0.00)	2 (6.67)	18 (60.00)	10 (33.33)	4.27
My interaction with the app would be clear and understandable.	0 (0.00)	0 (0.00)	3 (10.00)	17 (56.67)	10 (33.33)	4.23
I can use SMART LIST successfully every time.	0 (0.00)	0 (0.00)	3 (10.00)	14 (46.67)	13 (43.33)	4.33

Table 5. The respondents' responses on their SATISFACTION OF SMART LIST.

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
I am satisfied with SMART LIST.	0 (0.00)	0 (0.00)	3 (10.00)	22 (73.33)	5 (16.67)	4.07
I would recommend SMART LIST to my friends.	0 (0.00)	0 (0.00)	3 (10.00)	19 (63.33)	8 (26.67)	4.17
SMART LIST works the way I want it to work.	0 (0.00)	0 (0.00)	1 (3.33)	17 (56.67)	12 (40.00)	4.37
I feel I need to have SMART LIST app in my smartphone.	0 (0.00)	0 (0.00)	1 (3.33)	10 (33.33)	19 (63.33)	4.60
SMART LIST is wonderful and pleasant to use.	0 (0.00)	0 (0.00)	1 (3.33)	13 (43.33)	16 (53.33)	4.50

The outcomes of the evaluation suggested that SMART LIST is useful and easy to use. Further, the respondents reported they were satisfied with the feature of the app that facilitates them in creating and managing grocery lists. Analysis of the respondents' feedback about the specific features offered by SMART LIST shows that most of the respondents agree that the registration, login, search, and reminder setting processes were straightforward and useful. They also perceived that SMART LIST could help them in creating and managing grocery lists in a more effective way and met the way that they wanted to have in creating and managing grocery lists. In terms of the user interface, the respondents reported that SMART LIST was easy to use without the need for written instruction and they can easily remember the way of the using the mobile app. Further, the respondents satisfied with the appearance of the mobile app and intended to recommend the apps to other.

Conclusion and Future Work:

This paper described the design and development of a mobile app for creating and managing grocery lists. There are many aspects of grocery lists can be studied. In the future, we plan to expend the functionality of SMART LIST by providing support towards creating and managing collaborative grocery lists. Grocery lists may be shared with the other household members or housemate. Past studies suggested that the grocery lists act as a household planning tool where more than one member is participating in grocery shopping. Collaborative grocery involves of using shared lists, for example, lists that everybody in the household contributes to the lists. Collaborative grocery lists require simultaneous updates and mechanisms to avoid multiple members from buying the same grocery items. We also plan to implement an automatic acquisition of grocery data from images captured by the smartphone camera. Detail information of grocery items can be captured

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from photos and automatically transform into text for keeping the information in the apps' repository. There are also other potential studies could be carried out to enhance the process of creating and managing the grocery list. An automatic grocery item inventory could be interesting and useful in creating a grocery list. The internet of things could be integrated into the apps where sensors are embedded in the fridge or pantry and send a signal to the apps to notify grocery items that are almost running out of stock. The use of sensors can indicate that the grocery items are almost run out of stock and require purchase. The use of barcode scanning facility for a similar purpose could also be done. It could be extended into a recommender system which could suggest the users with healthy recipes and generate the grocery lists automatically based on the ingredients of the recipes.

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Conflicts of Interest: None.

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تصميم وتطوير القائمة الذكية: تطبيق جوال لإنشاء قوائم البقالة وإدارتها

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الخلاصة:

أثبت البحث في علم المستهلك أن التسوق في البقالة عملية معقدة ومحزنة. علاوة على ذلك ، يتم دائمًا تقدير مهمة إنشاء قوائم البقالة الخاصة بتسوق البقالة لأن الجهد المبذول والوقت المستغرق لإنشاء قوائم البقالة وإدارتها غير مرئي وغير معترف به. على الرغم من أن قوائم البقالة تمثل نية شراء المستهلكين، إلا أن الأبحاث المتعلقة بقوائم البقالة لا تحظى باهتمام كبير من الباحثين ؛ لذلك، توجد دراسات محدودة حول الموضوع في الأدب. وبالتالي، تهدف هذه الدراسة إلى سد الفجوة من خلال تصميم وتطوير تطبيق (تطبيق) للهاتف المحمول لإنشاء وإدارة قوائم البقالة باستخدام الهواتف الذكية الحديثة. الهواتف الذكية منتشرة وتصبح ضرورة للجميع اليوم. وبالتالي، فإن تطبيق الهاتف الذكي الذي يمكن أن يسهل عملية إنشاء وإدارة قوائم البقالة للأشخاص المشغولين والعاملين مفيد. يتبع تصميم وتطوير التطبيق منهجية تطوير التطبيق السريع. أولاً ، تم جمع المتطلبات الوظيفية من خلال المقابلات وتحليل المحتوى. بعد ذلك، تم تطوير نموذج أولي باسم SMART LIST بناءً على المتطلبات المجمعة، وتم إجراء دراسة ميدانية لتقييم قابلية استخدام النموذج الأولي. تشير نتائج التقييم إلى أن قائمة SMART LIST مفيدة وسهلة الاستخدام. راضون أيضًا عن وظائف إدارة قوائم البقالة التي تقدمها SMART LIST. تساهم الدراسة في فهم متطلبات النظام وواجهة المستخدم لتطبيق الجوال لإدارة قائمة البقالة. يمكن أن يكون نموذجًا مرجعيًا للمطورين والباحثين في المنطقة لتطوير تطبيقات مماثلة أو تعزيز القدرات في إنشاء قوائم البقالة وإدارتها.

الكلمات المفتاحية: علوم المستهلك، تسوق البقالة، قائمة تسوق البقالة، أنظمة التذكير.