The Design of Smart Shopper Applications Integrating Mobile Devices with Barcode Technologies

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Abstract—electronic shopping is increasingly being used for enhancing customers shopping experience. This paper explored on mobile devices for Smart Shopping, where a mobile based shopping management tool based on mobile phone and barcode technologies that applies to an individual's shopping set-up was designed and implemented. Results of a preliminary study showed that a typical way of planning a shopping budget is by making shopping lists. This method is usually cumbersome since calculations are done manually while tallying the total prices for the listed items counting on to time loss. In this study we collected and analyzed information about the ordinary way of managing shopping from local shopping malls. The analysis results were used in designing the Smart Shopper application using the Rational Unified Process methodology. The application was built to run on the Android Operating System which mapped product details to a remote database.

Index Terms— smart shopper, android, mobile devices, barcode, technologies,

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1. INTRODUCTION

Since time immemorial human have been doing trade. Trade and its processes are an area of research that has seen and still need much attention for technological innovation. Modern and innovative technologies that have caused revolution in the trade sector include banking technologies, cashless payment systems, point of sale technologies, and e-commerce among others. With the revolution of trade and innovation, one technology that has never gone obsolete is that of using product barcodes. Barcode technology can be used for a variety of applications because of its exclusive nature. Milne [6], stated that, "Since its first commercial point of sale application in the early 1970s, the barcode and related standards have become indispensable tools for the management of global supply chains, providing previously unimagined transparency about the location and progress of goods and materials."

The backbone of the Smart Shopper applications relies on barcode technology which supports the functionality of interest. This is to improve the shopping experience of customers by streamlining the budgeting process to a sort of Do It Yourself (DIY) feel as customer's budget from their own mobile phones. This method eliminates time consuming interactions with shopping malls staff making shopping convenient to the customer's.

2. OBJECTIVES

The major objective of this work was to create a mobile phone application that assists shoppers to manage their shopping lists through the use of mobile phone and barcode technology. To achieve this we reviewed current technologies used to manage shopping; designed and tested the efficiency of a smart shopping application based on mobile phone and barcode technologies using a mock database; and finally we benchmarked the smart shopping system against current shopping systems.

3. LITERATURE REVIEW

Shopping is a vital part of everyday modern life and is quite popular manifested by the huge number of supermarkets, malls, mega marts spread out into all parts of the world. Managing shopping however has its challenges. A number of methods have been used in managing shopping.

The common way that people manage shopping has been through paper shopping lists on which a list is written of the items to be purchased, the desired quantity and an estimated price among. In this method it is during shopping that one would check items on the list while tallying the totals of their prices to get the total amount before going to the till. This assists with the budgeting so as to avoid overspending. Some of the frustrations associated with shopping in supermarkets [3] include: aisles, traffic, and congestion, uninformed cashiers (who have no information concerning items on sale), planning and time management. The manual shoping systems are cumbersome since the shopper has to co-ordinate between the shopping and the tallying where in some cases price tags miss

on items. There are also a lot of customer errors in this way of managing shopping. The reason for errors is that written item list lead to poor budget decisions.

A second method of managing shopping is through the PC shopping list in which Windows applications such as The Shopping List are used for shopping list management [1]. The PC based Shopping List includes features for creating, viewing and managing of shopping lists, sharing, pining lists to the start menu, live tiles, Facebook integration and sharing, picking of files adding items as shopping lists in customer tutorials. These types of applications are step with the objective of automation, but because they run on desktops they have portability drawback. For instance, the customers have to print out the shopping lists leading to similar problems encountered in the paper base shopping list.

A third way of shopping management is the use of mobile platforms designed for planning activities such as shopping lists and to do work lists. Mobile platforms have high level functionalities for the categorization and addition of items to lists that can allow synchronization of the lists with other devices and sharing in real time. These applications can use barcode scanning technology to add items to the shoping lists [8]. Despite the advantage of high level list management functionalities, the weakneses are that the operations end at building the list. Hence the mobile platform solve only one part of the shopping challenges, that planning on what to purchase.

4. RESEARCH METHODOLOGY

As a first step in justifying the study a survey was conducted to gather specifications and requirements of the smart shopper applications using a case study of shopping malls in Kenya. Personalized interviews were used to gather data from the malls attendants and shoppers.

The analysis results showed that over 60% of the shoppers had android Smartphone devices. This showed that the smart shopper application has relevance to the local shoppers. The results of analysing shopper preferences were useful in determining the features to be included in the application such as the shopping list/cart; product names; quantity of items and estimate of prices.

The Rational Unified Process (RUP) methodology, which is an iterative software development process framework, was used to design the smart shopper application. All the four phases of RUP including the inception phase, elaboration phase, construction phase and transition phase were used in the design process. The technical validation and testing of the

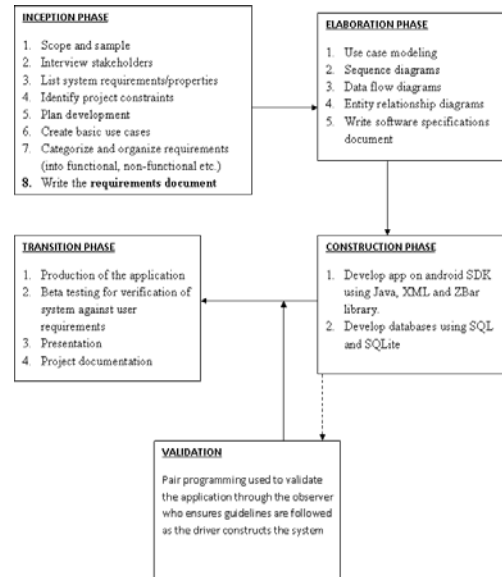application functionality was done through the pair programming methodology.
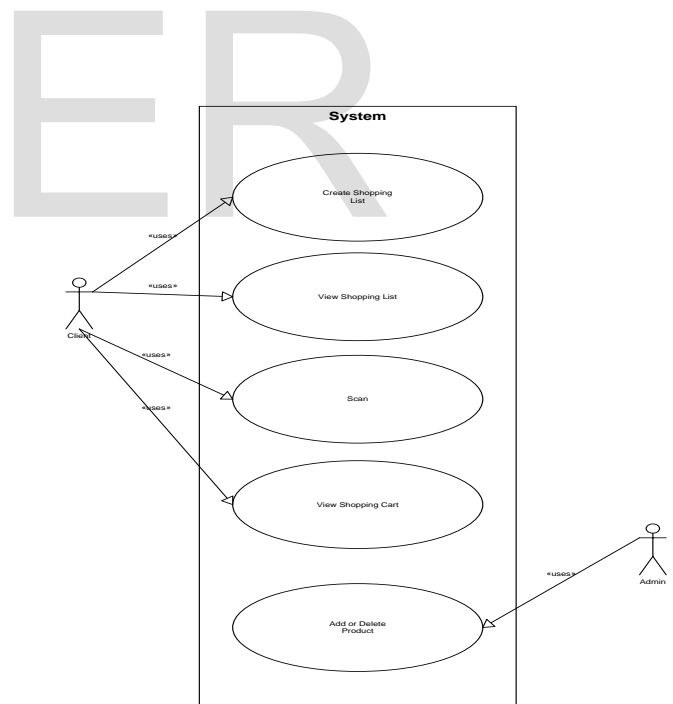

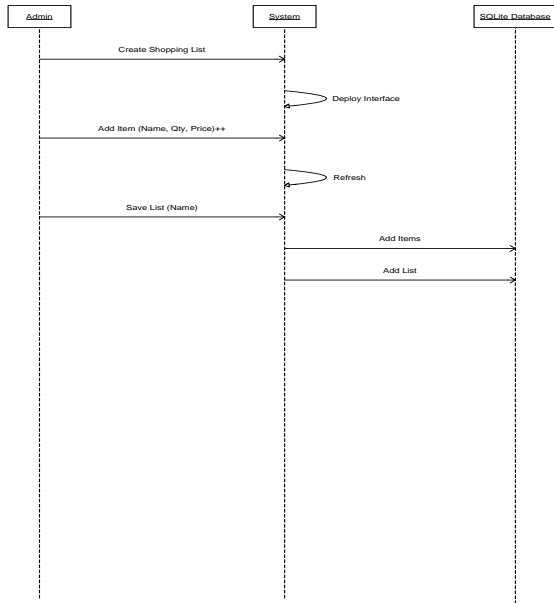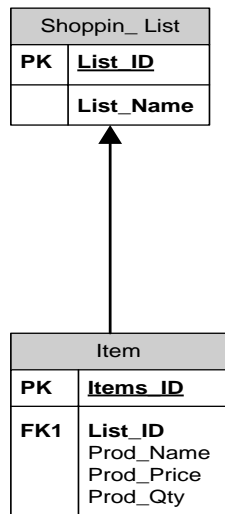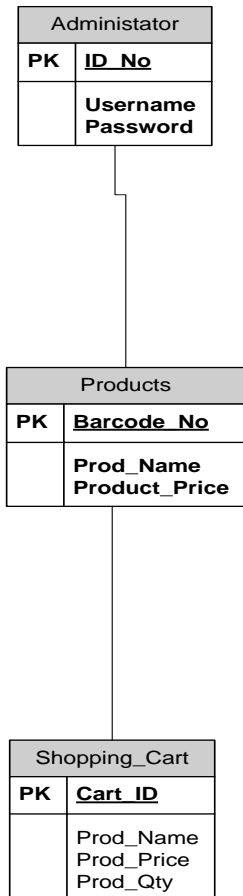Figure 1: The RUP process

Figure 2: Use Case Model

Figure 4: Entity Relationship Diagram

Finaly a software artifact (Smart shopper tool) that can help customers to manage their shopping experience was developed. The application was developed to run on the Google Android platform with integration to bar code reader technology. The application allowed shoppers to scan the barcode of the items they wished to purchase. This process was automated in such a way that the scanner picks the product's unique identifier and maps it to a product in the remote products database where it the prices of the items can be retrieved. The application also facilitated the tallying of the items already scanned and with shoppers input of quantities the application worked out final budgets.
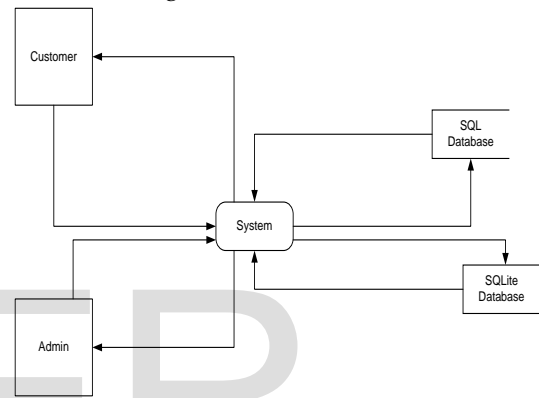
Figure 3: Customer Sequence Diagram

Figure 51: DFD Diagram

5. RESULTS

The output of this study was a Smart shopper application that had two modules (the client module and an administrator module). By the virue that that most shopping malls have a central products databases the testing of the client module proved effective in accessing the remote products database through a product barcode scan. The application allowed scanning product's barcodes followed by retrieving the names of the products and prices from a database. The client module allowed the shoppers to create shopping lists, view and modify the lists, scan products and finaly add products to the shopping cart together with quantities leading to automatic work out of the total cost of products in the shopping cart.

EXPEC-TATION	TEST CASE	INPUT	RESULT
That one can successfully create and save a shopping list	Checking that shopping list is updated every time an is added then after saving, checking to see if shopping list	Product details e.g. Blueband, quantity of 1 and price 450 Save shopping list under name 'List 1'	Product is posted to the list Shopping list saved in list of Shopping lists with all the products

is in the list of all shopping lists			posted to it
That one can edit (or delete) a shopping list as they need to	After editing a list item, checking to see if it has been updated in the shopping list's page.	Edit Blueband to Kiwi and save changes	Kiwi seen on shopping list rather than Blueband
That one can scan an item and have the credentials of the product posted back to them and posted to the shopping cart.	Checking to see if the user gets back details concerning a product when they scan it. This touches on integration testing, i.e. the link between the application and the online database. They should be able to also indicate the quantity of items that they need to purchase.	Scan the item Blueband that was earlier placed in the supermarket's database	Details of the product are returned i.e. Name: Blueband Price: 150
That tallies of items on the shopping cart are correctly posted	Comparing a manual tally and what is displayed on the application's total	Adding a quantity of 2 to the form that pops up on scanning blue band.	Tally expected increases by 300 i.e. (150*2)
That users can edit quantity of items that they buy updating the totals of the price of the assets	Editing quantities of items on the shopping cart and checking that the adjustment appropriately adjusts the shopping cart and total tally.	Open shopping cart and edit quantity of Blueband to 1.	Value of tally drops by 150

Table 1: Client Test Cases

6. CONCLUSION

This study revealed that Smart Shopper applications have high effectiveness in automating the shopper's processes starting from shopping list creation to budgeting and therefore reducing chances of errors while saving on time. The application allowed the entire shoppers expirience to be managed from a mobile application.

7. RECOMMENDATION

Further research will be geared towards expansion of the smart shopper application for use in the actual shopping environment. To assure of the security of the shopping mall databases the client's application should not directly interact with the actual database. It proves necessary to implement the smart shooper application for networked shopping malls. This can also serve as a benchmark and price difference control in different shopping malls. Further research can also be approached in with an intention to provide shopping expirience at home convenience where shoppers can access product details by quering the remote databases. Research can also be done to incooporate a control module that will benchmark values providing alerts if shoppers exceeed their budgets.

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