

## MOBILE SHOPPING MALL NAVIGATOR

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### ABSTRACT

Big shopping malls usually provide a directory to their available shops, but these directories are most of the time static and do not provide any interactivity features to the visitors. In this work, we present a mobile shopping mall navigator. The main reason behind our conceptual idea of our proposed project is because we feel that when visitors often change their plan to go to other shops instead of the ones in their minds, it can be full of effort especially considering the crowded levels and location of the navigation material. The application developed is practical and feasible; it is developed using Microsoft Visual Studio 2008, Microsoft SQL Server, and Microsoft Visual Studio 2008 mobile Application (<http://www.microsoft.com>). Pocket PC and Smart Phones are utilized for the front end and information retrieval purposes. This application runs with Bluetooth in shopping malls wherever the connection is available. This helps and assists our living tremendously by increasing the mobility to locate a particular shop or set of items while shopping or to subscribe to offers by SMS.

**Keywords:** *Shopping, Mobile, Mobile Shopping Mall Navigator (MSMN), Access Point, Pocket PC, Smart Phones*

### 1. INTRODUCTION

Shopping malls with large sizes may be considered an obstacle for the shopping experience for a lot of people, as they tend to waste most of their time trying to find a certain shop, or facility (bathrooms, prayer's area) or search for a specified item in several shops and because of the increased risk of time wasting to wander through the large halls and sections of the mall the visitor may opt to leave and not experience the full luxury of the mall's facilities.

The type of application that we are proposing is a portable shopping mall directory. The practicality of this work is high due to the fact that some malls are being poorly structured in their architectural build up. Our proposed project would be working using a server for database and information storage and portable clients for information retrieval purposes such as Personal Digital Assistants and Pocket PC. This application would be running wirelessly on Bluetooth technology wherever Access Points (AP) is available. Thus we believe

that this application may be of immense use to public people seeking to enjoy a shopping experience at the mall through increased mobility of locating desired destinations.

The proposed application; which we called Mobile Shopping Mall Navigator (MSMN), mainly addresses three problems: time, wasting, crowdedness and locations of boards. Table 1 summarizes these problems and their solution.

In this work, we intend to facilitate and increase the richness of a customer's experience in malls shopping by navigating the customer to their desired place within the mall whether it is a shop, restaurant or any other facility. The system allows the users to search by shop and item (which eventually leads to a shop).

The application supports customers by displaying user friendly dynamic maps instead of the static maps displayed in one large screen that can be hard to interpret, it also helps customers by supporting mobility to reduce efforts and increase efficiency in terms of time use, and displaying a user friendly



application. The application has the limitation of being only downloaded into the smart device if the user accepts the Bluetooth transmission.

Table 1: Mall Shopping Problems And Solution

Problem	Description	Solution
Time wasting	When visiting a mall; especially a very large one, a customer finds difficulty in locating all their desired spots and often gets lost or chooses not to pursue the search in fear of taking a longer way and time.	The proposed system allows customers choosing their desired locations as well as searching for the location of the item(s) they desire, a map will then show them the most efficient path to reach this location from their spot.
Crowdedness	Having only a certain number of boards in the mall there may be a lot of people lining up to check for locations.	The proposed system allows everyone to upload the web application to their individual pocket PCs and check for locations at their convenience.
Location of boards	The board maybe situated in places far from the location of customers seeking further information leading them to walk distances to find the board.	The proposed system allows this problem to be nullified by simply accessing the information on the application downloaded to their pocket PC.

The rest of this paper is organized as follows: Section 2 introduces a literature review about mall shopping; section 3 presents the design of the mobile shopping mall navigator (MSMN), Screen Shots at Run Time of the MSMN are presented in section 4; Section 5 presents a questionnaire about the effectiveness of the MSMN, and we draw the conclusion and future work in section 6.

2. LITERATURE REVIEW

A good deal of work has been directed toward mall shopping tools. The literature shows that serious efforts have been put in order to come up with an effective mall shopping mall navigator.

In [1], the authors developed a communication robot for use in a shopping mall to provide shopping information and give guidance to customers when needed. The authors faced difficulties in sensing human behaviors, conversation in a noisy environment, and the needs of unexpected miscellaneous knowledge in the conversation. The robot was designed to avoid the speech recognition problem by using radio-frequency identification (RFID).

The author of reference [2] tried to improve entertainment experience which represents a very

important role in shopping mall competitive edge. In his research, he depended on both theoretical and empirical studies which provide several strategies principles for mall manager. He proposed and empirically investigated the premises of the ‘Holistic Entertainment Experience for Wooing Shoppers’ (HEE-WS) model which is illustrative for mall managers to pursue seamless alignment between the creation of holistic entertainment experience and the creation of perceived satisfaction in mall attributes. This kind of alignment is crucial in predicting policies to elevate the effectiveness of shopping mall management.

In a study carried by [3], the authors examined the effect of gender and work status on Shopping Center Patronage, and they improved what other researches recommend that there are important differences between men and women models as well as between women who work outside a home as opposed to the ones that don’t.

Social presence influence on perceived security is studied in [4]. Conceptual model was built to represent virtual malls where behavior of users was enhanced to provide more intensive view of virtual reality.

In a study showed that pre 1994, low income earners depend on small and informal businesses represented as retail landscapes, which provide very limited choices and services to the customer, therefore shopping outside town appeared and known as "outshopping". Moreover in 1994 the income growth rapidly resulted in "in-bound shopping", which forms the last retail in South Africa. After that the shopping malls appeared on small townships which reduced the market share of retailer [5].

According to reference [6], in 2002, as a result of the increasing number of small-sized online malls, the number of customers who depend on online shopping is increasing. However, these online shopping malls won’t exist for a long time since the shortage in Customer Relationship Management (CRM) strategies imply their needs. The CRM strategies can be improved by making some analysis on transaction data of a certain shop. Some types of analysis can be made by using some data mining techniques, decision tree, association rules and sequential patterns based on data about VIP customers.



The effect of Mobile Data Services (MDS) on quality of life (QoL) was conducted by [7] in Korea. They depended on three outcome variables to measure such effects which are: Experience Satisfaction, Domain-Specific Contribution and Overall Contribution. They found that users are satisfied with MDS and affected the contribution of MDS to QoL in eleven life domains. As a result, such contributions influenced the overall contribution of MDS to QoL.

IT implementation is needed in shopping center according to its heterogeneity. In their research, the authors of [8] dealt with different sociological and economical aspects. Several issues related to feasibility emerge when designing the architecture of logical and physical systems; in addition, such design must cope with the individual needs and supply services that can be adopted easily by them and employing several sociological and economical aspects by using technologies emerging from semantic web, tracking systems, mobile device, children monitoring and disturbance detection.

Reference [9] proposed an indoor navigation and positioning model that is based on the calculated received signal strength of the wireless local area network. The location is determined by sensing. They implemented their model successfully on a PDA and tested it on 30 visually impaired subjects and proved that it is a lightweight system and it outperforms other traditional positioning and tracking systems.

Reference [10] indicated that tools or partners can be used to perceive assistive robots. They investigated the effect of conversation and robot-type on assistive robots. As a typical scenario, they had a robot carries a shopping basket for old people. They experimented this on 24 elderly persons and concluded that people prefer assistance on the form conversational humanoid.

#### **A. OVERVIEW of SOME SIMILAR WORK**

While at researching and gathering information stage, we found several useful sites worldwide with ideas similar to ours with some differences in features. In the following 4 subsections, we introduce four of these cases.

**MaddieApps' new iPhone application:** This application includes around 35 of the largest malls in USA, users need to be connected to the internet

in order to use this application, if not connected through 3G, the mall has to provide WIFI or else the application is useless.

**Point Inside Mall Maps:** Once an application is downloaded on the iPhone, all available malls will appear for you to choose the one where you are, tapping on the mall the user wants, not only brings up the map of its stores and dining but also guides the user to find the bathroom, ATM or other needed services. Point Inside also has store information, such as working hours and phone numbers. It even gives an option to input your parking space level or number, just in case you forget it after hours of walking through a mall. The map viewed inside the mall is one of the entire floor of the shop where the customer has to zoom in to find their desired destination.

**FastMall:** This application is free to download; however each mall's virtual map and restroom locator, arguably two of the app's best features, have to be bought with prices ranging from \$0.99-\$2.99. The virtual maps supported by FastMall have turn-by-turn guidance to get you from store to store as well as the option of routing a path without stairs/escalators (great for people with strollers or wheelchairs and elevator enthusiasts) with features like that and the shake to locate the nearest restroom.

**West Edmonton Mall in Alberta, Canada:** This mall has an application which allows you to search by several categories such as by Name, by category and by keyword.

The above four applications (MaddieApps', Point inside Mall, Fast mall and West Edmonton) as they were developed in USA and Canada are very efficient, but when compared to MSMN we developed, it has the advantage of providing Bluetooth technology which can be considered more secure than WIFI and more reliable as it cannot break down, it has the extra feature of searching by item and has the subscribe feature where phone numbers may be entered and stored in the database of a shop for future offers to be sent. The MSMN and when accessing shop information, provided information about shop items. Also, the map viewed of the specific shop is concise and easy to read. The map provides efficient pathways (same idea) as well without any cost. Such advantages can benefit people and inspire them to think always of newer, faster and more efficient technologies for the ease of our everyday life.

### 3. MOBILE SHOPPING MALL NAVIGATOR DESIGN

In this section, we will introduce the architecture, components and all the necessary aspects of the Mobile Shopping Mall Navigator (MSMN) tool.

The MSMN is designed with three types of stakeholders in mind: system owner, shop administrator and customer. Fig. 1 illustrates the model block diagram.

As shown in Fig. 1, the system has five subsystems connected together to form our main system. The Authorization Login subsystem allows personnel (administrator and owner) to use their systems by specifying a specific username and password pair. The Owner Subsystem option allows the owner to show and modify all information in the mall. The Administrator Subsystem allows the administrator to show and modify specific information (shop, customer and offers). The Pocket PC Subsystem acts as an intermediary between the server and the customer returning desired information. The Server Subsystem is the central part of the whole system; all subsystems communicate with each other through it.

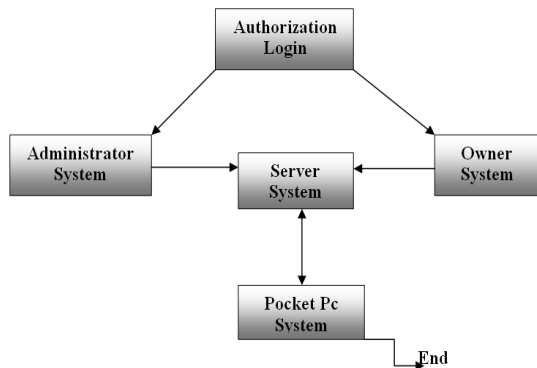


Figure 1: MSMN Block Diagram

Looking at the logical design of the model, the Entity-Relationship Diagram (ERD) which is a graphical method for representing the logical structure of the database is shown in Fig. 2. In the ERD, all the tables, their fields and their relationships of the application are presented.

Also, in Fig. 3 we show the main use case of the tool. Use cases are a scenario based technique in the Unified Modeling Language (UML) which identifies the actors in an interaction and describes the interaction itself.

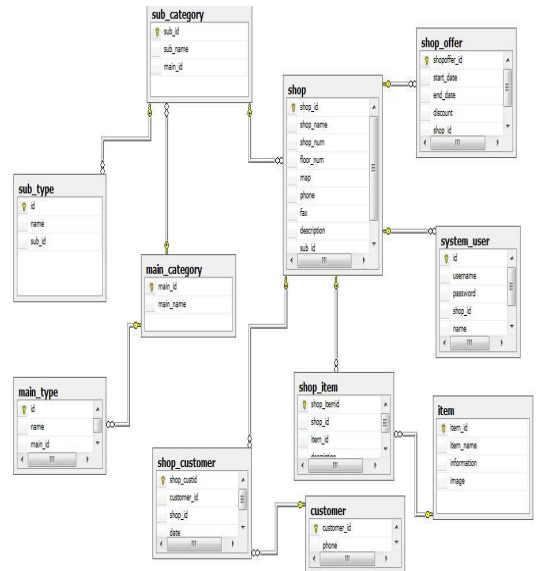


Figure 2: ERD Block Diagram

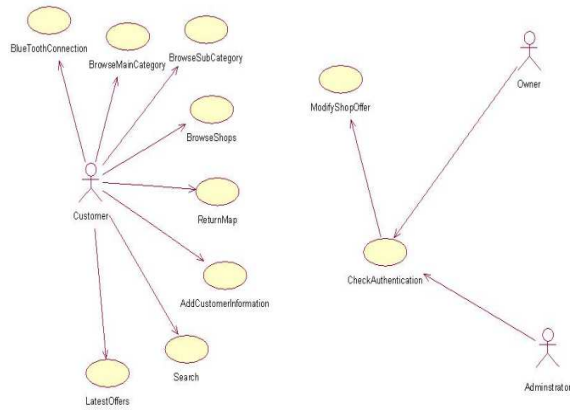


Figure 3: Overall main Use Case Diagram

As shown in Fig. 3, the customer brings the pocket PC then goes to the mall and downloads a file into his/her pocket PC in order to use the tool, the server searches via Bluetooth about a device name to connect with then the main menu is displayed on the pocket PC device for the customer to choose from. The menu has a number of buttons including main categories buttons and search and mall Information buttons.

Main Category screen contains (services, dining, entertainment and shopping) once the customer clicked one of them then the server returns all sub categories related to the clicked main category back to the customer pocket pc screen. Customer may choose any one of sub categories, in this case the server returns all shops related to sub category clicked then when one of the shops clicked a return



menu with a shop information appears (shop name, section, floor, description, subscribe to offers button, View Map and Items buttons) when the customer clicks on item button, all items in selected shop appears with a subscribe to offers button appears again. In items menu when the customer chooses one of the items, information about it displayed such as (item image, item name, information about item, shop name and description about this item). The button “Subscribe to offers” Present in both the Shop form and the Item form specifies the ability to subscribe to the shop by entering your phone number in a fill customer phone number screen which contains add button and by clicking on it customer will be added to the shop, so that he/she can view the shop map. Finally view map button used to show the customers how to reach a certain shop.

1. Search button used to help customers to find a specific item. When a customer choose search button he/she can search either by using item or shop name from drop down list, such a search will be started when clicking a search button.

Mall Info button used to show a dialog box with “welcome to Mecca mall today is: 27-10-2012 thank you for visiting us” message. Different malls will have different messages.

The owner can login to his/her system by using a valid username and password. After a valid connection to the tool, the owner can insert, update and delete any information in the owner categories, shops and items tabs by choosing one of these tabs:

1. Categories tab: The admin can choose main or sub category. If the admin chooses sub category then (s) he/she has to fill the information: sub category name and type. In the main category option, all the sub category fields are needed in addition to the ability of saving, updating, inserting or deleting before clicking the save button.
2. Items tab: Shows item information (item name, information and Item picture) and the owner can insert, update or delete any item in the mall.
3. Shop tab: The owner can add new shop information and then save it by clicking the save button, (s)he also can make updates on an existing shop if necessary.

The administrator logs into system by using a valid username and password. Once gets connected

to the system, (s)he can insert, update and delete any information in the admin offers, customers and items tabs by choosing one of these tags:

1. Offers: The admin can update the discount, start and end date for this discount and save this updates.
2. Customer: This option shows all customers phones numbers and the admin can export these numbers to send out any discounts updates by saving these numbers on a file to send it to one communication companies to send the updates to customers.
3. Items: Show item information (item name, information and Item picture) and the admin can insert, update or delete any item in his shop.

The processes that are supported by the application are:

1. Bluetooth Connection: When a customer brings the pocket pc to the mall, the server searches for a device to connect it.
2. Browse Main Category: This scenario allows the customers to choose among the available main categories to allow accessing to sub categories.
3. Browse Sub Category: Customer can choose any sub category and shops related to selected sub category.
4. Browse Shops: This scenario allows the customers to choose among the available shops to allow them to be able to access its information and map.
5. Return Map: The customer can see a map of a certain shop by choosing it from a list of a mall shops.
6. Add Customer Information: This scenario allows the customers to insert his information to send him the offers by SMS.
7. Search: The customer can search by item or by shop name.
8. Latest Offers: This scenario allows the customer to see the latest offers by SMS.
9. Check Authentication: This case allows the administrator to access his system to update, delete or add offers. For the owner, it allows the owner to access his system to update, delete or add any information about the mall database.

Modified Shop Offer: The administrator can make insert, update and delete on shop or offer table.

4. MSMN SCREEN SHOTS AT RUN TIME

In this section, we will present screen shots of the application at run time. Details about each screen shot will be also presented.

A. CUSTOMER RELATED FORMS

The forms used by customers are identified here. It all starts with a Bluetooth connection between the user (visitor's) Pocket PC and the server. After connection has been confirmed and successful, the form (Main Menu) shown in Fig. 4 appears.

There are several services the customer can use on the main category page: Search shops by category, Search items and Information on the mall including the date.

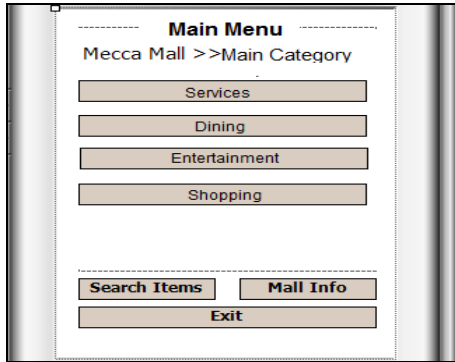


Figure 4: Main Category Form

**Search shops:** This path will view the form displaying the sub-category of Services (see Fig. 5).

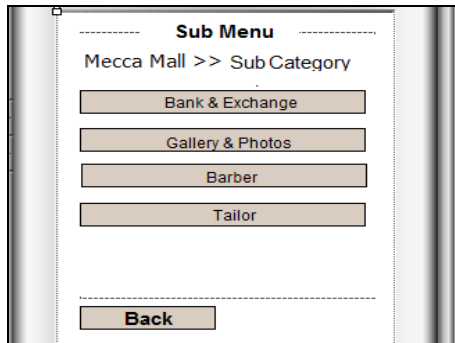


Figure 5: Sub-Category For Services

The 'Bank & Exchange' button will lead to the form shown in Fig. 6.

Mall information includes a dialog box that contains the following text: 'Welcome to Mecca Mall today is "The date"'. (Again, for other malls the message is different).

**Search Items:** Once a shop is chosen from the drop down list shown in Fig. 7 in 'shop', for example we chose the shop 'HAVANA' which views the form shown in Fig. 8 containing shop details.



Figure 6: Bank & Exchange Shops

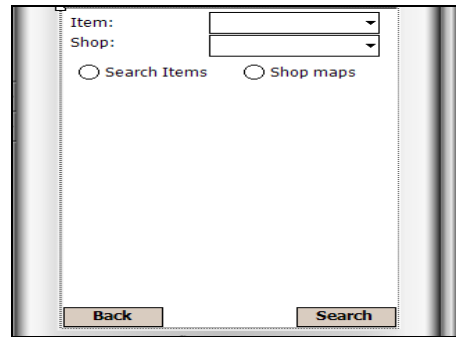


Figure 7: Search By Item



Figure 8: Havana Shop Example

The form of the shop like the one shown in Fig. 8 contains several services; among them is the "View map" button that shows the customer how to reach a certain shop for example the shop Centre point in Mecca Mall, (see Fig. 9).



Figure 9: Centre Point Map

The “Items” button views all the available items in the shop as shown in Fig. 10.

Specifying the item of choice in Fig. 10, for example Ladies Coat will show the item and its information as perceived in Fig. 11.

The button “Subscribe to offers” Present in BOTH the Shop form and the Item form specifies the ability to subscribe to the shop by entering your phone number in a form as shown in Fig. 12.



Figure 10: Items Of The Chosen Shop



Figure 11: Item Information

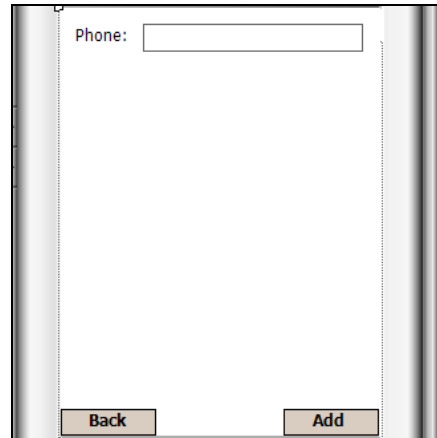


Figure 12: Customer Subscription Form

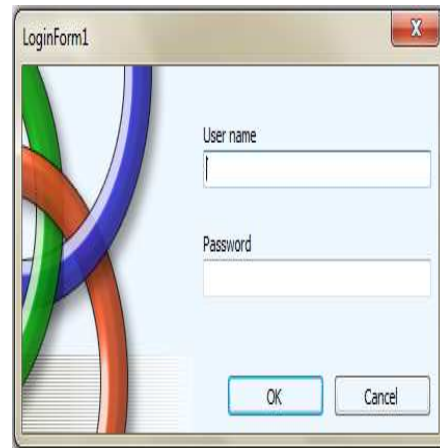


Figure 13: Login Form

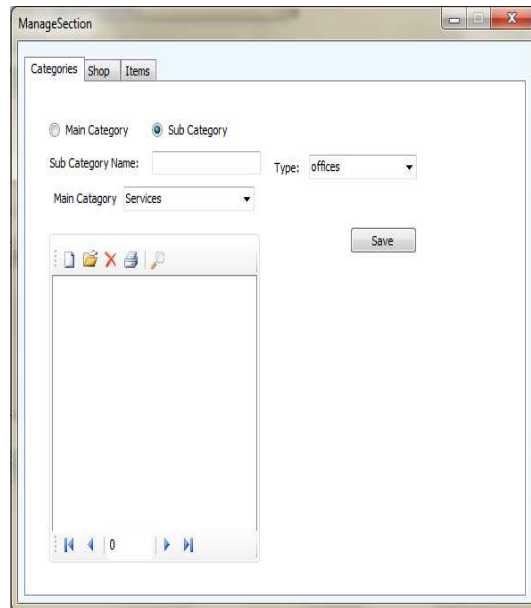


Figure 14: Owner Form ‘Categories’

**B. ADMINISTRATOR AND OWNER SCREEN SHOTS**

**Verification form:** The security of our system is very important therefore only two users may enter our system and access our database with different authorization: administrator and owner. Fig. 13 shows the login form.

**Owner Forms:** When the owner signs in, the form shown in Fig. 14 appears.

The owner can access several tabs defining several aspects of our system. The Categories tab shown in Fig. 14 allows the owner to manage the system through, ‘inserting’ a new main or sub category and specifying its details such as type (what it sells) and if it’s a sub-category the owner can classify it under the appropriate main category, ‘updating’ a certain main or sub category appearing in the list box, ‘deleting’ a certain main or sub category selected in the list box.

**Shops:** In this tab and as shown in Fig. 15, the owner is able to access and edit all the information of shops in the mall, such as inserting a new shop, updating shop details like inserting a map, deleting a shop.

**Items:** The owner has access to all the items in the mall by accessing them through the search button, the owner may edit these items however he wishes from the list box like with the Categories. Fig. 16 shows the items tab of the owner’s form.

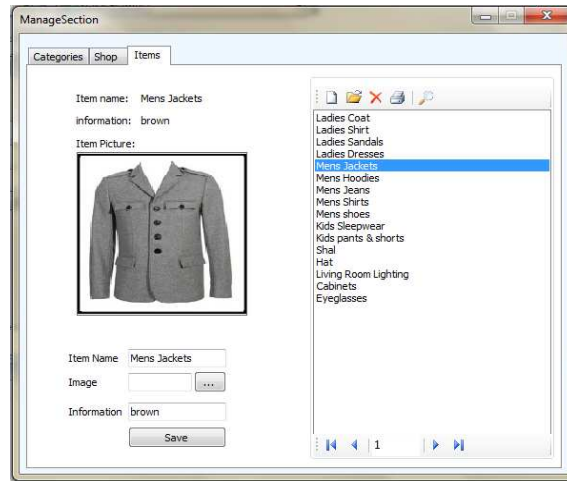


Figure 16: Owner Form “Items”

**C. ADMINISTRATOR FORMS**

The following set of forms is all related to administrator.

**Offers:** In this tab (as shown in Fig. 17) the administrator has the authorization to specify their shop’s offers and their due dates.



Figure 17: Administrator Form “Offers”

**Customers:** In this tab (as shown in Fig. 18) the administrator has details of all the phone numbers subscribed to his shop which he can export to an external file to send to the telecommunication company (such as Zain) which is responsible for sending messages containing the offer to the customers’.

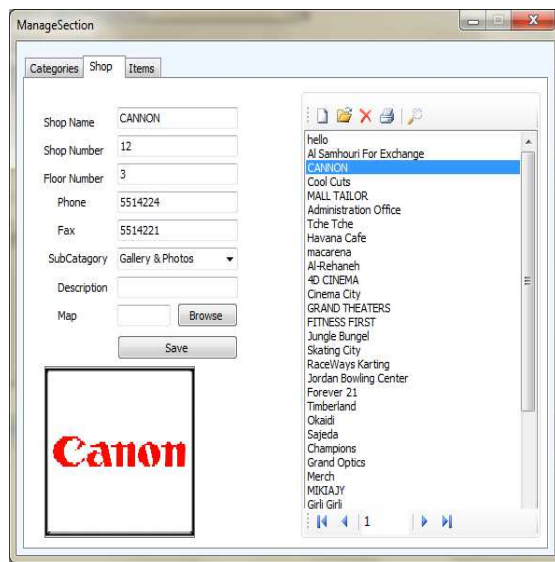


Figure 15: Owner Form “Shop”



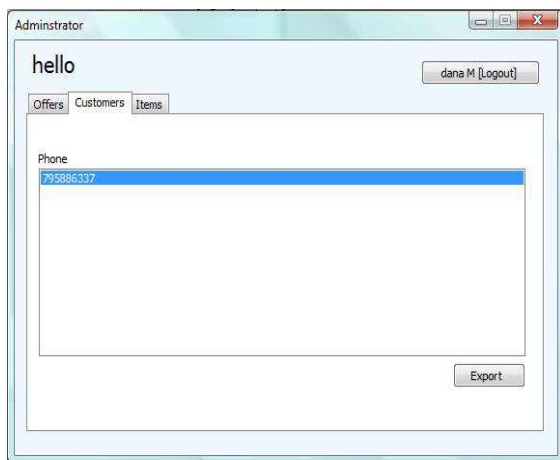


Figure 18: Administrator Form "Customers"

**Items:** In this tab (see Fig. 19) the administrator is able to edit the items present in his shop such as insert a new item, update item information and delete a certain item.



Figure 19: Administrator Form "Items"

### 5. QUESTIONNAIRE ABOUT THE EFFECTIVENESS OF THE MSMN

In order to get some quantitative results about our developed system, we conducted a survey with 10 questions (see Table 2). After collecting the opinions of 25 users (see Table 3), we validated our work and gained a positive feedback. As indicated by Table 3, the row answers were collected under the title Answers Count and then the percentage of all answers were calculated and shown under the title Answers Percentage. Each question has one of five answers: **Strongly Disagree (SD)**, **Disagree (D)**, **Undecided (U)**, **Agree (A)**, and **Strongly Agree (SA)**.

Table 2: Questionnaire

Q1. I am familiar with mall navigation systems; have you ever used it elsewhere?
Q2. I agree with the idea of identifying the shops locations via navigations tools.
Q3. I know what exactly I need from the shopping mall and where they are located.
Q4. The application gave me the needed information about the shopping efficiently and effectively.
Q5. The searching options and types helped me reaching what I want and saved me a lot of time and efforts.
Q6. I am convinced that the Subscribe function in the application will allow me to be updated with the new offers that are available in shopping.
Q7. I am satisfied with the application and like being involved in using technology in my daily life style.
Q8. The application is user friendly.
Q9. The application is complete; doesn't need improvements at all.
Q10. The application helped me a lot; it is not complicated.

As indicated in the third row of Table 3 (Q1 answers count and percentages), most people are not familiar with mall navigation tools; which is normal as this is a new tool; but once these people used the developed tool, they answered positively. A summary to the survey answers are shown in Fig. 20 and Fig. 21.

Table3: Customers Answers

Question	Answers	SD	D	U	A	SA	Total
Q1	Count	8	9	3	4	1	25
	Percentage	32	36	12	16	4	100
Q2	Count	3	4	1	10	7	25
	Percentage	12	16	4	40	28	100
Q3	Count	4	4	5	7	5	25
	Percentage	16	16	20	28	20	100
Q4	Count	1	2	2	9	11	25
	Percentage	4	8	8	36	44	100
Q5	Count	2	1	4	9	9	25
	Percentage	8	4	16	36	36	100
Q6	Count	3	3	5	7	7	25
	Percentage	12	12	20	28	28	100
Q7	Count	2	2	3	8	10	25
	Percentage	8	8	12	32	40	100
Q8	Count	2	2	2	10	9	25
	Percentage	8	8	8	40	36	100
Q9	Count	4	4	2	8	7	25
	Percentage	16	16	8	32	28	100
Q10	Count	3	2	3	8	9	25
	Percentage	12	8	12	32	36	100
Average	Count	3.2	3.3	3.0	8.0	7.5	
	Percentage	12.8	13.2	12	32	30	

Fig. 21 shows how the users of the application replied to the 10 questions. By excluding Q1 answers which indicates the familiarity of users to this kind of applications, it can be noticed from

Table 3 and Fig. 20 that most users replied positively to all questions (Q2 through Q10); for example, 68% of the users replied with SA and A to Q2 (40% + 28%) and Q10 (32% + 36%). About 50% of the people answered Q3 positively and about 80% were positive about Q4, more than 70% were positive on Q5, Q7, and Q8. About 60% of the users were positive on Q6 and Q9. It is also worth mentioning that all percentage values for questions 1 through 10, listed in Table 3, are rounded to zero decimal places.

Fig. 21 shows a summary to the average of the users' answers to all survey questions and reflects the positive feedback about the application. Overall, more than 60% of the users were positive (32% + 30%) and about 26% were not while the remaining 12% were not decided as the idea is new to them and are not able to make decision. We expect that the positive feedback percentage will increase as by time and by giving the chance to the undecided people to practice and trying the application, they will become positive.

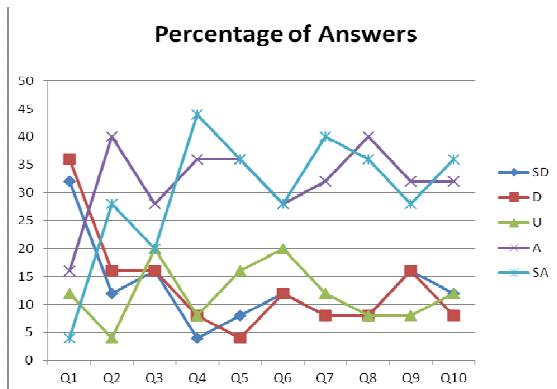


Figure 20: Percentage Of Answers To All Questions

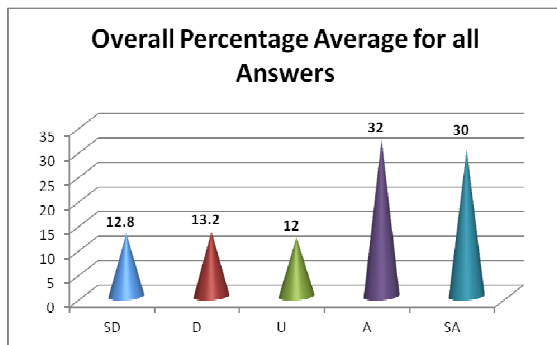


Figure 21: Overall Percentage Average For All Answers

To summarize and according to the charts above, we can see that visitors are highly positive and in agreement with implementing the mall navigation system and this questionnaire enabled us to

determine other needs and expectations of the system for future work.

## 6. CONCLUSION AND FUTURE WORK

In a step aimed at promoting shopping methods and make people life easier in Jordan; we built this mobile application that could play an important role in the Jordanian society as a whole. The usage of Pocket PC mall navigator as a shopping mall navigator, in addition to helping the users to find shops efficiently and effectively, were able to create awareness in using smart mobile devices for flexibility in almost every task among the community including shopping.

For major shopping complexes being equipped with Bluetooth in the near future to cater the ever-increasing need among Jordanians who are always on the go, we believe that MSMN application is feasible and very practical and have met most of our expectations and proved to have positive feedback from its users who tried it.

We realize that not everything is perfect; therefore we plan to improve our application so that it can carry more weight with this vastly changing era. Places to improve might include: having the customers automatically download our application instead of initially doing it manually when entering the mall, introducing videos instead of close up maps, increase search criterion for example searching by price or keyword, and GPS system, which helps identifying the customer's position and generates a path to their required shop.

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