ICSITECH2015

by Yana Hendriana

Submission date: 04-Jan-2023 12:43AM (UTC-0500)
Submission ID: 1988426702
File name: hendriana-ICSITECH-2015.pdf (382.25K)
Word count: 4869
Character count: 25356

2015 International Conference on Science in Information Technology (ICSITech)

Generic Shopping Mall Directory Mobile Application

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***Abstract*—Directory is defined as a board in an organization or large store listing names and locations of departments, individuals and others. Directory is important as guidance to people because it provides information about the mall such as list of shops and locations of the shops. Some of the directory boards are difficult to find, especially in the big shopping mall. Generic Shopping Mall Directory Mobile Application (GSMD) with the web-based support system is proposed to make the searching of information of a mall much easier. This application acts as a guide for users in the mall to get the accurate information all the time whenever and wherever they want. This system is supported by the online database server which can be manipulated by the administrator of the shopping mall. The function of this application is to let users know the latest events and promotions that took place at the mall besides providing them a guide at the mall. The methodology used in this project is prototyping model. The main developing languages for this project are Java and PHP programming languages. A usability testing has been conducted at the AEON Taman University to identify the efficiency of GSMD in providing the mall information to users and determine the user's satisfaction on the product. Based on the testing result, GSMD has increased the efficiency in finding the shop in a mall. The users' feedback that GSMD is useful and convenient as it helps them to find the information that they want in the shortest time. As a conclusion, GSMD can be used as guidance for users in the mall to get the accurate information all the time.**

Keywords—generic shopping mall; mobile application; mobile directory; mobile recommender system; usability testing

I. INTRODUCTION

Nowadays, there are many shopping malls in Malaysia especially at Kuala Lumpur. Shopping mall is important for customer because it provides almost everything they need all under one roof. Hence, the bigger the shopping mall, the more things and services that they can provide. Shopping mall should have at least one directory board for each level. This facility is the most important thing that should have in the shopping mall. However, having a static directory board is troublesome for user as user need to walk to the directory board to seek for information. Therefore, a mobile application which provides the directory of the shopping mall will be useful at this moment. Generic Shopping Mall Directory (GSMD) is an application which acts as a guide for user. The directories are divided according to their category such as fashion, food and beverages, health and fitness and others. When user tap on one of the category, for example, fashion, a list of all fashion shops and boutiques that are available in the mall will be displayed on the screen. User can tap on the shop or boutique to view the details and the location of the shop. Apart from that, user can view the floor plan for each level of the mall. There is also a section for events and promotions in this application. Through this application, user can view the events and promotions that are held in the mall. Information of the mall and how to get to the mall are also shown in this application.

The paper is structured as follows: An overview of GSMD is presented in Section 2. In Section 3, methodology before built the GSMD application. Section 4 describes result and discussion about this application, and finally Section 5 concludes the paper.

II. LITERATURE REVIEW

A shopping mall needs to have a good directory boards with the most updated information. This is to guide and direct users to the right path with the accurate information. Thus, it will help users to save time. Poor directory will lead the users to a wrong path and make them confuse about the orientation of the shopping mall. They might get lost in the mall. This is a reason why a shopping mall directory application is indeed very useful to user. This section explains about the information, methods that will be used to build this application and related application.

A. Shopping Mall

According to Oxford Dictionaries, a mall which is also known as a shopping mall is a large building or series of connected building containing a variety of retail stores and typically also restaurants [1]. A shopping mall is a place with multi-functional purpose such as entertainment, business, medical, food, shopping and an accommodation center [2].

Many people like to go to shopping mall to do their shopping especially on weekends. People usually love to shop at shopping mall because of the comfortable environment

whereby it is air-conditioned and they can get everything they need at one stop. Many shops are available in a shopping mall such as boutique, restaurants, bookstores, IT stores and so on. It is good to have a variety of shops under one roof. In addition, it becomes the meeting point for adolescents, a workplace for adult, and an eating destination for families and an entertainment center for kids. It is also a place that appeals for all group, ages and classes to have their gathering at the shopping mall.

B. *Directory*

According to Oxford Dictionaries, directory is defined as a board in an organization or large store listing names and locations of departments, individuals and others [1]. Directory is important as guidance to people because it provides information that is needed and guides them to the correct route. Directory board in a shopping mall contains the information about the mall, list of shops and locations of the shops. The specified directory will be designed in the form of a mobile so that it becomes a mobile directory. Mobile directory is designed to provide easy, real time access to the directory via a mobile device, so it can provide the right solution, quickly and accurately.

C. *Android*

Android is a Linux-based operating system developed by Android [3, 4, 5], which backend financially by Google. It is designed for smart phones and tablet computers which become the most popular mobile platform in the world. Millions of people use Android to make their mobile devices so powerful and useful. Android was developed jointly by Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, and NVIDIA who are members of the OHA (Open Handset Alliance) with the aim of making an open standard for mobile devices.

D. *Mobile Recommender System*

Mobile recommender system [6, 7] is one of the growing areas of research under recommender system. Recommender systems are information search tools that have been proposed to cope with the "information overload" problem which is the typical state of a web user, of having too much information to make a decision or remain informed about a topic [8]. In order to solve the problem, recommender systems were developed by aiding users in the search for relevant information. Besides that, it also helped users to identify which products are worth for detailed viewing [9]. Recommender systems are classified into 4 main categories which are collaborative-based [9], content-based [10], knowledge-based [8] and hybrid [11]. There are 3 fundamental directions for recommender systems. They are user mobility, device portability and wireless connectivity [8]. This project application will consists of all 3 fundamental as it can be accessed by user in different locations. For Android development, Global Positioning System (GPS) and Android's Network Location Provider can be utilized to acquire the location of the user [5, 12]. Mobile recommender system helps user to search for the relevant information [6, 7]. This project will be based on 3 categories from this recommender system which are content-based, knowledge-based and hybrid categories to provide the relevant information of the shopping mall to the user.

E. *Development Technologies*

Combination of different languages would help in developing a new application according to the requirements. Therefore, choosing the correct languages could prevent some unnecessary mistakes as well as making the development more efficient. Next is the review of the 3 languages which is XML [13], PHP [14] and SQL [15] including Eclipse [16, 17] that will be used to develop the new application.

F. *Related Systems*

GSMD development can be seen also from identifying the advantages and disadvantages of some of the current application or something similar on the market several sites such as Pavilion Kuala Lumpur, AEON sites and applications MyMall Pavilion. The strength of the existing system can be implemented into the development GSMD while the weakness of the system can be avoided during application development. The following is a general overview of things to be learned and the weaknesses of the existing system:

TABLE I. THINGS TO LEARN AND THE WEAKNESS OF THE EXISTING SYSTEM

System	Things to learn	Weaknesses
Pavilion Kuala Lumpur	1. The directory is well organized, each of the shops are categorized to their related fields. 2. Coming events can be found by user at event and promotion part. 3. A brief description about the mall is given, as well as the way of reaching the mall by different kind of transports. 4. The feedback section is a good way to receive customer's opinion for further improvement.	1. The application does not function well as expected, this can be proved when users are trying to view the floor plan and there is a bug occurs. 2. Not user friendly when viewed using mobile devices.
AEON	1. Provide a space for company history and any related information which can help customers to know more about the company 2. Any events and current status can be updated to the	1. No directory provided in the online website system, no reference for the customers 2. Directory board in the mall are not frequently updated by the administrator

	system allows users to catch up what is actually happening at the mall	3. Not getting in their business with the usage of available technology is a big loss
MyMall Pavilion	1. Design the icon which is big and clear enough for user to see and read 2. Categorized the shops according to category for fast and efficient searching 3. Provide a space for events and promotion held at the mall 4. Provide a space for customer to give feedback on the mall	1. Does not allow information update services 2. Floor plan is not working properly and confusing

After comparing the 3 systems, it is cleared that some of the features are important and must have in the development of GSMD mobile application. Hence, the development technologies that would be used in the development of this new application have been decided. The following section describes the development technologies that will be used to develop GSMD mobile application.

III. METHODOLOGY

Prototyping model is a system development method whereby a prototype is built, tested and reworked when necessary until an acceptance prototype is achieved. Prototyping model consists of 6 phases which are project planning phase, requirement analysis phase, design phase, testing phase, implementation phase and maintenance phase as shown in this section.

A. Project Planning

Initial investigation phase is a process of studying the system's request and preparing a recommendation [18]. The followings are the activities that have been carried out:

1) Browse through the internet to search for the information of the project title. Collect more information about the project title from journals or books from the library.
2) Study and do research on a few current or similar applications that exist in the market such as Pavilion Kuala Lumpur website, AEON website and MyMall Pavilion application.
3) Study the development technologies and tools to build an application. Next, learn to use the software that can be used to develop an Android platform application.

B. Requirement Analysis

Requirement analysis phase is a process to find out the basic requirements of the project application. The purpose of the requirement is to understand how the application functions and how users interact with the application. In order to collect the information of the requirements, several activities have been conducted as follows:

1) Compare the similar systems that exist in the market. Analyze the features and functions of the existing system and choose the most suitable of it for the implementation of GSMD.
2) Study and analyze the users' review about the existing system. Revise on their feedback and comments about those systems as their review will affect the features and the user interface of GSMD. Based on the feedback and comments, improvement will be made and implement into GSMD.
3) Study the directories of the shopping mall to identify the information that should be available in the project application. In other words, the study of the directories is to understand how to organize the shops into suitable categories.

GSMD is an application which acts as a guide for user. User can check on the information of the mall, view directories, floor plan, event and promotion that are held at the mall. This system allows admin to update the information of the mall anytime he wants. The functional requirements and non-functional requirements will be shown below:

1) Functional Requirement

The aim of GSMD is to provide a guide to user wherever and whenever they need it. User can view the shops in the mall according to their categories. Therefore, the system should organize the shops and category in the form of list to ease the searching processes. Besides that, the system should be able to let the administrator to update the information from time to time.

2) Non-Functional Requirement

The non-functional requirements for GSMD are shown as below:

a. Data security is controlled with the use of user authentication to prevent the invasion of unauthorized access.
b. Data in application must be updated every once the application is open by user in condition of Internet connection is available.

Administration system must be limited with the use of session for each log on user in a specified time in order to remove idle users and reduce traffic volume.

IV. RESULT AND DISCUSSION

This chapter explains about step-by-step processes are to ensure the project is running systematically and successfully. There are three main steps design system, development and testing.

A. Analysis and Design System

Analysis and design system is a process based on specified requirements which defines the architecture, components, modules, interfaces and data for a system. System design is important as it is critical for consistency and ease of use. This

section will discuss about the use case and the class diagram for GSMD.

Use case diagram is a diagram which represents the user's interaction with the system and depicting the specification of a use case. Different types of users of a system can interact with the system in various ways. This can be portrayed by the use case diagram. In this application project, there are 2 actors which are user and admin to achieve the goal. We can see at Fig. 1.

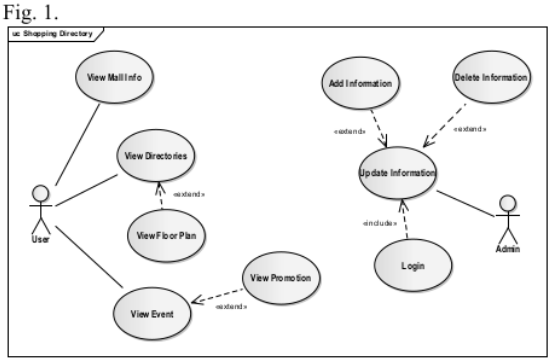

Fig. 1. Overall Usecase Diagram GSMD

Actor is the role played by the user or some other system when interacting with the system. User can use all the functions in GSMD except for updating functions. Admin can fully utilize all the available functions in GSMD as shown in Fig. 2.

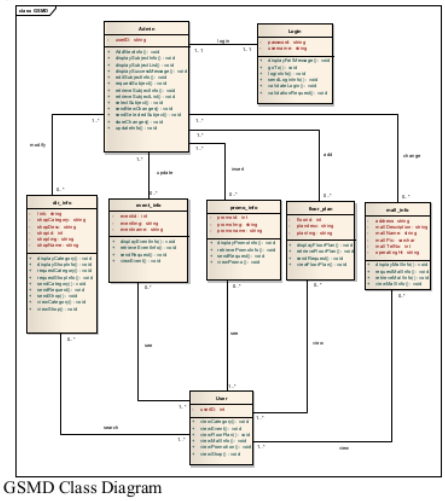

Fig. 2. GSMD Class Diagram

B. Development

The results will be the application that is developed in this project. The following subsections will discuss on the interface of GSMD with the functions of each modules. The modules include mall info, store, event, promotion and floor plan. This application will be used by the customer. There are 5 functions in this application which are home function, store function, event function, promo function and plan function. The application built in mobile application and website.

Fig. 3 illustrates the Home page for the application. At this page, the picture of the shopping mall is displayed. Below the picture is the information of the mall such as mall history, operating time, address and website. The information may be varied according to malls. It depends on the admin to update the information that they want to this page.

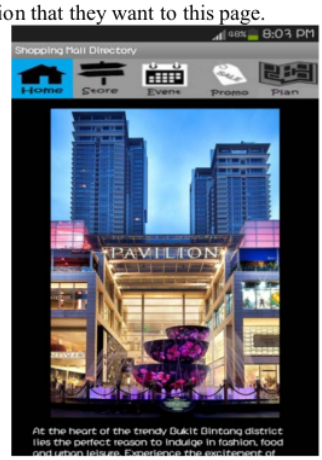

Fig. 3. Home page

User can view the stores which are available at the mall in this page. The stores are categorized according to their category as shown in Fig. 4. This make the searching more efficient and well organized. After selecting one of the categories, for example, "Beauty & Personal Care" category, the list of shops under that category will be displayed. User can view the information of the selected shop as illustrated in Fig. 4. User can find the location and contact number of the shop in this page.

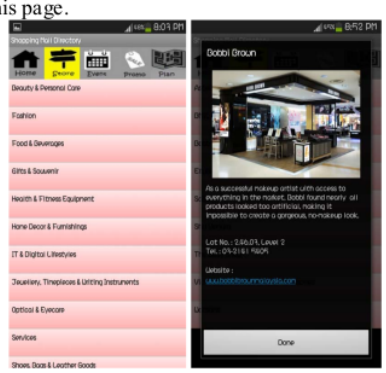

Fig. 4. Store page

After retrieving the shop information from the *sqlite* database, the algorithm can be seen from Fig. 5 will start to dismiss the progress dialog that preventing user from doing anything while the retrieval process is running. Then, the program will put all the information into the elements defined in the interface layout in XML, by throwing all the data into an adapter (ListAdapter).

```
get data with json encode
set list data by shopcategory
if not message equal (“ ”) then
view list data
else end message
endif
```

Fig. 5. Algorithm for dismiss progress dialog

In the event page, user can obtained the latest information of the event, which is held at the mall. User can view the details of the event by tapping on the selected event on the list. After that, a window will pop out showing user the information of the event. The algorithm for display the image as shown in Fig. 6.

```
set variable name, imgtv : string
set button touch
if button on click then
view image with name
view image zoom in 5
else view list data
endif
```

Fig. 6. Algorithm for show the picture

Furthermore, user can zoom and pan the image to have a better view. User can get to know the details of the promotions that are held at the mall at promo page. When user select on one of the promotions, a window will pop out showing the information of the promotion. Moreover, user can zoom and pan the image to have a better view on the details of the promotion. The purpose of this page is to let user to view the floor plan of the mall. When user taps on the plan button. User can view the floor plan of each level. By tapping on the selected level, a window will pop out the floor plan of that level. User can now zoom and pan the image to have a better view of the information provided in the image.

Website will be used by admin to manage the information of the mall can be shown in Fig. 8. There are 7 main functions in this application which are mall information, store, promotion, event, floor plan and manage user. The algorithm for login as depicted in Fig. 7.

```
set username and password
if username and password is true than
start the session
set header to dashboard edit
else error message and set login page
endif
```

Fig. 7. Algorithm login

Fig. 8. Website login

C. *Usability Testing*

Usability testing is a technique to evaluate a product or service by testing it with users and used in user-centered interaction design. During the test, user will try to complete the typical tasks while observers watch, listen and take notes. The aim of this test is to identify the usability problem and determine the user's satisfaction on the product [19]. For this project, a usability test is carried out to test the functionality and interactive design of the application. 5 users are selected for this test and 2 tasks are given. Testing was conducted to 5 users are considered sufficient because in addition it can save research budgets, 5 users are able to find 85% of usability issues and can be quickly solved [20]. Time is taken for each user to complete the task is recorded. Comments and feedbacks are collected at the end of the test. The data collected is analyzed and the result is presented in the next section.

The testing was done at AEON Taman University on 18th April 2014. The 5 users selected come from different background as shown in Table 1 and the time take to complete each task are shown in Table 2. The mean and standard deviation for each task is calculated. A bar chart of time taken for each user to complete the task is depicted in Fig. 9.

TABLE II. BACKGROUND OF THE USERS

User	Gender	Age	Occupation	Data Plan
A	Male	18-25	Student	No
B	Female	18-25	Student	Yes
C	Female	18-25	Student	Yes
D	Female	18-25	Student	Yes
E	Male	18-25	Student	Yes

TABLE III. TIME TAKEN FOR EACH TASKS, MEAN AND STANDARD DEVIATION FOR EACH USER

User	Task 1 (Second)	Task 2 (Second)
A	288	60
B	222	58
C	168	59
D	294	59
E	312	61
Mean	256.80	59.40
Standard Deviation	53.85	1.02

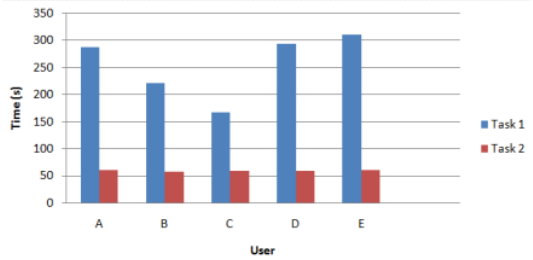

Fig. 9. Bar chart of time taken by each user to complete the task

Two tasks were given to the users. For Task 1, users have to find the shop named "Eu Yan Sang" without using the application. For Task 2, users have to locate the shop named "Focus Point" by using the application. The time taken to complete the tasks is recorded.

1) Task 1

The mean and the standard deviation for task 1 are 256.80 seconds and 53.85 seconds respectively. The standard deviation is high for task 1 because there is more variation of the result around the mean. From the result, users B and C are within the range of the mean whereas users A, D and E are out of the range. User E took the longest time to complete the task because he never knew that there is a shop named Eu Yang Sang at this mall. So, he searches up and down to locate the shop. He did not realize that Eu Yan Sang is just opposite of Sushi King. Users A and D have the difficulty to locate the shop as this shop is located at a corner in the mall.

2) Task 2

For task 2, the mean and standard deviation are 59.40 and 1.02 respectively. The standard deviation for this task is low because there is little variation of the result around the mean. All users can complete the task in around 1 minute when using the application to locate the shop. GSMD provides user with the location of the shop. By looking at the lot number of the shop, user can easily find the shop in the shortest time.

V. CONCLUSION

This paper tell about the GSMD. GSMD acts as a guide for user in the shopping mall. The directories are divided according to their category such as fashion, food and beverages, health and fitness and much more. When user tap on one of the category, for example, fashion, a list of all fashion shops and boutiques that are available in the mall will be displayed on the screen. User can tap on the shop or boutique to view the details and the location of the shop. Apart from that, user can view the floor plan for each level of the mall. There is also a section for events and promotions in this application. Through this application, user can view the events and promotions that are held in the mall. As overall, it can be summarized that GSMD gives a lot of advantages to Android users who like shopping very much. Besides that, this application can help those who have no sense of direction to locate the store that they desire to go. User can save their time in finding the shops which are available at the mall. This is because all the information can be obtained from this application without having to search for the directory board in the mall. It is hope that more mobile shopping malls' navigator [21] or directory and other interesting features can be added to achieve user's requirement. Hence, we hope that this project can be continued in future to give more benefits to the users.

ACKNOWLEDGEMENTS

This work is supported by Ministry of Education Malaysia and Research Management Centre (RMC), Universiti Teknologi Malaysia (UTM). This paper is financially supported by UTM Flagship Grant Q.J130000.2428.02G70, FRGS Grant, R.J130000.7828.4F634 and E-Science Fund, R.J130000.7928.4S117. Our gratitude also goes to Soft Computing Research Group (SCRG) for their continuous support and fondness in making this project success. Last but not least, anonymous reviewers for their helpful comments and Merlinda Wibowo for her help to edit the paper.

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