Development of Mall Maps and Directory for Android

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Abstract – Android-based Mall Maps and Directory is an android application intended for mall and its location information. This application offers a convenient way of accessing the direction of certain mall through GPS (Global Positioning Satellite), the application also provides navigation features, such as the proximate calculation of time required and distance based on the user's location.

Keywords: *mall maps and directory, mall locator, android-based mall navigator, shopping mall.*

I. INTRODUCTION

The emergence of mobile computing has been made possible with the convergence of a wide range of mobile phone technologies. Mobile phone users can access databases, manipulate data and get information through their mobile phones without the need of heavy equipment, PCs or even laptops, Partridge (2011). Mobile phones now have enough power to rival conventional computers, considering the huge amount of data storage and processor speed, coupled with multiple data communication protocols which include wireless connectivity, bluetooth and infrared connections among many others.

In the developing countries, mobile phones are increasingly being utilized mostly in transferring money and as a critical payment system that has facilitated e-commerce transactions, Klemens (2006). Other, business applications include the dispatch and tracking systems for luggage, vehicles and even animals. Mobile phones have also been significantly used in the processing of varied online transactions, enabling travelling professionals to work from their remote locations through applications such as Google Office and Portable Document Applications such as PDF readers among others.

A developers survey conducted on April-May 2013 found that Android is the most popular platform for developers, used by 71% of the mobile developer population. This factor have contributed towards making android the world's most widely used smartphone platforms, overtaking the Symbian in the fourth quarter of 2010, and the software of choice for technology companies who require a low-cost, customizable, and lightweight operating system for high tech devices without developing one from scratch.

Android supports to develop a location-aware application utilizing Global Positioning System (GPS) and Android's Network Location Provider to acquire the user location. Using this technology, the user can now go to any place without any tourist guide to lead the direction. One of its practical application is its mall mapping and directory services. Malls have become a part of the life of the average Filipino. Filipinos shop, dine, stroll, and unwind in these places. Malls with nearly complete amenities dominantly draw attention for outgoing people to visit. Secondary to their enormous infrastructure, the shoppers usually end up being lost. As a result, shoppers spend more time in searching for a store inside the mall instead of enjoying shopping.

In the light of this issue, the developers propelled to develop an android-based mall directory to help shoppers enjoy their shopping and stroll spree without the hassle of guessing to know the location of stalls and being lost.

Since android phones come out with different brands, versions, colors and sizes, the cost also comes in different ranges from a few thousand pesos to a hefty amount. In addition, since mobile internet connection in the Philippines is not as strong as those of some Asian countries, which sometimes makes it difficult to get connections when indoors, the developers opted the system to be placed in an android platform which is a downloadable application with maps already being embedded into the user's smartphones. Suppose the

internet connection later fails, the user can still have access to the map using his Android mobile phone or tablet.

A. Statement of the Objectives

The main objective of the study is to design and develop an Android-based Mall Map and Directory for android platforms which shall help in pointing out the direction of people in visiting malls.

Specifically, it seeks to meet the following objectives:

1) Identify the data requirements needed for the application;

2) Describe the features of the application;

3) Identify the hardware and software requirements of the application; and

4) Test the usability of the application.

II. METHODOLOGY

A. Research Design

The developers of this project utilized the descriptive-developmental type of research. These two approaches were deemed appropriate and absolutely suitable for the development of the project on hand as both of these research designs complement one another. Descriptive research described, evaluated and analyzed the data requirements of the system and in addition it provides information on the desired functions and features of the stakeholders, while the developmental type of research was administered in order to develop an application in accordance with the requested requirements both functional and non-functional.

The Rapid Application Development (RAD) methodology was used in the development of the application. Martin (2009) described RAD as a development life cycle designed to give much faster development and higher-quality result than those achieved with the traditional life cycle. It was designed to take the maximum advantage of powerful development software that has evolved recently. This was achieved by using a series of proven application development techniques, within a well-defined methodology. The Rapid Application Development is a development methodology that breaks the overall application into a series of versions that are developed sequentially, namely the requirements planning, user design, rapid construction and cutover.
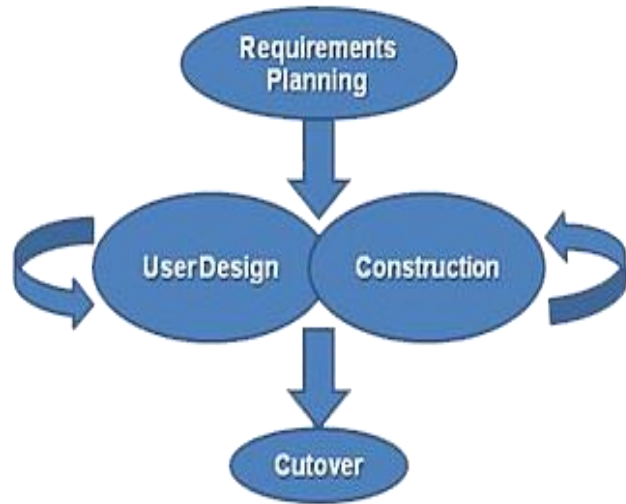
B. Phases of Rapid Application Development

Requirements Planning. The requirement planning stage consists of meetings between a requirements planning team and key client users. Meetings focused on both developing a high level list of initial requirements as well as setting the project scope. In this phase, the developers gathered all the necessary requirement by means of interview and guided questionnaire. Additional requirements were also identified during the observation. The users, managers and IT staff agreed upon business needs, project scope, application requirements and the continual achievement of approval.

User Design. This stage, also known as the Functional Design Stage, is where the analysis team meets with end users in Joint Application Development Workshops. During the workshops, the analysis team flushed out the requirements in full details, developed the entities developed in the Requirements Planning into a data model known as the Entity Relationship Diagram, formalized business rules, developed test plans, and created screen flows and layouts for essential parts of the application. In this stage, the developers analyzed in detail some business activities associated with the application area, to develop the application structure in terms of the automated and manual functions that comprised the application.

Rapid Construction. In this phase, the team developed the application in iterative cycles of development, tested, requirements, refined, and developed again, until the application is complete. The aim of construction phase is to develop and generate an entire application that can serve as a working prototype without a line of development code. The developers in this phase completed the detailed

design of the application, developed the application according to plan, and tested the software that implements the application.

Cutover. The implementation stage integrates the new application into the business. The developers in this stage installed the application in production operation with minimal disruption of normal business activity and for potential future enhancement. Further, in this phase, the developers conducted data conversion, full- scale testing, application changeover, and user training.

C. Sources of Data

The primary sources of data for this undertaking include the mall administrators, the Department of Tourism, and shoppers who were chosen because of their active and participative role in the development of the Android-based Mall Map and Directory.

D. Instrumentation and Data Collection

In this section of the document, the gathering of all important data that was needed in the creation of the application was discussed. The developers employed survey, structured interviews, internet research and library research to complete the study.

Survey. A survey is an investigation about the characteristics of a given population by means of collecting data from a sample of that population and estimating their characteristics through the systematic use of statistical methodology.

Structured Interview. An appointed formal conversation was conducted by the developers to obtain reliable and valid information which were considered to be essential elements in the development of the application .The developers clarified questions pertinent to the study as deemed necessary during the course of interview in order to elicit proper responses.

Internet Research. A form of research which is used to gather information on and study a particular subject using resources published on the internet. The developers utilized this type of research to gather information online pertinent to the study.

Library Research. A form research which is used to gather printed literatures such as books, theses, dissertations, magazines, journals and written materials needed for the study thereof. The developers gathered and used all related pertinent printed scholarly documents to support the study conducted.

E. Tools for Data Analysis

The developers employed various tools in software engineering in order to treat and analyze the data that have been collected from the respondents. In analyzing the data that have been collected, the developers used the tools such as use case diagram, entity relationship diagram, and database schema.

Use Case Diagram. This tool captured the intended behavior of the application. This behavior may be expressed as services, task, or features the application was required to perform. Use Case Diagram can be used to capture the features and the actors that interact within the application required to accomplish a specific goal (Pressman, 2012). The developers made use of use case diagram to identify the basic features that the application must possess. Using this diagram, the developers identified the scenarios showing how the application worked when implemented. Aside from this, the developers also identified the actors of the application

Entity Relationship Diagram. The heart of the Android-based Mall Map and Directory is the information placed within the database. The pertinent contents of the database are best represented using the Entity Relationship Diagram (ERD). This graphical representation identified the main components of the application: entities, attributes, and relationships (Pressman, 2012). The developers identified the entities that have something to do with the operations of the application. These entities contained information which described the attributes that are unique to each entity. Each entity was uniquely identified by a key called primary key.

Database Schema. It is a structure described in a formal language supported by the database management system (DBMS) that refers to the organization of data to create a blueprint of how a database will be constructed. This schema will aid the developers in visually outlining the records in the database (Pressman, 2012).

Wireframes. A wireframe is a visual depiction of the functionality and basic layout of a software application. Much like a blueprint, a wireframe depicts the structure of the application and describes its functionality, but it is not used to describe the look and feel of the software application.The developers used the application wireframe to determine the layout of the application interface as well as the position of the elements, thus it allowed the client to decide the layout that they want before the implementation or coding of the application.

Average Weighted Mean. It is an average calculated by taking into account not only the frequencies of the values of a variable but also some other factor such as their variance. The weighted average of observed data is the result of dividing the sum of the products of each observed value, the number of times it occurs, and this other factor by the total number of observations. The developers made use of the Average Weighted Mean to determine the usability of the application. The following 5 – point Likert scale was used to interpret the result: strongly agree, agree, undecided, disagree, and strongly disagree.

III. DISCUSSION OF FINDINGS

A. Data Requirements of the Application

Data requirements provide a detailed description of the data model that the application must use to fulfill the features of the Android-based Mall Map and Directory. It is as detailed as possible concerning the definition of inputs, procedures, and outputs. According to Manansala (2013), the requirements needed in developing the software used by the developers were based on their experiences or derived from different books. Data requirements include the software needed in developing the map and directory used for the basis of information.

B. Features of the Application

The Institute of Electrical and Electronics Engineers defines the term feature in IEEE 829 as a distinguishing characteristic of a software item such as performance, portability, or functionality. An application is said to be feature-rich when it has many options and functional capabilities available to the user. Based on an interview and survey of the stakeholders, the following feature for the application have been derived. This section provides the summary of the expected features that the application must possess in order to perform its functionalities.

Home Screen. The home screen holds different images of malls being featured. It has two main menus which are the mall destination and search outlet. The mall destination, when clicked, will show to the user the different list of malls in Pangasinan. The search outlet on the other hand is a search feature that will provide quick information on specific mall queries of the user. The home screen provides a navigational drawer that contains the following: the home, about, help, settings, and exit.

Mall List Screen. The mall list screen holds the selected list of malls in Pangasinan. The mall list screen of the application contains logo image and text-based information of the different malls.

Mall Information Screen. The mall information screen of the application contains images and an information of the shifted mall. It also has three main buttons, which when pressed, will provide details on mall location, mall directory, and mall hours.

Navigation Screen. The navigational screen provides the exact location of the mall. This feature will provide the actual distance and time duration required to travel to the mall. This feature will provide an approximate location via global positioning satellite assistance. The navigational screen acts like a global positioning satellite device. This feature will provides an immediate update of the location of the person holding the device.

Outlet List Screen. The outlet list screen holds the different list of outlets in every chosen mall. The outlet list screen of the application contains logo image and text information of the different outlets. Upon clicking the list, it automatically directs the user to the outlet information screen. This screen also contains a menu button that helps the user to navigate all throughout the application.

Outlet Information Screen. The outlet information screen of the application provides detailed information and images that describe the chosen outlet and the location where it can be located.

C. Hardware and Software Requirements

The hardware and software requirements are the components required to be able to use the application. The following hardware and software specifications are the needed platforms in order to run the application smoothly and to prevent software failures.

Table 3.1. Minimum Hardware Requirements

Component	Specifications
Screen Resolution	QVGA TFT LCD or larger, 16-bit color or better Minimum: 320 x 480 Pixel or Higher
Memory	128 MB RAM; 256 MB Flash External or higher
Storage Memory	Internal Storage : 2Gb or higher Mini or Micro SD : 1Gb or higher
Processor	800Mhz or Higher with single Processor or Higher
GPS / Wifi / Data	Wireless LAN 802.11b/g/n / 3G

Connection	Signal

Source:http://www.netmite.com/android/mydroid/develo
pment/pdk/docs/system_requirements.html

Table 3.1 exhibits the set of the minimum hardware requirements in order to deploy and run the developed application according to its purpose.

Table 3.2. Minimum Software Requirements

Component	Specification
Android OS Version	Minimum OS Version is Android 3.0(Honeycomb) or Higher
Google play Services	Google Play services 3.2.66 or higher.

Source:http://developer.android.com/guide/components/
fundamentals.html

Table 3.2 displays the set of all the minimum software requirements needed for the deployment and execution of the developed Android Mall Maps and Directory.

Android operating system is a mobile operating system. In order for the application to run, an android-based platform is required for the execution of the entirety of the system. Mobile operating systems manage cellular and wireless network connectivity, as well as phone access. The developers shall require the use of an Android 3.0 (Honeycomb) or higher version of android operating system as a minimum requirement in order to run the application.

D. Usability of the Application

Usability is the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use (Redwood, n.d). To test the usability of the developed Android-based Mall Map and Directory, the developers conducted a survey to the mall management and shoppers who were the expected clients or users of the developed application.

Table 3.3: General Weighted Mean for Usability of the Application

Description	MEAN	RESULT
1. Usability	4.56	SA
2. Design	4.07	A
3. Navigation	4.27	A
4. Information	4.11	A
5. User-friendliness	4.35	A
Weighted Mean	4.27	A

LEGEND: SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree, SD: Strongly Disagree

Table 3.3 reveals the respondents' evaluation of the overall usability of the application. This exhibits the average weighted mean for every assessment answered by the respondents which is categorized by the system's Usability, Design, Navigation, Information, and User – friendliness. In terms of usability, the stakeholders provided a score of 4.56 which is described as "strongly agree". In terms of design, the stakeholders provided a score of 4.07 in which the stakeholders agree that the design used by the developers is pleasing to them. In terms of navigation, the stakeholders provided a score of 4.27 which the users agree that the navigation capability of the application is sufficient. In terms of information, the stakeholders provided a score of 4.11 which the stakeholders agree that the information catered by the application is sufficient and reliable. In terms of user-friendliness, the stakeholders provided a score of 4.35 which is described as "agree". In general, the stakeholders agree with the newly-introduced concept justified by a weighted average mean of 4.27.

IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the presented findings the following conclusions were drawn:

The data requirements which follow serve as the bases for the development of the application. Google maps and mall directory, and pertinent outlet information such as address and contact numbers. The features of the application were based from the response of the requirements as identified by the stakeholders using survey and interview instruments. These features include assistive global positioning satellite to determine the direction of the mall. Features also include the measurement of the distance in terms of kilometers and the time required to travel the distance in terms of hours and minutes with an assumption under moderate traffic state of the passages. The application also utilizes search feature in order to quickly access the requested outlet. Further, the application features updated images and pertinent details about the mall and also the outlet within. The hardware and software requirements for the application include any device that runs under android-platforms either tablet or smartphones. The application is also proven to be usable based on the survey conducted.

Based on the presented conclusions, the following recommendations are presented herein:

1) Before the actual implementation of the developed application, the developers should first conduct an initial beta test to ensure that the application prior to uploading to the google play site is exactly working the way it should be.

2) It is also recommended that a training, most especially for the walk through, should be conducted to the mall stakeholders.

3) Finally, the administrators of the application should also constantly update the   images and pertinent details of the malls and the outlets located inside.

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