Design and Implementation of Mobile and Internet Product Access Information and Its Administration System

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Abstract - Internet has become a ubiquitous access to information. Mobile smart phones are becoming popular today as well in the area of interactive information retrieval. Many applications are developed on these mobile intelligent machines. This paper presents the design and implementation of a seamless distributed product access information system that can be accessed through Internet and/or Google Android smart phones. The system uses a hybrid approach of master-slave and peer-to-peer communication models. This system may help to increase business activities in an area because consumers can access to more information about products that they are interested to purchase anywhere with Internet connection and any time. In addition, these customers are able to know about shops that sell a particular product, including the price and the shops addresses. This might help to save their shops hunting time. The main purpose of the administration system is to help the administrator manage the system.

Keywords: Distributive product access information system, Google Android smart phones, Internet access

1. INTRODUCTION

INTTERNET can be accessed through desktops, notebooks, smart phones, and other electronic equipment. Recent advancement in mobile and wireless technologies has made possible the creation of applications on smart phones that were not possible ten years ago. Smart phones have become ubiquitous as latest and less expensive models with more and advanced features are built into the phones. Smart phones have become pervasive as people can always access information, anytime and anywhere. Hence, useful application will continue to be developed on them, especially those that can help to increase business activities and improve human life.

At present, it is easier to develop software applications on platforms supported by vendors like Google, Apple, Microsoft, and Nokia. The mobile product access information (PAI) distributed system reported in this paper is developed on Google's Android platform because the platform adopts an open source strategy which gives more flexibility to developers. This distributed system can also be access through Internet via smart phones, desktops, or notebooks.

Some research work on mobile phones like software test framework [1], middleware for building mobile applications [2], enhance mobile phone usability through personalization at user interface [3] and integration of different technologies [4], mobile applications in education [5], performance study of mobile applications [6], and applying context-aware technique in mobile applications [7] have been reported in the literature. In addition, specific software applications on mobile phones, for example SMS on demand [8], a type of wafer packaging system [9], and a wireless news browsing application [10] were developed. On Android platform, location-based mobile service [11], safety functions in vehicles [12],

and global positioning system [13] were implemented.

A lot of research has been done in the area of web based information system like in manufacturing [14-15], shopping [16-18], education [19] and shares [20]. In the area of web based distributed system, there are work published in web service [21-27], in particular the mobile transaction management system in a distributed environment [26], where heterogeneous of computer systems and synchronization and control of operations are issues, and mobile agent-based Internet commerce system [27] that analyses number of agents to contact for price comparisons.

In this paper, we present the design and implementation of mobile PAI distributed system developed on Google's Android and Internet platform and its administration system, which resides in the server. Our system employs a hybrid approach of master-slave and peer-to-peer communication models. The main purpose of the PAI system is to assist consumers make an informed decision whether to purchase a particular product. Furthermore, this system helps consumers, in particular mobile consumers to search for shops that sell a particular product so that they can save product hunting time. The administration system is to help the administrator manage the PAI system.

A typical scenario is described as follows. Every year millions of visitors visited Singapore. One of the main tourist attractions is the shopping paradise of Orchard Road which offers major departmental stores like Paragon, Ngee Ann City, and Far East Shopping Center, and many retail outlets that sell wide variety of electronic goods. Very often, tourists require more information about a product before making an informed decision to buy it or would wish to know shops that sell a particular product. Assume that the PAI system is installed in a mobile phone that runs on Android platform. A tourist can then access the required information from a nearby server via a wireless router. If the requested information is not found in that server, the system will automatically communicate with an adjacent server via a wireless router. This continues to happen in the background until the information is located. Once the information is found, it is transferred back to the original server and then to the requestor. Another scenario is that a tourist carrying any smart phone can access the PAI through Internet.

The rest of the paper is organized as follows. Section 2 presents the tools, development languages, and overview network architecture. Section 3 briefly describes the design method used which includes the high level framework of PAI distributed system and its administration functions. Section 4 briefly explains the implementation of the entire system. Section 5 concludes this paper.

2. TOOLS, DEVELOPMENT LANGUAGES, AND OVERVIEW NETWORK ARCHITECTURE

The following software tools are employed to develop the distributed database systems: Eclipse 3.5 Galileo Integrated Development Environment with Android ADT plug-in, including Dalvik Debug Monitor Server, Adobe Fireworks, Droid Draw, Dreamweaver, Photoshop, and XAMPP. The system is written with the use of JAVA, XML, HTML, and PHP programming languages.

Figure 1 depicts the overview distributed network architecture for the systems. The clients can be Android phones, notebooks or desktops that run a Google smart phone simulator, Internet Explorer, or Firefox

software. Each client is able to access the XAMPP database located in any of the three servers via a wireless router or a switch. The client may be connected to a wireless router using a wired or non-wired connection. Every client can access to Internet through the server which is connected to the Ngee Ann Polytechnic network center, located a few floors below of an adjacent building.

A gateway is given a unique Service Set Identifier (SSID) or unique network name in order to prevent duplicate names from nearby wireless router. This is to prevent consumers from joining the wrong network. The default gateway Internet Protocol (IP) address is of class B which is 192.xxxx.xxxx.xxxx. In the wireless router, the broadcast of SSID is set to enable (Refer to Figure 2) so that mobile users are able to search and then join the network. In order not to degrade the performance of the network, the maximum number of users connected simultaneously to the network is configured. The server IP address is reserved so that it does not have a different address each time the network is build up. However, Dynamic Host Configuration Protocol can be initiated to get automatic IP address for the server.

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3. DESIGN

3.1 High Level Framework of Android Phone Access

Figure 3 shows the high level framework of PAI and its administration system. The system is divided into two main parts. The first part is the PAI software that resides in a smart phone that runs on Google's Android platform. This software consists of three main functions – bookmark, browse, and search. The bookmark feature gives users the flexibility to mark frequent or important information so that it can be retrieve quickly and easily. The browse function allows users to list all the items or shops. The search function gives users the option to perform a full or partial name information retrieval from the database via the wireless router. Users can then select the particular item and more information about it is displayed like the price, background information, and shops that sell it. Users may do a shop search to get a list of shops and their addresses and contact numbers that sell a product in that shopping area. Feedback to the administrator can be generated through the administration function in the search module.

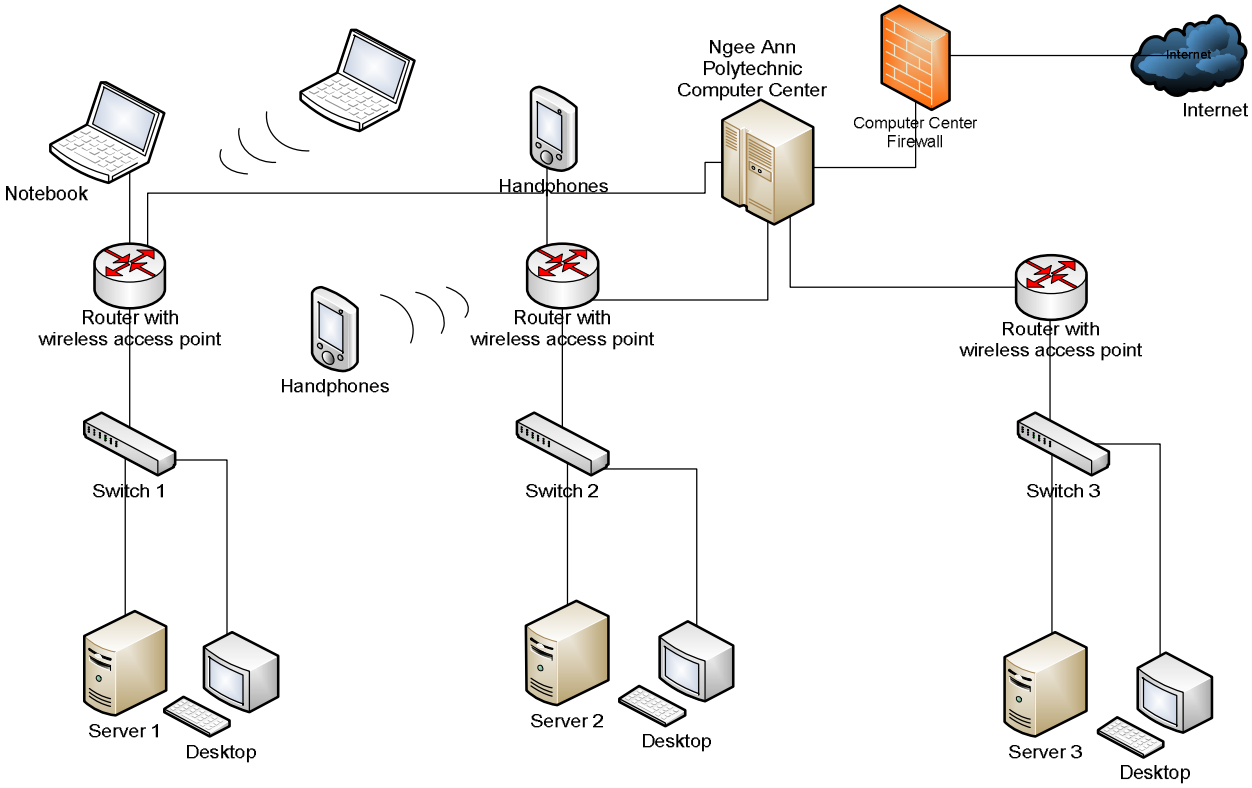

Figure 1. Overview Distributed Network Architecture

Figure 2. Set SSID to Broadcast Mode

The second part is the PAI administration system which is installed in the server. The administration module allows the administrator to add, delete, and update products information to the database. The inventory module allows the number of stock of a product to be updated when necessary. This information gives clues for reordering of a product. One of the functions of the account module is to provide total revenue generated for a particular product during a given period. The search module provides a full or partial search for a particular product. The shop module lists shops that sell a particular product.

The XAMPP is located in the server but the SQL Lite database resides in the phone that runs on Android platform. If the information is not found in a XAMPP database, a search is conducted in an adjacent database via a wireless router.

3.2 High Level Framework of Internet Access

The high level framework (Figure 4) is similar to Figure 3 except the user features reside in a server and can be accessed by any smart phone, desktop or notebook through Internet.

3.3 Some Parts of Overview Design and Process Flow Access by Android Phone or by Smart Phones/Desktops/Notebooks

The main modules for PAI and its administration systems were identified and relationships among them were known.

Figure 5 gives the overview of the PAI Design. The XML scripts are generated to present the user interface and capture commands from users. Then the commands are configured so that the correct database is accessed through the activation of relevant PHP script files.

Figure 6 illustrates the process flow of browse shops. The user interface displays the list of shops. If a user selects a shop and the system will depict information about it, in particular the address and contact number. Otherwise, continue interaction with the user is activated.

Figure 7 displays the overview of administrative management system design. The GUIs are written in HTML, specifically to capture user inputs. The command initiates the correct PHP script files so that the database access may be invoked.

Figure 8 exhibits the administration process flow. A user has the option to add product records, update existing product records or delete an existing product record.

Figure 9 shows the high level distributed database query processing. The communication between servers and databases is built using a hybrid model of master-slave and peer-to-peer communication models.

The master-slave similarity procedures are explained as follows. Every time a device request information from the system, the request is only sent to one of the many servers, in this context the master server. Residing in the master server is also a complete list of all the servers and databases that is in the domain of the system, the slave servers. Every time the request is received by the master server, it would call its own database and process the request, adding all the results found into a result set. After which the master server will proceed to call the slave servers according to the list and pass on the request. Currently this procedure uses a linear

algorithm to process the list as the list is small and it is a product in development. It can be edited to use a parallel algorithm to speed up the processing if the server list is large. All the search results found will be accumulated to the same result set. Once the list is exhausted, the result set will then be returned to the device that sends the request for further processing.

Next, the P2P similarity procedures are described. Some components of the system such as the server scripts and the news bars are not dependent on databases but instead store their information directly on the server. As the system final design is centered on efficiency, the closest server to the client will be deemed as the master server, the rest slaves. Thus changes made on one server will be required to be reflected on all servers as the master server will change depending on where the system is being accessed. As the system will be broad and servers scattered over different areas and each having different administrators, the easiest and cost/resource efficient method to deploy updates and changes would be to use P2P model. As per the client's request, the database will still be isolated from each other but scripts and web pages updates will be deployed in this manner. When changes are made in one of the servers, it will send out the new copy to servers closest to it. Upon receiving the new files, the servers will pass on to the next closest server and this continues till all the servers have the new files and the files are synchronized with one another. This deployment saves bandwidth and manpower resources as it is dynamic and changes made will be reflected within the entirety of the system in the shortest time possible.

4. IMPLEMENTATION

The top down approach is used to write the software codes for the whole system. First, the user interface was developed and tested. Then the main module was coded. The scripts files were parsed by the application modules. The key obstacle was passing correct information between modules, especially between databases. Figure 10 presents the access to the PAI system through Android phone. The smart phone can access to Internet by clicking the browser button. Figure 11 depicts the front page of the PAI system which we call Android Search-A-Ble. This system is coded using JAVA and resides in the phone. The coding Search-A-Ble by Internet is similar to Android Search-A-Ble except that it is developed using PHP instead of JAVA and resides in a server. Figure 12 shows the main page of the Android Search-A-Ble administration management system which resides in a server. This system and the communication between databases are developed using PHP. There were about 1000 lines of code written and complied for the entire system. System testing was carried out successfully. The response time of a user request using Search-A-Ble that resides in the Android phone is much faster than the Search-A-Ble that stores in the server. The reason is because the software is already being processed and ready to execute user commands. However, the Search-A-Ble software for Internet access does not constraint to Android phone only but can be used by any smart phones, notebooks, and desktops that run Internet Explorer or Firefox software.

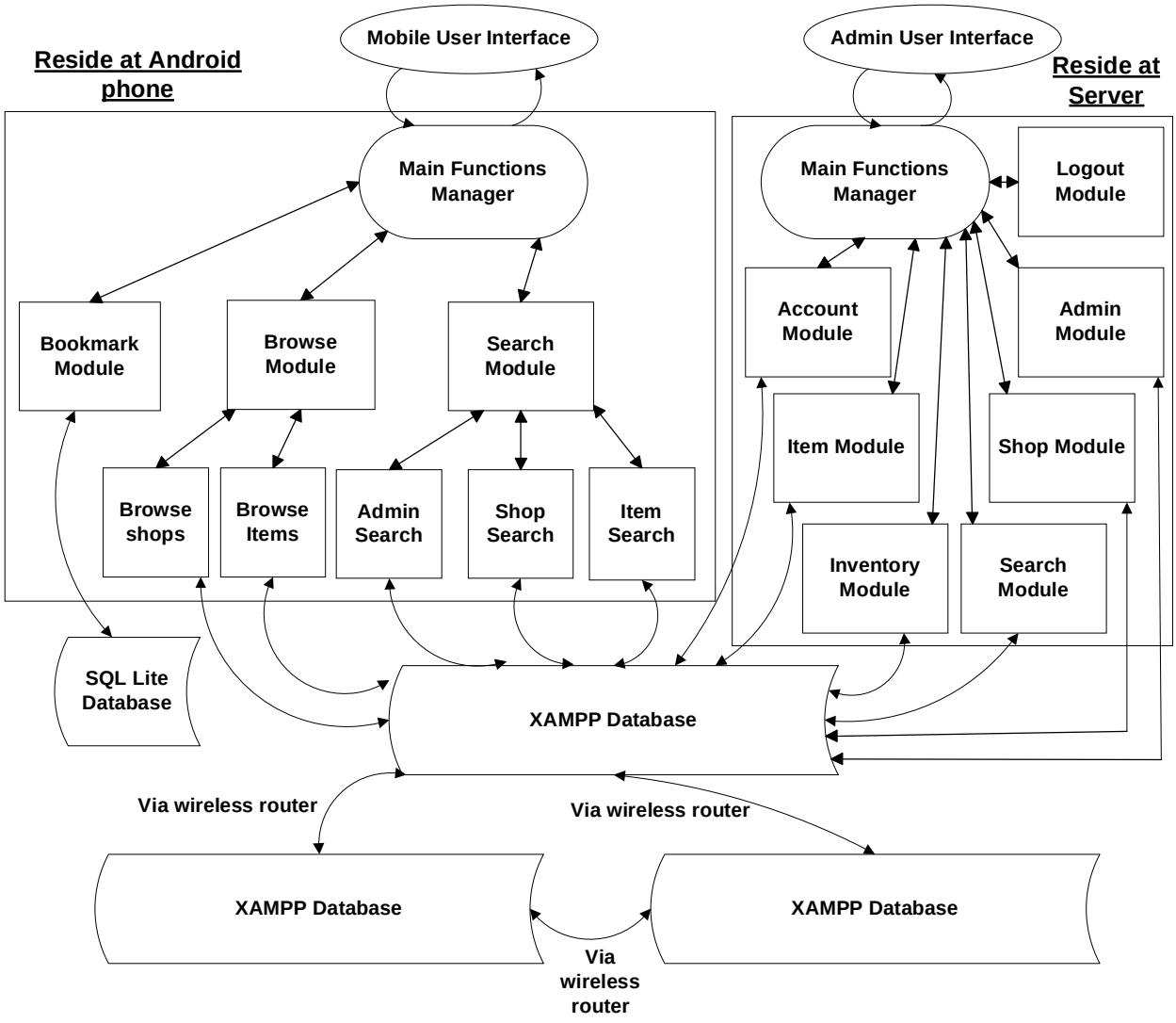

Figure 3. High Level Framework of PAI and its Administration System Access by Android Mobile Phone

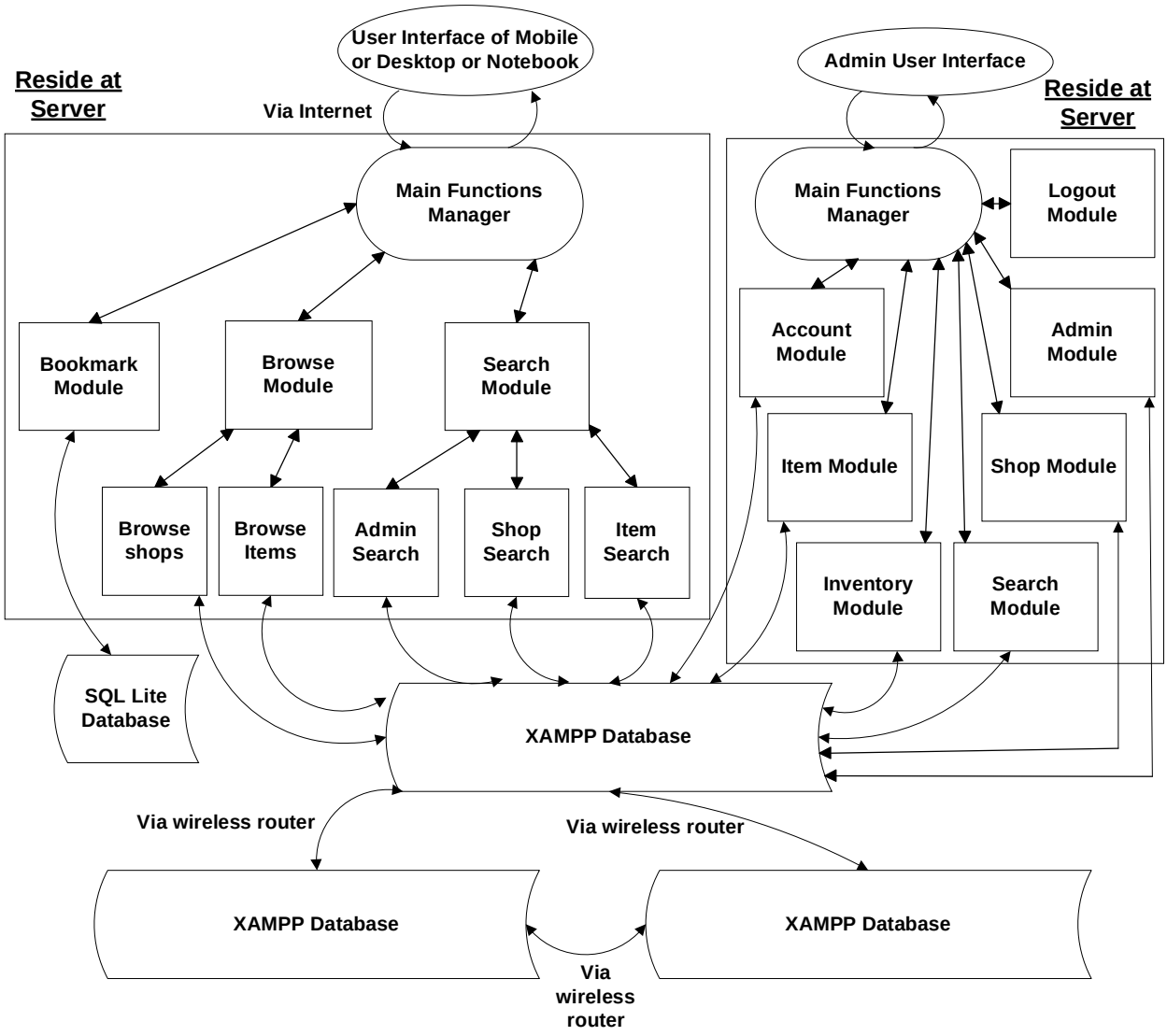

Figure 4. High Level Framework of PAI and its Administration System Access by Smart Phones, Desktops or Notebooks via Internet

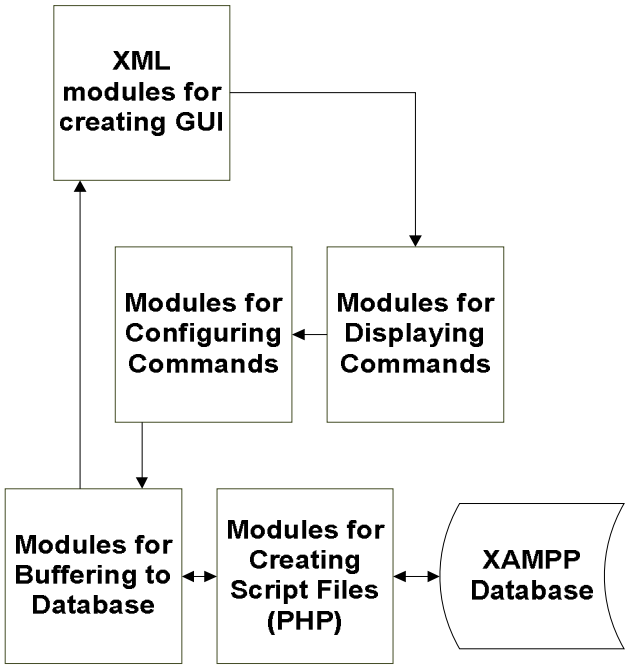

Figure 5. Overview of PAI Design

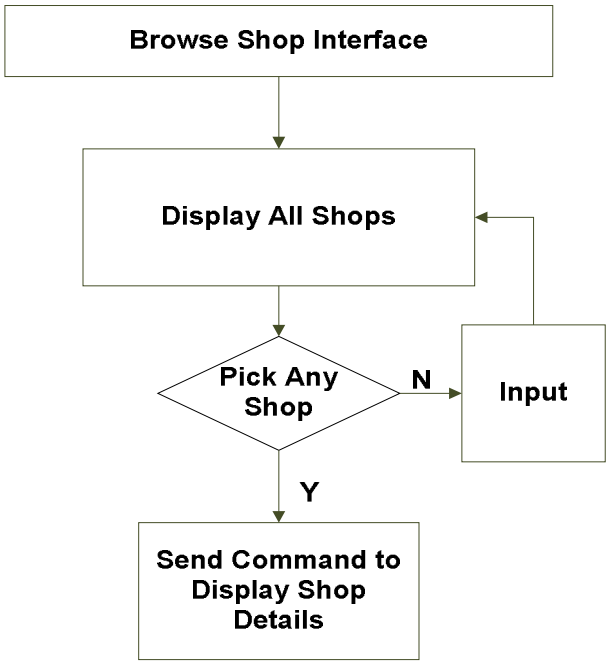

Figure 6. Browse Shop Process Flow

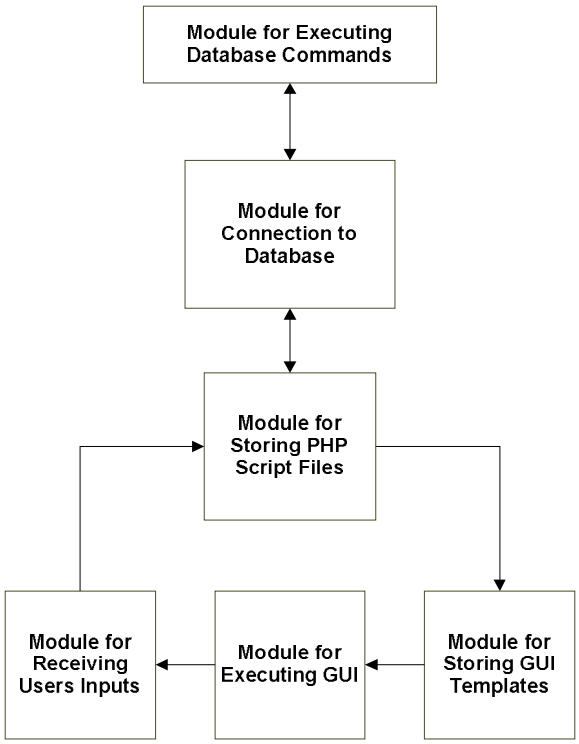

Figure 7. Overview of Administrative Management System Design

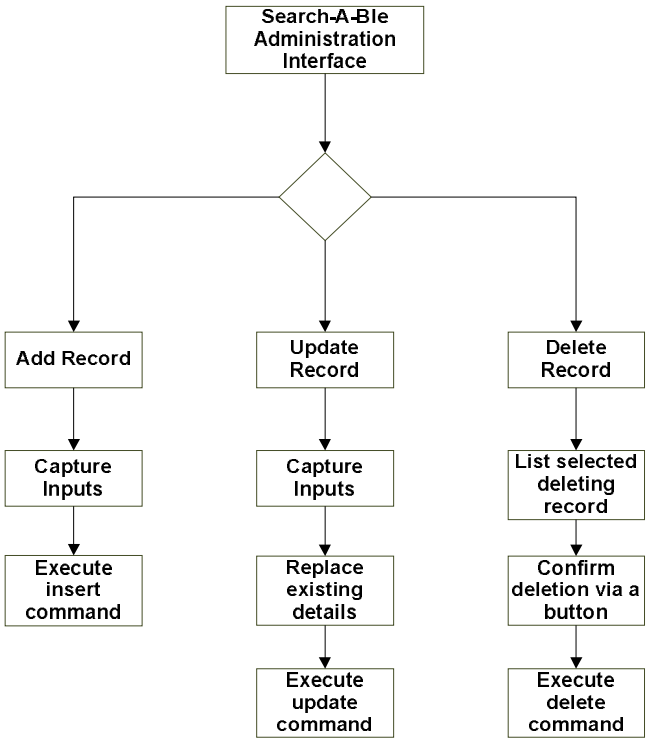

Figure 8. Administration Process Flow

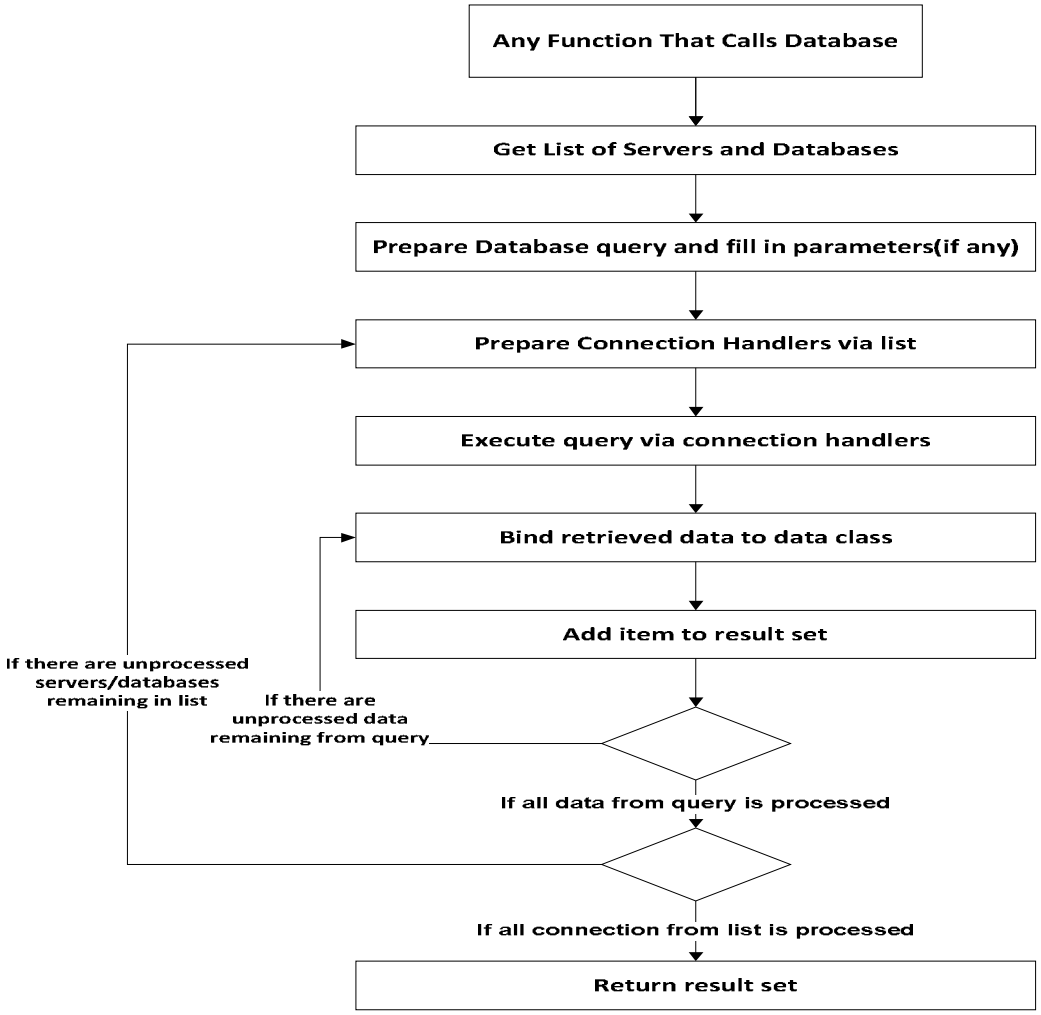

Figure 9. Overview of Distributive Database Query Processing

Figure 10. Access to PAI system

Figure 11. PAI system functions

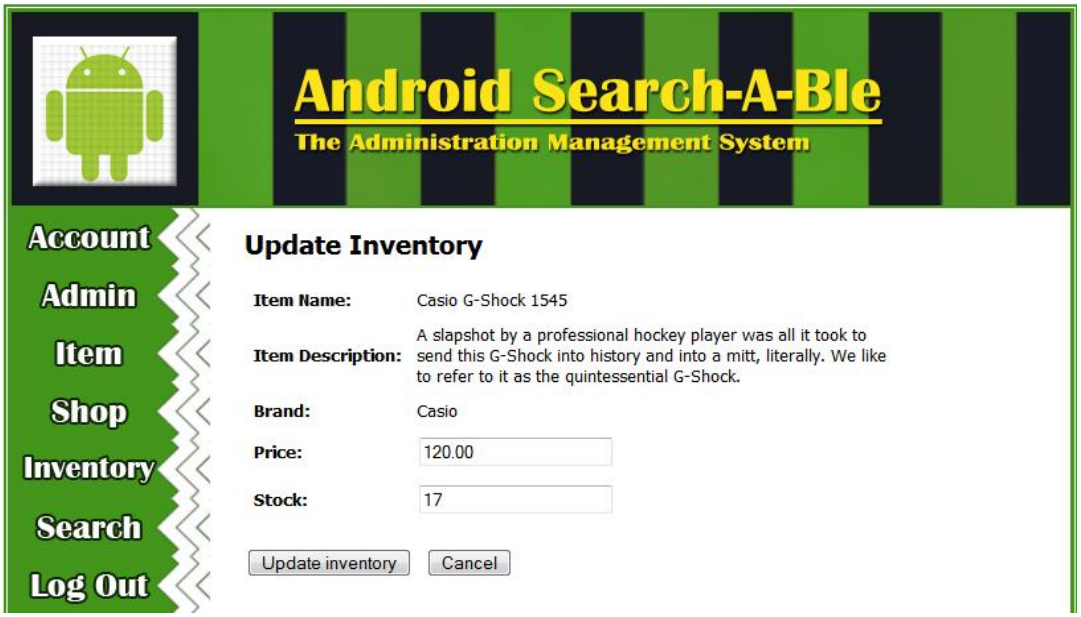

Figure 12. Administration Management System Features

5. CONCLUSION

In this paper, the design and implementation of the PAI distributed system and its administration system that can be accessed by any smart phones, desktops or notebooks have been presented. The systems were written in Java, PHP, XML, and HTML programming languages.

The main purpose of the PAI distributed system is to help increase business activities in an area because consumers can access to more information about products that they are interested to buy before making a purchase decision. Furthermore, this system can help these consumers to save their shopping time as they can locate the places which sell particular goods. The major objective of the administration system is to assist the administrator manage the PAI system.

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