# CERTIFICATION OF APPROVAL


**Mobile Library**


By

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Approved by,


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(Dr. Azween Abdullah)

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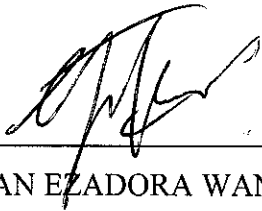**TRONOH, PERAK**

**September, 2006**

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# CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

(WAN EZADORA WAN RUSLI)

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# ABSTRACT

Wireless application system and application has large potential due to the very personal and intimate nature of the device and high targeting possibilities. Due to rapid advancement of advertising and informing technologies recent years, the concepts and such applications have been significantly extended. This research will look deeply into the acceptance level of implementing the wireless system at the defined area. In this project the application and the function of advertising on mobile device has been modified to another alternatives that can enhance the environment surrounding us. This project is basically will be functioning as a reminder system. This system will establish the connection between the server and the Personal Digital Assistants (PDAs). The system will deliver location-aware of information that allows the transition info from the server to the PDAs using WiFi pull-based technology. The objective of this system being developed is to enhance the idea and the technologies of wireless nowadays which definitely can be implemented in various ways later on. In this project, several techniques have been used starting with ideas and information research and gathering that have been done through journals, existing paper work, and previous systems that create by previous students. This report covers the background study, literature review and theory based on research, and also methodology used in research and design phase. In research, questionnaire is used to gather information pertaining to user preferences. Meanwhile, in design phase, the methodologies will be explained more in chapter three (3). The last two part of this report covers result and discussion from the research and testing phase, and also recommendation for future work.

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# CHAPTER 1

# INTRODUCTION

## 1.1    Background

This project and research are mainly on getting a better understanding on the wireless technology and how this technology can be implemented in various ways. When we talk about wireless area, the thing that might occur is about how the wireless technology now has been the important medium to connect this worldwide.

But when we are talking about wireless technologies, we must keep in mind that wireless is not a replacement to wired network ... but an extension to wired network. By this way, when we are talking about wireless computing, which will give a possibility to build a new communication infrastructure; we must develop the following key wireless technologies: wireless media, spread spectrum techniques, interconnection with backbone networks, authentication and security, data-video-voice compression, and multimedia, adaptive database.

Perhaps, we already know mobile marketing, wireless marketing to name a few. One might ask, why just for the sake of marketing? Why not providing all the technologies for the public?

Libraries [16] long have been innovators in the use of information technology. They began mechanizing their operations early in the 20th century with punched cards and microforms, and by the mid-1960s began automating internal operations such as cataloging, acquisitions, serials, and circulation. By the 1980s, [16] a marketplace for automated library systems existed; by the 1990s, the primary technical operations were integrated; and by [17] 2001, most local systems incorporated networked access to electronic journals and other external resources. The initial goals for automating libraries largely focused on efficiency of internal operations. Subsequent goals included better access to local resources and access to resources outside the library. While all of these

goals remain essential, an additional goal now exists to improve interoperability among systems and services that are both internal and external to any individual library.

This paper will study the matter, where instead of using the technologies for the advertising it will be implemented to give an information to the defined area i.e. library where the information or data is sent to mobile devices via WiFi technology.

## 1.2    Problem Statement

One of the main challenges is the way the system in the library interacts with the student is less effective. The main example is when students borrow books, there is no message or information that will alert or remind them about returning the books and the cost to be paid if the book overdue the returns date.

During the creation of the system, the problem that drives to the development of the project is how to have a system to represent the information to the student. This system will increase the percentage of the details or data to be visible to the students

Another problem that occurs in the old system is providing the recite to the student for their own keep. The small pieces of paper are not suitable for the student who always busy with another program and task in their routine day. Sometime they tend to forget to return back the books and it could take up until two months for them to return the books back. This is not good for another student who really needs to lend the book but failed to do that because of this small problem. This new system will keep always reminding the student whenever they across the range of WiFi.

This system cannot be found in any library in the Malaysia for now so it can be classified as the first ever being created for the public (library). The problem occurs is making a research about how far the student can see the benefits of this system. Lots of research of the efficiency implementing the WiFi technology in the library needs to be done. The

research about a connection and relevant between WiFi technology and the library need to be more emphasized in developing the system

Another problem that drives this system to be developed is to enhance the lack of technologies that the library have now. For example, there is no technology in the library that involves with the wireless system. This enhancement can make the library looks established and more sophisticated.

## 1.3 Objective of Study

The objectives of this project are:

- To develop system that uses WiFi pull-based technology that can eliminate, or at least reduce the problems of previous problem above.

- This project should be able to solve the problem less effective of the procedure in giving the information to the students.

- To gain knowledge of the uses of information technology in library operations and services.

- To develop a basic knowledge of the management issues involved in automating library operations and services.

- To understand the complex computing and telecommunications infrastructure in which libraries exist;

## 1.4 Scope of Study

This study will focus on Wifi pull- and push-based technology in this system in terms of feasibility and effectiveness of both systems. Listed below are the scopes of this study:-

### 1.4.1 Analyze the pull-based technology system that existed

Current push-based mobile advertising systems will be looked into to pin point out the major flaws of the system.

### 1.4.2 Study the functionality of the database

Outline the criteria of the database and its attribute and study how to connect between the databases with the Bluetooth connection.

### 1.4.3 Field train and survey

To qualitatively evaluate the prototype, system and the end user experience, a field trial in real use of environment will be conducted. The testing will be done by students in UTP. Testers will be given a set of questionnaires to be answered at the end of the testing.

### 1.4.4 Analyze and interprets user's response

Information gathered from the field trial will be analyze and interprets.

Based on issues pointed earlier, this study will test the feasibility of pull -based informing system solving the issues. These issues have been identified as problems of the push-based system. But to ensure the effectiveness of this system, deeper study and more detailed research is needed.

Data and information gathered before and after the field trial will be used in identifying the effectiveness of the proposed system. Several steps will be proposed to enhance the system for future works based on comments of testers.

## 1.5    Methodology

In developing this system, a project work and methodology has been established to make sure all the works to develop the system that to be done will be levels in an appropriate approach. The methodology consists of 7 phases of development:

a)    Revise existing system.

b)    Planning.

c)    Analysis.

d)    Design.

e)    Build.

f)    Test.

# CHAPTER 2

# LITERATURE REVIEW AND THEORY

## 2.1 The Introduction of WiFi

WiFi [1] is short for "wireless fidelity" - a technology that lets people log onto the Internet without using a wired connection. It can be done in homes, businesses, between businesses etc. WiFi offers a lot of advantages over LANS, but it does include disadvantages

Public libraries all around the nation are going "wireless" and most of the public libraries in Rock County have followed suit. Many airports, hotels, and other services also offer public access to WIFI networks so people can log onto the Internet and receive emails and search the Internet on the move. These locations are known as "hotspots".

A person with a WiFi device, such as a computer, telephone, or personal digital assistant (PDA) can connect to the Internet when in proximity of an access point. The region covered by one or several access points is called a hotspot. Hotspots can range from a single room to many square miles of overlapping hotspots. Wi-Fi can also be used to create a Wireless mesh network. Both architectures are used in Wireless community network, municipal wireless networks like Wireless Philadelphia, and metro-scale networks like M-Taipei.

Wireless local area networks (WLANs) use a technology called WiFi, or Wi-Fi, to create a small-scale wireless networks that have a typical radius of several hundred feet. The most prevalent form of WLAN technology is called WiFi, which encompasses a host of standards including 802.11a, 802.11b, and 802.11g. Wireless Internet via WiFi offers blazing fast data speeds (11Mbps at the low end with 802.11b and 54 Mbps at the high end for 802.11a and 802.11g). While WiFi technology does not offer the degree of

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ubiquity that wide area networks do, the fast data speeds and relatively cheap costs of setting up a WiFi-based WLAN have spurred it ahead in the market.

Companies implementing WiFi see a positive impact on productivity and profitability. Not only are large companies adapting the technology, but businesses in the SOHO sector are also seeing the benefits of WiFi and are actually driving the market.

### 2.1.1 WiFi- How does it Works?

Wireless Internet Access has four components that form its structure: [1] high-speed access, a networking gateway, a wireless network and a wireless customer. The customer connects wirelessly through the wireless network to the gateway, it then launches their internet browser, authenticates through the gateway by entering a coupon code or purchasing time and the user has high-speed internet.

The four components are [1]:

1) High-speed access which is also known as broadband is an internet connection which is generally faster than dial up service. Examples of high-speed internet access are ISDN, cable modem, DSL, and also satellite services.

2) Network Gateway is between your high-speed access connection and the wireless network, it acts like a gate. This gate will prevent people from accessing your wireless network unless you know about it, the gateway also allows managing tools as well. These can include authentication, network monitoring, and other services such as printing and voice over IP.

3) Wireless local area network is a system of connecting PC's and other devices within the same physical proximity using high-frequency radio waves instead of wires. Wireless networks work as long as your wireless ready device is within range.

4) Wireless customers are people who have a PC and a wireless adapter which means they can access the internet wirelessly. The wireless adapter can be built in or it can be an external device plugged into your computer.

WiFi, allows a universal internet connection to be broadcasted through radio waves.

Radio waves are what make WiFi exist and run. They allow WiFi networking to occur between numerous people. The radio waves are transmitted from antennas and routers and are picked up by WiFi receivers such as computers and cell phones equipped with WiFi cards. When these devices receive a signal within the range of a WiFi network, the WiFi card then reads the signals and produces an internet connection without a cord. Once a connection is established between user and the network, the user will be prompted with a login screen and password if it is fee based.

WiFi networking around the world is creating not spots in the cities where anyone with a laptop can wirelessly plug into the internet. Hot spots are connection points for WiFi networks; areas where wireless internet is available for those who have internet ready devices. Hot spots are becoming available everywhere, in restaurants, hotels, airports, schools, etc.

The following is a simple and understandable way to picture the way WiFi works. The main source is the antenna; the antenna sends radio signals to the people who want to access the internet. The people wanting access must have a Wife card; the Wife cards receives the radio signals through its' Wife receivers and creates a wireless connection.

## 2.1.2 How Secure is WiFi?

WiFi has had, and continues to have several security issues. In September [4] of 1999 WEP (Wired Equivalent Privacy) was the standard for wireless PC's. WEP is used in the physical and data link layers, and was designed to give wireless LANs the same security

that wired LANs had. WEP [4] provided security by encrypting the data while it traveled from one end point to the other. Unlike wired LANs who's networks are usually inside of a building where it's protected wireless LANs are more vulnerable due to the fact that the data travels over radio waves which are much easier to intercept. Another reason WEP is vulnerable is because in some corporations the managers do not change the shared keys for months or years at a time. That is way to long for the key to be in use, with that much time the key can get into the wrong hands, which could be disastrous for the corporation.

In 2002 the wireless LANs security was upgraded when WiFi Protected Access (WPA) was introduced [2]. WPA had several improvements like better encryption, and it also used the RADIUS-based 802.1X, which authorizes the user to gain access to the ISP provider. Also the setup for WPA was much simpler than the setup for WEP. WPA came in two types, Enterprise which was used for corporations, and also Personal which was used for home users.

In June of 2004 802.11i [4] was completed and became the new and current standard for WiFi. 802.11i is also known as WiFi Protected Access 2(WPA2). WPA and WPA2 have several of the same qualities, but WPA2 upgraded its encryption of data with the Advanced Encryption Standard (AES). There is a problem with AES however, and the problem is that this could require hardware upgrades for many wireless LANs. WPA2 is compatible with WPA products, and consumers can upgrade to WPA2 easily. However WPA2 is not compatible with the original WiFi standard WEP. Also like WPA, WPA2 has two versions, WPA2 Enterprise is for corporations, and WPA2 Personal is for the home users [4].

Many corporations today use a Virtual Private Network (VPN) to send and receive important information. Virtual Private Networks use the internet to send and receive information by creating a tunnel connecting the two end users. VPN encrypts the data to keep any hackers from stealing the information while it is being sent. To use a VPN the

two end users must be using the same authentic protocol or it will not work. The authentic protocol gives only certain users access to certain information.

## 2.1.3 Risk of WiFi

Wireless networks offer tremendous benefits, but also present significant risks, particularly around "end-point security", which is the requirement for end devices to be managed and secured whether or not they are connected to the corporate network. As more and more mobile workers use their laptops to connect to corporate and public WiFi networks, IT departments and end-users will need to be aware of the risks and implement the right mitigation plans.

Most WiFi security stories focus on the over-the-air (OTA) data encryption, wireless access control, or intrusion prevention. Although these are important issues, there are hidden risks with wireless that may not be well known, but still present some serious security challenges. Two of them are (a) working in ad hoc mode, and (b) dual homing - the simultaneous connection to two networks.

Wireless laptops in ad hoc mode. Wireless Network Interface Cards (NICs) operate in two modes - infrastructure and ad hoc. Infrastructure mode is when you connect to an access point, perhaps in your office, at home, or at a public hotspot. Ad hoc mode allows you to make your laptop behave like an access point and have others connect to you through a peer-to-peer wireless connection. Wireless laptops in ad hoc mode are prime targets for hackers to connect to and steal information because it is easy to do so and almost undetectable. Interestingly, many users inadvertently have their wireless NIC set to ad hoc mode by default because that's how the laptop manufacturer set it, or they may have turned it on before but forgot to switch back to infrastructure mode. An even scarier scenario occurs when a hacker sets his laptop as an ad hoc connection with the same

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name as a legitimate network, causing unsuspecting users to connect to it thinking it is a valid WiFi network, and divulge important information such as passwords or credit card numbers.

Wired+Wireless Dual Homing. Most laptops today have two NICs - one for a wired connection (Ethernet, dialup, etc) and one for WiFi. This enables the laptop to be dual homed, or connected to two networks at the same time. If the WiFi card is set to ad hoc mode, and the user logs on to the wired network, hackers can easily connect to the laptop via the ad hoc mode and then get access to the wired portion of the enterprise network using the dual homed laptop as a conduit.

Another risk to your network is rogue access points connected to your wired networks. These rogue access points may have been installed by employees or attackers, but serve basically as a subversion of whatever wireless security mechanisms are in place. For instance, a developer may want wireless access in a nearby conference room, buy an access point from an electronics store, plug it into the Ethernet jack in her cubicle, and make her own "private" network. The problem with this technique is that there's no real guarantee that the access point is secured in the least, and it may serve as a gateway into your enterprise's network. The media has helped to address this issue, as most of the public now knows that doing something like plugging in their own access points to a corporate network is a bad idea.

One of the biggest risks to modern WiFi networks is the wireless clients themselves. Even if your network is configured correctly, your clients can give up everything anyway. Rather than attacking the network directly, an attacker may choose to go after the client and then leverage the client to access the rest of the network traffic or the network itself.

### 2.1.4 Future in WiFi

Bluetooth [2] is a wireless technology that allows computers, phones and other devices to talk to each other over short distances (typically about 10 meters). It is found in many of the newer mobile phones, handheld computers, and laptops as well as in other sorts of products. Bluetooth uses radio waves and is designed to be an inexpensive way of connecting and exchanging information between devices without wires. Bluetooth can be used to exchange business cards or even used for sending voice from a headset to a mobile phone. Examples of this type of technology [2] are the Nokia 6600 and the Sony Ericsson P900 mobile phones. These specific phones allow you to connect your PC and enable you to transfer files and perform backups. Some of the disadvantages to this technology are that confidential data can be obtained, anonymously, and without the owner's consent from other Bluetooth enabled mobile phones. This data includes not only the phonebook and calendar, but media files such as pictures and text messages. Most devices have and option where you can put your device into a non-discoverable state so that you are invisible to other Bluetooth devices. While in this mode all your information and data are safe. However, in order to receive business contacts wirelessly you will need to place the phone in discoverable mode.

Bluetooth is all [2] good and well but one of the most leading technologies is Ultra-wideband (UWB) modulations. UWB usually refers to a radio modulation technique based on transmitting very-short-duration pulses, whereby the occupied bandwidth goes to very large values. This may also be used to refer to anything with a very large bandwidth. UWB is now going through the necessary authorizations and developments for public and commercial use. There's a possibility that this will become the "next best" technology for all types of wireless networks, including wireless LANs. Because UWB operates at such low power, it has very little interference impact on other systems. Another advantage is that it could connect virtually every multimedia device in your home without using any wires. Digital cameras and camcorders could wirelessly stream images and video to your TV or and flat screen monitors could wirelessly connected to computers, DVD players, or any other source you desire. UWB will very likely

revolutionize the home multimedia scene and eliminate all the tangled wires found behind home entertainment centers.

## 2.1.5 WiFi Hotspot - New Market Demands

The widespread expansion of Wi-Fi hotspots is the long waited fulfillment of high-speed data for mobileusers. Today's goldrush to capture the new generation wireless market of business travelers, Internet surfers and email/messaging users is only the beginning. In the future common shoppers will use SIM (Security Identification Module) authentication to buy everything from groceries to vacations, and have it billed back through their mobile phone account.

HP and Intel [9] have brought together Axalto and *airwide solutions*to create an end-to-end authentication solution based on phone SIM cards for Wi-Fi Hotspots. It enables Mobile Carriers to leverage their legacy roaming technology, processes and agreements to solve a critical industry problem.

Subscribers wanting to login to a Wi-Fi hotspot will need to equip their laptop with the ability to access the SIM chip on their mobile phone. They may do this via an Axalto SIM reader connected to their PC by either a USB Dongle, PCMCIA card, or wirelessly through Bluetooth. When roaming in hotspot coverage, the Axalto Client supplicant on the laptop detects PWLAN, signals, and handles all login procedures.

Bergen Medical Center [21] uses WiFi application which allows patients to search for physicians within their area code and get a complete profile of their practice.

## 2.2 Library nowadays

The study about the development of technology in library has been made recently [21], and the output from the survey said that what young people think about public libraries is- new study findings public libraries must continue to evolve to keep pace with the expectations of young people.

In Malaysia, Online Public Access Catalogue (**OPAC**) is the latest technology that being used by the established library such as National Library of Malaysia, Universities, and to name a few. In this research, there is no such system that required the library to use wireless technology. From the public point of view, as a center or academic resources, library should implement this new technology in order to move along in the same level with other institutions.

### 2.2.1 Wireless Implementation

An assumption is made that there are probably too little to none mobile library system exist, although there are many implementation of mobile commerce available in the world today. There are two specific current application will be discussed as a relevance to the study, which are the Smar Library [1] and the m-Mall [5]. Related information on the study is limited as the technology is still new and not much companies and business have ventured into this area.

The SmartLibrary [23] is a location-aware mobile library services that provides map-based guidance to books and location on a PDA. The SmartLibrary is completely software-based solution, which can be provisioned atop a WLAN installed for wireless Internet access, without any additional hardware [23]. Using the SmartLibrary, users can search for books in the library using their PDA and locate the location of the book in the library on a user-friendly map, as well as providing the shortest path possible to the location. The m-Mall [24] is a system where its user are walking individuals that shop in stores nearby, or interact with the stands in an exhibition [24]. The m- mall server will know user location real-time, by means of an auxiliary network, and push information

into user handhelds, regardless of their technology. A simpler explanation of this system is where user with Bluetooth-enabled mobile device will accept offers, advertisement and other shopping information on their mobile device once they have entered the mall implementing the m-Mall system.

## 2.3 Related Works

Public Library of Fairfield [5] is now implementing the WiFi system. The website stated the term and condition in order for the user to access the system.

Greenstein [19] suggests that the third-generation of digital library nowadays abandoned this experimentation and the "build it and they will come" philosophy that characterized early library system. Through this matter, he says that information technology (IT) groups began to partner with the library to develop campus-wide standards for the deployment and operation of digital libraries as an integral part of the education enterprise. This development paralleled the development of heightened student requirements for access to library resources.

Cheryl Gastitus [18] claimed that a push application will automatically search a database for specific information and deliver it when and where the user directs--usually straight to their desktop. This form of information delivery represents not only a convenient means of receiving important information the user may not otherwise know exists, but more importantly for information professionals, this evolving distribution technology is substantially changing the way in which users interact with information, particularly in the time-sensitive financial services arena. Cheryl also claimed that this criterion that is push technology is enhancing the value special librarians add to the information dissemination process.

Kaasinen [14] analyzed user needs for location-aware services. In her interviews, most users did not mind being pushed information, as long as they really needed the information. Thus, location itself is not enough to trigger pushed advertisements, but it

has to be complemented with personalization. This need for personalization is recognized in a number of other studies as well.

Experts say the "simplicity" of accessing Wi-Fi is leading to its proliferation. Most new wireless devices, like PDAs and laptop computers, include wireless capabilities as a standard, rather than as an add-on, feature. What is more, standards for more advanced local area networking (LAN) technologies have come to the fore in recent years, showing corporate and government executives that they can, indeed, secure their wireless connections. [13]

According to M. Ocana from University of Alcala, [38] WiFi location determination systems use the popular802.11b network infrastructure to determine the user location without using any extra hardware. This makes these systems attractive in indoor environments where traditional techniques, such as Global Positioning System (GPS) fail

Yunos *et al.* [29] addressed the challenges and opportunities of wireless advertising. They surveyed existing advertisers like Vindigo, SkyGo and AvantGo, and approaches and technologies currently in use. They also presented five business models applicable to advertise

Mayo, Diane [15] Answering two key questions can enhance the effectiveness of current library technologies and ensure that new investments support the library's mission. First, what technologies provide the most effective support for the library's service priorities? Second, what technologies allow administrative functions to be managed more efficiently? Mayo makes an argument that the efficiency of management in library administration will lead to the best improvement for the public especially for the students.

A number of location-aware service studies list the mobile informing as one of the future possibilities in the application area. Barnes [3] introduced the concept of tempting nearby

users into the stores and delivering geographic messaging related e.g. to security in particular area of a city. Varshney and Vetter [13] suggested advertising/ informing to be a very important class of wireless commerce. They augmented location information with the personalization of the delivery by obtaining the history of the user's purchases or consulting the user at an earlier stage. In addition, the users might be able to either receive push information or actively pull the messages.

Ranganathan *et al.* [10] discussed informing in the context of pervasive computing environments. They presented a list of challenges and possibilities as well some ideas of solutions for informing in pervasive environments. The challenges include: reaching the people with the right infomation, delivering information at the right time, means for users to follow up on the information, and how to take next step for the information.

Christine L. Borgman [17] discussed that in the past, most theory and research presumed that the human activities involved in access to information could be isolated sufficiently to be studied independently. This is particularly true of information-seeking behavior, for example the information seekers' activities can be studied from the time they log onto an information retrieval system until they log off with results in hand. The process can be continued further by following subsequent activities to determine which resources discovered online were used, how, and for what purposes. Another approach is to constrain the scope of study to library-based information seeking. But to create the system that can transit the information to the student in the library is different compared to the situation of student purposely entering the library to find a specific info.

Cheryl Gastitus [18] also claimed that, today's push technology acts like a digital sieve that separates nuggets of critical information from mountains of data dirt. It delivers specific information to the user, often eliminating altogether the need to dig. For special librarians, this not only minimizes or eliminates laborious searching requirements; it can also reduce the need to educate users about how and where to find specific information

and should limit repeat requests for the same or like data. Although push functionality provides an efficient means of disseminating general information and recurring updates, it clearly is not a replacement for customized research.

Another approach for informing is the distribution of advertisement using multi-hop ad-hoc networks (MANETs), for example "AdPass" [11] or "eNcentive[11]. MANETs don't require an installed infrastructure consisting of base stations, cables or routers. If the distance between two mobile terminals is short enough they can establish a peer-to-peer communication (using Bluetooth or WiFi for example) to exchange the information

# CHAPTER 3

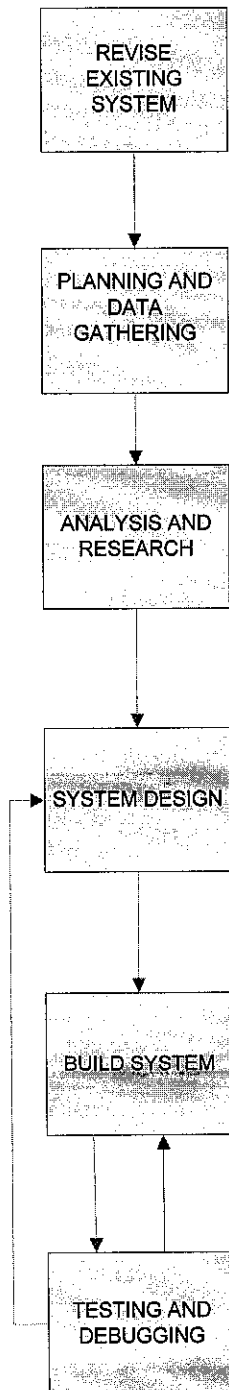# METHODOLOGY / PROJECT WORK

## 3.1 Methodology



**Figure 1: Project Methodology**

## 3.2　Project Steps and Phase Identification

As mention in the introduction part, in enhancing and developing this new system, it will involve 6 main phases which is basically referred to the normal system development life cycle. The 6 main phases are:

**a) Revise existing system.**

- In this phase, analyzing of the existing system is very significant to gather all the ideas needed. From the analysis, it is to acquire the information on the limitation of the system. Is the functionality of the system completely satisfied for the business need?
- In this part, the progress that have bee done by asking the administration about how does the flow of the old system now works in the library. This phase also is the beginning of the old system to be enhanced. Questionnaire is distributed to the staffs/ administration in order to get the clear picture of how they think about old system. The limitation of the system also is gathered and analyzed.

**b) Planning.**

- From the data gathered on the limitation of the previous system, new ideas should be formed on how to improve the limitation and to make sure the ideas should meet the latest users and business requirements.
- This is where all the data of the library materials collected. Also included is planning the type of user involve, specific function that appropriate for each users, and plan how to coordinate input and output data accordingly. The list of the system data is been search through multiple sites on the internet and also several journals.
- The importance of planning and collect reliable information is to gain as much knowledge and understanding the scope of library and how it can be related to

the wireless application. After some discussion and agreements, the data that are very sufficient to this research should include:

     i. List of books including the category, title, serial number and etc.

     ii. Students' data that are registered to this system including: Name, Student ID, login ID, password and email.

     iii. The level of ICT (Information and Communication Technology) awareness among students and administration.

     iv. The functional and non functional requirements for the e-procurement system.

## c) Analysis.

- Data gathering and fact finding by doing research, meetings, interviews and etc to collect information regarding the new systems developments, problems statement, requirements and preferences.

## d) Design.

- Plan and design the system on paper. Design system storyboard and user interface. Logical and physical design created such as data flow diagram and ERD diagram of the system.

## e) Build.

- Design the prototype by creating the functioning system and the design of the source code involve for the system.

## f) Testing.

- Provide training materials and test the system in the real environment experimenting using several users. Test the system compatible with the user requirements.

## 3.3 Tools

To accomplish the task of designing and developing this system, some applications and tools required. Different parts of the prototype need to author by using different tools such as the database, the coding to create function and to design the user interface.

- **Adobe Photoshop CS and Image Ready**

Adobe Photoshop CS and Image Ready is hands down, the most popular program for creating and modifying images. This image authoring tools is used for the design phase of the system. Adobe Photoshop will be used to design the interfaces of the web pages and used to editing some graphics or pictures which need to be touch to produce good image.

- **Visual Studio 2005**

This is the latest version of Visual basicl.net. The 2005 version is more easier in creating the wireless application because it got its own emulator for the mobile service. Since that most of the administrations and institutions in the Malaysia tend to use Microsoft as their operating system, therefore the Visual Basic .net is the best platform in creating this system

- **MySQL**

The database of choice was MySql Server. The database is used to store and retrieve information using the application system. Beside that, the store procedures are written and executed on this database server.

## 3.4 The design of the database

In this part, the author will be explaining the details of the database and its attribute for each of the table of the data. As the author mentioned before the platform to create the database for this system is the MYSQL. MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL), the most popular language for adding, accessing, and processing data in a database. Because it is open source, anyone can download MySQL and tailor it to their needs in accordance with the general public license. MySQL is noted mainly for its speed, reliability, and flexibility

Below is the illustration of the tables that is inside the 'library' server.



**Figure 2: List of the tables in the MySQL Server**

We can see that there are five (5) tables have been created for this system which is Announcement, book, book inventory, login and student. All the tables have their own fields and each table has their primary key and unique key so that it will be easier for the tables to interact or connect to each other if they got same key.

```
mysql> desc announcement;
+------------------------+--------------------+------+-----+---------------------+----------------+
| Field                  | Type               | Null | Key | Default             | Extra          |
+------------------------+--------------------+------+-----+---------------------+----------------+
| announcement_id        | int(10) unsigned   |      | PRI | NULL                | auto_increment |
| announcement_date      | datetime           |      |     | 0000-00-00 00:00:00 |                |
| announcement_description | varchar(100)     |      |     |                     |                |
+------------------------+--------------------+------+-----+---------------------+----------------+
3 rows in set (0.03 sec)

mysql>
```

**Figure 3: Table- Announcement**

**Figure 3** shows that the description of the announcement table. As we can see, the table consist three (3) attributes or fields which is announcement_id, announcement_date, and announcement_decsription. The Announcement_description is set to 100 (the value) which means that 100 words can be key-in for the description.

```
mysql> describe book;
+-------------------+------------------+------+-----+---------+----------------+
| Field             | Type             | Null | Key | Default | Extra          |
+-------------------+------------------+------+-----+---------+----------------+
| book_id           | int(10) unsigned |      | PRI | NULL    | auto_increment |
| book_title        | varchar(100)     |      |     |         |                |
| book_serial_number | varchar(100)    |      | UNI |         |                |
| book_type         | varchar(100)     |      |     |         |                |
| book_shelf        | varchar(100)     |      |     |         |                |
+-------------------+------------------+------+-----+---------+----------------+
5 rows in set (0.30 sec)
mysql>
```

**Figure 4: Table – Book**

**Figure 4** indicates the book table consist five (5) fields. There are book_id, book_title, book_serial_number, book_type, and book_shelf. In the book is the Primary Key for this table. Primary key means are used in building relationship between tables in the database. For this table, book_id pointed as primary key because in order to select the primary key, the character of the field is need to be a unique value. It means it cannot be replaced or duplicate in that system. Meanwhile the Unique key means that the data inside that field cannot be duplicated in any ways in the system. (Note that one table cannot have more than 1 key). From this table we can see that the book_serial_number is the unique key for

this table. Meanwhile foreign key (can be seen as _fk at the end of any particular field in the table.

```
mysql> desc book_inventory;
+-------------------+------------------+------+-----+---------------------+----------------+
| Field             | Type             | Null | Key | Default             | Extra          |
+-------------------+------------------+------+-----+---------------------+----------------+
| book_inventory_id | int(10) unsigned |      | PRI | NULL                | auto_increment |
| book_id_fk        | int(10) unsigned |      |     | 0                   |                |
| student_id_fk     | int(10) unsigned |      |     | 0                   |                |
| borrowed_date     | datetime         |      |     | 0000-00-00 00:00:00 |                |
+-------------------+------------------+------+-----+---------------------+----------------+
4 rows in set (0.00 sec)

mysql>
```

**Figure 5: Table – Book_inventory**

Above is the book_inventory table consist four (4) fields. The book_inventory_id is the Primary key for this table. There are also a book_id_fk (means foreign key), the student_id_fk and the borrowed_date in this table

```
mysql> desc login;
+----------------+------------------+------+-----+---------+----------------+
| Field          | Type             | Null | Key | Default | Extra          |
+----------------+------------------+------+-----+---------+----------------+
| login_id       | int(10) unsigned |      | PRI | NULL    | auto_increment |
| login_username | varchar(100)     |      | UNI |         |                |
| login_password | varchar(100)     |      |     |         |                |
+----------------+------------------+------+-----+---------+----------------+
3 rows in set (0.33 sec)

mysql>
```

**Figure 6: Table - Login**

Figure 6 shows the login table which got three (3) attributes in it. There are login_id, login_username, and login_password. This login tables is basically to match the administration access login with the system. Because this system is not a wholly system, the author assumes that all the passwords and the usernames for the administration will be handled by the IT department in the UTP.

**Figure 7: Table - Student**

The student table got five (5) fields in it. The student_id (Primary key), student_name, student_matrix_no (Unique key), student_email, and student_password. The extra column means that the student_id will be auto incremented whenever the data is being key-in in the database.

## 3.5 The Information in the database

This part is to give the example of the database that already filled with the information required. This is to help you to get the picture of how does the information looks like in the database. Those figure is basically show the 'behind the scene' of the database. The real interface will be shown later on the real system later on.

In order to view the database, the author needs to use;

select *from tableName;

(Note: This command is being used in the command prompt)

For example, if the author wanted to view book table, all the author needs to do is;

select *from book;



**Figure 8: Data Viewed - Book**

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Figure above shows the filled information in the book table. There are only two (2) keyed-in information is used for the testing. All the real data will be keyed-in later when overall project is finished.



```
mysql> select *from book_inventory;
+-------------------+------------+--------------+---------------------+
| book_inventory_id | book_id_fk | student_id_fk | borrowed_date       |
+-------------------+------------+--------------+---------------------+
|                 3 |          1 |            2 | 2006-09-15 10:21:20 |
|                 4 |          2 |            2 | 2006-09-15 10:21:27 |
+-------------------+------------+--------------+---------------------+
2 rows in set (0.00 sec)
```

**Figure 9: Data Viewed – Book_inventory**

From the above figure, we can see that the book_id_fk shows the book that is borrowed by the student_id_fk. From the book table above, we can see that the book_id and the book_id_fk is the same attiribute in this database.



```
mysql> select *from login;
+----------+----------------+----------------+
| login_id | login_username | login_password |
+----------+----------------+----------------+
|        1 | superuser      | superuser      |
+----------+----------------+----------------+
1 row in set (0.00 sec)
```

**Figure 10: Data Viewed- Login**

As the author mentioned before, in **Figure 10** part the author assume that all the administration login access is handled by the IT department of UTP. The author only makes a dummy password or the default password. That is why only one password can be used for this system.



```
mysql> select *from student;
+------------+----------------------+------------------+---------------------------+------------------+
| student_id | student_name         | student_matrix_no | student_email             | student_password |
+------------+----------------------+------------------+---------------------------+------------------+
|          1 | student1             | 1234             | student1@email.com        | password         |
|          3 | Wan Ezadora Wan Rusli | 4006            | ezadorarusli@gmail.com    | 4006             |
|          4 | Wan Ritaelfera       | 4008             | ladyyamp_ono@hotmail.com  | 4008             |
+------------+----------------------+------------------+---------------------------+------------------+
3 rows in set (0.00 sec)

mysql>
```

**Figure 11: Data Viewed - Student**

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For the student table (**Figure 11**), the author for now only adds three (3) dummies informations in order to ensure that the system is working out.

## 3.6 How to connect the MySQL with VB. Net

There are so many methods to connect to MySQL from .net environment. But in order to make it more sufficient, then there are three ways to connect to MySQL as mentioned by MySQL themselves.

- The ODBC.NET Solution - MyODBC Driver
- Using MySQL Native .NET Providers
- Using the OLEDB.NET Solution - MyOLDDB Provider

In this system, the author using the the ODBC .Net solution since that it is an open source and there a lot of tutorial that can be found in the Internet.

Since the author at this time yet to develop real connection between the real data, the author decide to show the simple connection that can be made using the simple database.

Now, the author develops a sample program to manage the information of the contact info. The sample application will store and retrieve data from MySQL in the backend.

First the author opens the MySQL client and types the following SQL commands.

```
mysql> CREATE DATABASE TestDatabase;
Query OK, 1 row affected (0.02 sec)

mysql> USE TestDatabase;
Database changed
mysql> CREATE TABLE Contacts
-> (ID Varchar(30),
```

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-> FirstName Varchar(25),

-> LastName Varchar(25),

-> HomePhone Varchar(20),

-> OfficePhone Varchar(20),

-> MobilePhone Varchar(20),

-> EMail Varchar(40),

-> PRIMARY KEY(ID));

Query OK, 0 rows affected (0.03 sec)


Now, the author has created a database in MySQL named TestDatabase with a table Contacts. This table will store the information of our Contacts in the VB.Net sample application. To check the database and the table just created, run the following two SQL commands in the MySQL client.

**SHOW DATABASES;**

**SHOW TABLES;**


Then,

Open MS Visual Studio .Net and create a new solution. The author names this as **MyContacts**. A form is automatically added to the project created by default. Now do the following UI programming on it.

In the Code window of the form, write the code as given in **Code-1.**


**Code 1**

```
Imports MySql.Data.MySqlClient


'Declare the following variables in the form


Dim cnMyContacts As MySqlConnection
Dim tblContacts As DataTable
```

```
Dim daContacts As MySqlDataAdapter
Dim cbContacts As MySqlCommandBuilder



'In the Load event


'Server is "TRYSAHAJA", UserName is "root" and Password is ""
Try
Dim strCon As String = String.Format("server={0};user id={1}; password={2};
database=TestDatabase; pooling=false", "SAJAD", "root", "")
cnMyContacts = New MySqlConnection(strCon)
cnMyContacts.Open()
Catch ex As Exception
MessageBox.Show(" Connection to MySQL Failed ", "Error", MessageBoxButtons.OK,
MessageBoxIcon.Error)
Exit Sub
End Try


tblContacts = New DataTable
daContacts = New MySqlDataAdapter("SELECT * FROM Contacts", cnMyContacts)
cbContacts = New MySqlCommandBuilder(daContacts)


daContacts.Fill(tblContacts)
grdContacts.DataSource = tblContacts


'In the Click event


Try
daContacts.Update(tblContacts)
Catch ex As Exception
```

MessageBox.Show(" Update Failed ", "Error", MessageBoxButtons.OK, MessageBoxIcon.Error)
End Try


**'In the Close event**

If Not cnMyContacts Is Nothing Then
cnMyContacts.Close()
End If


In Code-1, we first imported the Namespace MySQLClient. Then we declared the variables for MySqlConnection, MySqlDataAdapter, MySqlCommandBuilder and DataTable.


In the Load event of the form, we opened the Connection. Here, we assumed that the name of the Server is "TRYSAHAJA", the user being "root" with no password. We created an instance of the Adapter wherein we used the constructor which takes the SQL string and the connection object as the arguments. We used the MySqlCommandBuilder to generate the required command objects for the MySqlDataAdapter. Then we filled the data table using the adapter.


In the Click event of the button, we update the data in the database, and finally in the Close event of the form, we closed the connection.


Below is the 'MyContact' interface that connected with the 'TRY SAHAJA' MySQL server

**Figure 12: MyContacts**

# CHAPTER 4

# RESULT AND DISCUSSION

## 4.1 Previous System Discussion

The previous system is basically in manual system and flow. This system is focusing on normal system which contains borrow the books, return the books, database record, which is kept by the librarian, and also the OPAC which is the search system that need the user to go to the specific computers in order to get the access of the database for books. From the research that has been made, the previous systems do have several limitations in terms of lacking of information present to the students. The limitations are:

- User need to remind themselves each and every day about returning the book.

- User cannot get any updated news related to the library especially when lost something in the library. They need to ask leady cleaner in order to retrieve any lost.

- Students need to go to particular computer to get the information of the books that they are looking for. This make no sense when students in rushing doing something.

- Students need to meet the administration to know how much fines they cost for any overdue.

## 4.2 Ideas to Overcome Results

The new propose system should be able to provide better information for the students in order to make the system is easier to be followed by them.. In reply to this proposition, the new system should be able to overcome the limitation that exists by creating:

- Better system by connecting student with the database and any information needed by them
- Better system is significant for better attraction to the student because it is less complicated and sophisticated
- All the information regarding the information in the library is gathered in one channel that us mobile medium.

## 4.3    System Constraints

The discussion on system constraint for this project will be divided into two parts. The first part will be on the constraint before the project start and another part will be the constraint after the project is completed. For the first part the project constraint will be discuss based on four main factors which is schedule, cost, technology and policy.

| Schedule | The mobile library system must be fully operational by $25^{th}$ of Septmeber which is less than 2 months from now. There are 14 weeks given in completion of the project, the process of analysis, design, testing and implementation should be able to complete within this period of time. |
|---|---|
| Cost | This is an academic project, the tools and equipment should be provided by the university, the main objective is the system to accomplish the requirement of the project.The cost of the full functional should affordable enough for the users. |
| Technology | The new system must operate during office hour and peak hour. It should able to connect with the students. The new system should be highly supported by database management system. The user interface design for the new system should be user friendly and well coordinated than the previous system. |

| Policy | The system only involve licensing that's has been permitted by the institution. All the procedures provided by the administrator should be understandable and agreed by involved party |
|---|---|

**Table 1: System Constraint**
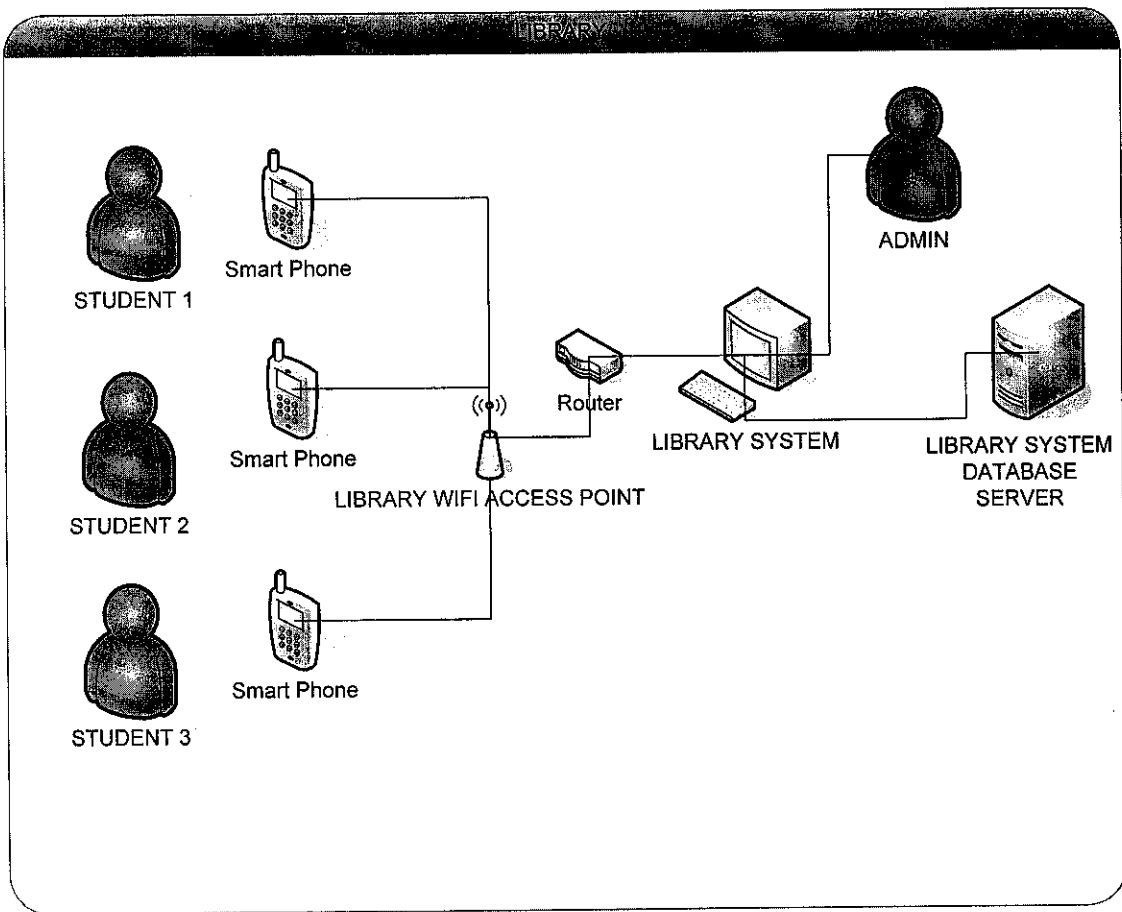
## 4.4 System Architecture



**Figure 13: Mobile Library System Architecture**

**Figure 14: Library System – User Modules**

**Figure 13 and Figure 14** shows the architecture of the system generally. Basically to access the system, students have to register at the library admin to get the username and password to access the library system. Student will use the smart phone as the intermediary tools that will connect to the system through wireless connection by using WIFI technology. The WIFI area is limited covered only the library which means as long as the student is inside the library they can get access the library system. The mobile library system and server will be fully under management of the administrator that will control and validate each input and output flow of information through the system.

For the Mobile Library System, the main task will be divided into two categories which is the Student module, Admin module whereby each user will have different function modules in the system. Below are the details of each module:

➤ Student Modules – Login modules to access the system, Status modules to view any related issues with library, Announcement modules to view any latest update or news post by the admin and Search modules to look for any books information that is available inside the library.

➤ Admin Modules – Student info and Status modules is to key in student information that is registered into the system database and post any status message to any particular student that have any issue with the library, Books info modules to key in and update books information inside the library system, Books inventory modules to update books quantity and availability inside the system and Post announcement modules is to update and post any news or announcement for the student.

## 4.5 System Process
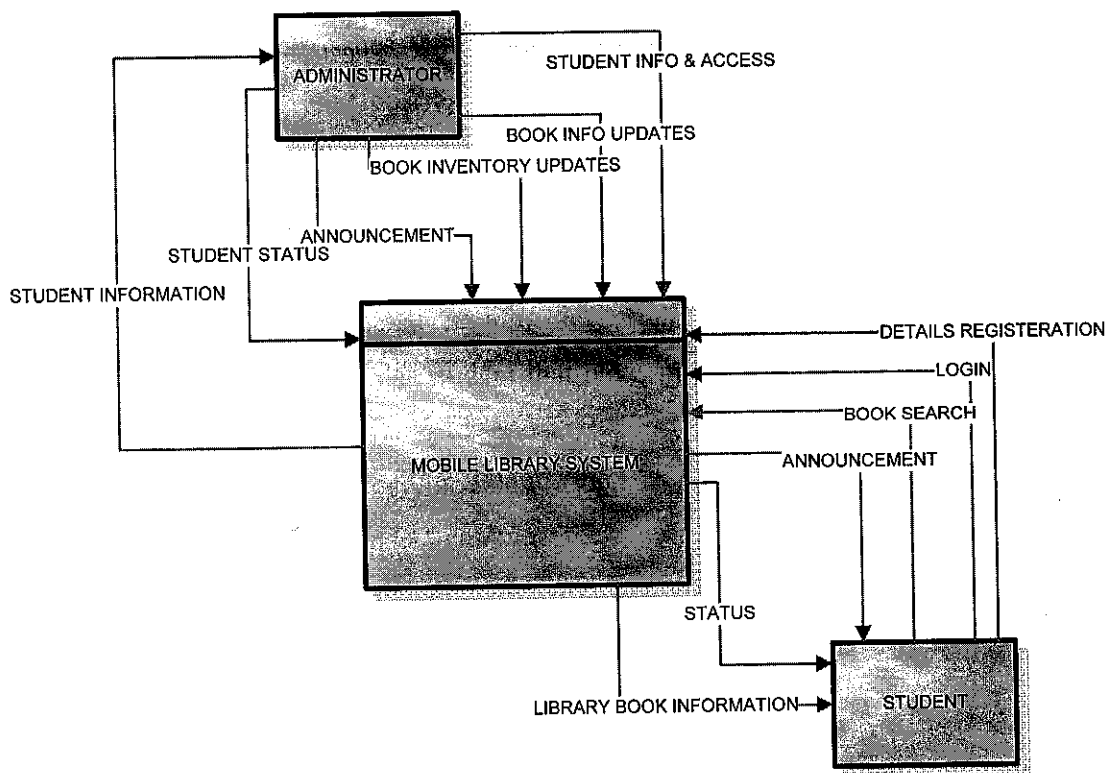


**Figure 15: Context Data Flow Diagram**

## 4.6  System Improvement Objective

| System Improvement Objectives | |
|---|---|
| **System objective** | **System constraint** |
| 1. Decrease the time needed for the students and administration. | 1. Human manual workforce will decrease. |
| 2. Decrease the workload required to handle manual system such as borrowing and loaning book procedure | 2. System must be compatible with windows XP operating system. |
| 3. Provide more important data related for student satisfaction | 3. System must always be in availability state. |
| 4. Improve user interface design. Make it more user-friendly. Information content should be placed in a correct page. | 4. System must be connecting to a database management system. |
| 5. Provide system help. | 5. Must be handle by a reliable and good server to handle multiple data and access. |
| 6. Maintain page, background, button and surrounding colors. | 6. System must be secured from internet viruses and hackers. |
| | 7. System must have a backup if something bad to happen. |

**Table 2: System Improvement Objective**

## 4.7 Requirement Analysis

The initial task of the requirements analysis phase is to identify requirements. While this may seem to be an easy or trivial task, it is often the source of many errors, omission and conflicts. The foundation for this task was established in the problem analysis phase when we identified system improvement objectives. Minimally, this task translates those objectives into an outline of functional and nonfunctional requirements that will be needed to meet the objectives.

A *functional requirement* is a description of activities and service a system must provide. Where else, *nonfunctional* requirement is description of other features, characteristics and constraint that define a satisfactory system.

- *Functional Requirement*

### Student's function
o Student login

In order to interact with the system, students need to login by entering the user name and password that are given by the administration during the registration process.

o Status function

Once entered the system, student will see the status interface which indicate the related information about the status of the student in the library database. For instance, if the student overdue a book from the library, the system will list all the information of the particular book including fines, book title, duration and etc through the status interface

o Announcement function

This function helps the student to get updated with the news in the library, any lost and found and etc.

o   Search function

This function will help the student to get information about the book in the library. For instance if the student wanted to search a book that related to a particular category such as programming, he or she can type the related keyword of the book and the system will list all the possible titles and where the book is located in the library.

**Administrator Function**

o   Student info

Admin is able to register any new member of the students that wanted to be part of this system. All the related information of the student such as name, matrix number, email and password will be registered to the system database.

o   Book information function

Administrator will be able to add in or register new books inside the database that will be available for the student to borrow or search. The admin will key in the book title, serial number of the book and book category.

o   Book inventory

Administrator will responsible in managing the availability of the book. This function will indicate which book is overdue, available and so on. This function also contains the 'borrow' and 'return'.

o   Announcement function

Administrator will responsible updating any announcement or any news that related to the library in order to help the student to be updated.

- *Non-Functional Requirement*

o  Inexpensive

This system is specifically design for particular business; in this case cost must be taken into great consideration to support and pursue this system. The student need to get a pocket-pc in order to access this system. Nowadays, pocket-pc is cheaper compared to a few years ago.

o  Security

For a wireless system, the level of security is undefined. This is depends on how strong is the encryption and decryption the data between two parties. This system basically did not focus well in the security part. All the transaction is based on the application tools used to create this system. Especially, for admin that will be controlling this system. A login page is being developed where by only registered user with specific password can enter the system. Each user a responsible for their information, meaning user can't manipulate other information without permission.

o  Reliability

The system should be reliable. The system must not perform with any error that can harm any transaction, the system also must be able to perform intensively and simultaneously where by multiple users connect to the system from different place and perform different task on the system at the same time. The system should be able to handle the situation. All the data that save should be accurate and safely store and as and this system should be able to work 24 hours everyday.

o  User friendly

In terms of the design of the system, user of the system (admin and student) should be able to understand on how to navigate through out the procurement for example on how to register, how key-in the data, how to login and etc. A user friendly system will make the user comfortable to use the system.

## 4.8 Prototype Interfaces
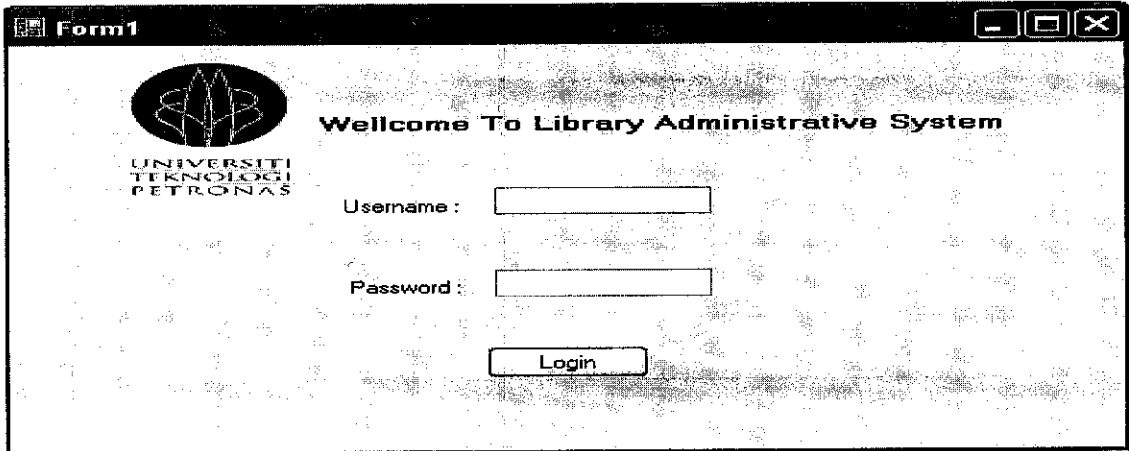
### 4.8.1 Administration

<u>Login Page</u>



**Figure 16: Login Page**

In order to access the administration system, the admin need to have the password. For this part, the author assumed that all the password and username of the administration is being given to them by the IT Management department.

## Student Information



**Figure 17: Student Information**

Above is the interface prototype of student inventory. This interface is for the admin to key-in or register the first timer (student) who wanted to access the facility of this system. The author assumed that the library administrator will provide some kind of policy or a letter of agreement between the admin and the student regarding the security or any circumstances that might happen in the future.

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## Book Information



**Figure 18: Book Information**

This interface is basically for the admin to update all the new arrival books. All the data of new books need to be saved for the future before the admin let the book being borrowed by the students. The serial number of the book is important because it will be using by the admin to keep track all the data of the books in the MySql Server. The data of those books will be updated later on in the Book_Inventory database.
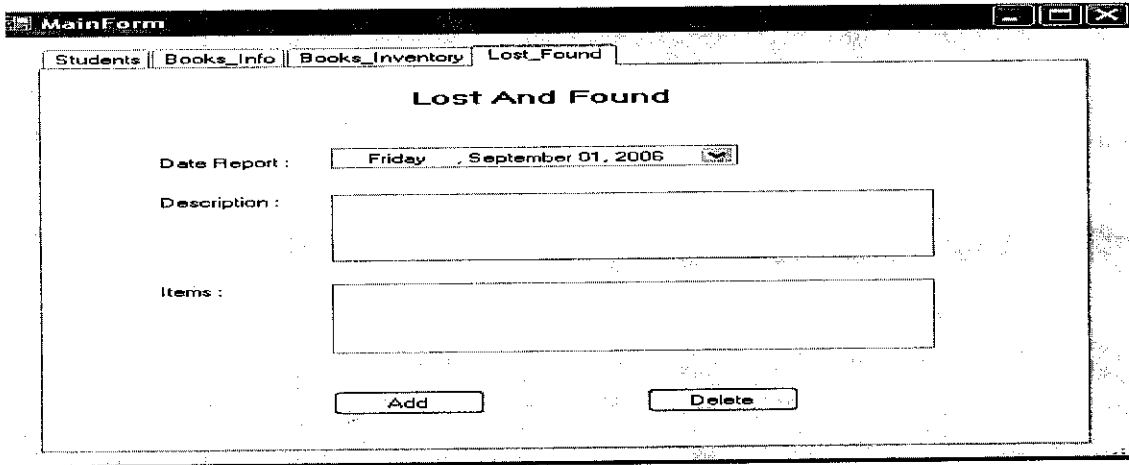
## Books Inventory



**Figure 19: Books Inventory**

This prototype is called Books Inventory where all the transaction (lending and returning) will be handled here. The admin can update the entire book by search any particular book with its serial number. All the data regarding the book itself, the student who lends the book and so on will be appeared here.

## Lost & Found (Announcement)



**Figure 20: Announcement**

This prototype is basically to help the admin to interact with the student. Once the information such as an announcement is added, the news or information will be appeared on the student's pocket pc. This is very helpful for the student to get any update news, any lost / found items and so on.

### 4.8.2 Student

The interface for the student part is simpler because the student role is to get the information directly from the administration. As the author already discussed in the objective, the system needs to be simpler yet effective for the student who is busy with their other routine activities.
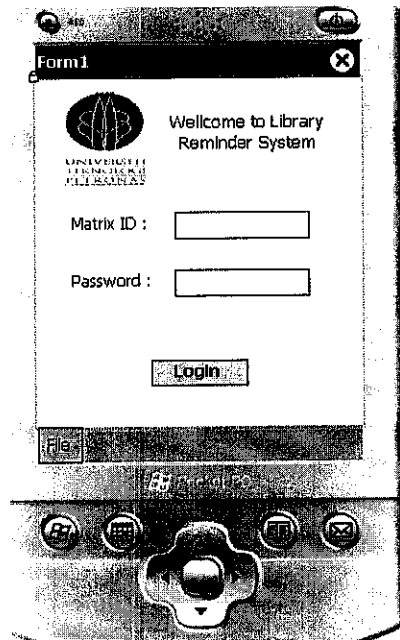
## Login Interface



**Figure 21: Student's Login**

This is the basic part of any student which needs to have a login interface for security. The password will be given by the admin who will receive the default password for each student from the IT & Management department of UTP.

## Main Student Interface
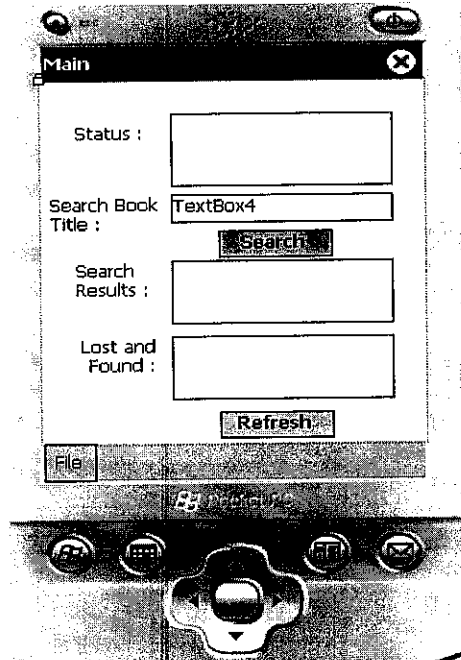


**Figure 22: Student Main Interface**

In order to make it simpler and effective for students, all the functions will be gathered in one interface. As you can see, the status box is for the information of the student whether he or she borrowing the book. If yes, then all the information of the book that they borrowed will be shown here. The Search Book Title is for the students who wanted to find a particular book in the library. They just need to key-in the keyword of the book, and the result of possible book will be appeared on the Result box. The Lost & Found is for the announcement that has been added by the administration in the administration system.

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## 4.9 User Acceptance Test

User acceptance test has been conducted in order to obtain the user's view regarding the finished system. This is important as to know how the user would preserve the system functionality and efficiency. The test was conducted on 10 students and 2 administrators who take the library as their routine thing to do everyday. The users evaluate the system using the form as shown in the table below.

| Attributes | Rating | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1. User Friendliness | | | | | |
| 2. Functionality | | | | | |
| 3. User control and freedom | | | | | |
| 4. Visibility of system status | | | | | |
| 5. Aesthetic and minimalist design | | | | | |

**Table 3: Sample Evaluation Form**

The definition for scale is:

1 - Very Poor, 2 - Below Average, 3 - Average, 4 - Meet Expectation, 5 - Outstanding

Each of the evaluation characteristic are explained to the volunteers. They are:

- User Friendliness: evaluation of the overall system interface design including its efficiency, visual visibility, ease of use and color coordination.
- Functionality: Evaluation on the importance of the functions inserted in the system as well as the usefulness of the data and the automated personality test
- User control and freedom: Evaluation on the ease of use and undoing action function.
- Aesthetic and minimalist design: evaluation on the system content, whether it contains enough relevant data within the page to be useful for the user.

The results of the user acceptance test are shown in the figure below in the order of the criteria measured. Please note that the full score of the rating is 5.

## 4.9.1 User Friendliness



**User Friendliness Rating**

■ 9%     ▣ 9%

■ 18%

□ 9%

□ 55%

Legend:
- ▣ Very Poor
- ■ Below Average
- □ Average
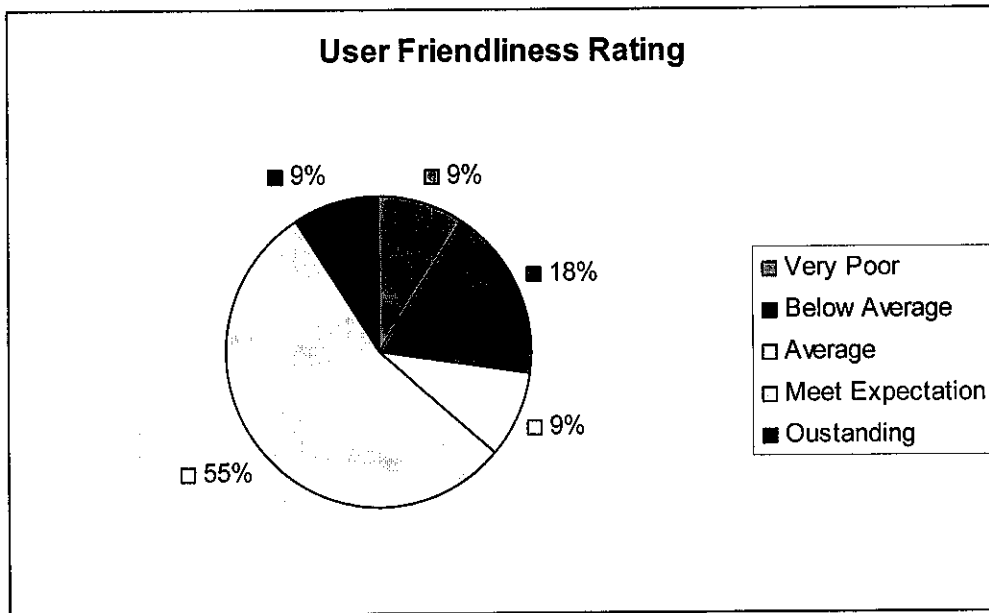- □ Meet Expectation
- ■ Oustanding

**Figure 23: Summary of User Friendliness criterion**

73% of the user gave rating above average for this criterion. Based on an informal interview session, the students perceived the need website will need some improvement in terms of its consistency between the information of the late in returning the books. Because, somehow the admin late in updating the information in the database. However, they agreed that the system's layout is simple yet knowledgable for the students in getting the inforamtion related to the library.

## 4.9.2 Functionality



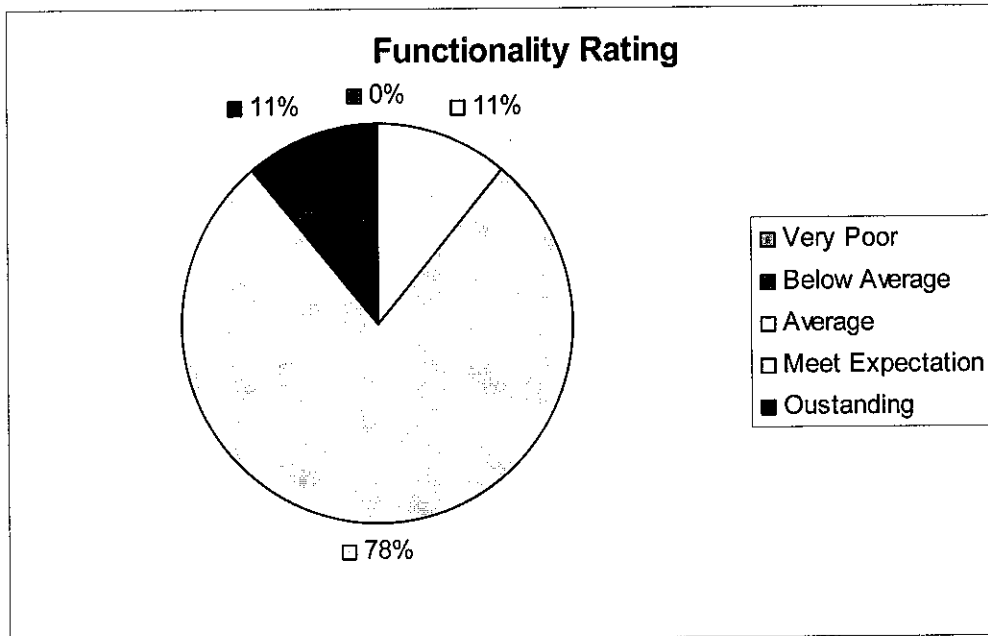**Figure 24: Summary of Functionality criterion**

89% of the users gave scores above average for this criterion. All the samples agreed that the system provided enogh information for the user to view the information provided by the library. This is regard from the 'Search' function that really helps the user to find particular book without them moving to the computer that provided the search system.

## 4.9.3 User Freedom & Control



**User Freedom & Control Rating**

■ 0%    ■ 9%

□ 45%

□ 46%

- ▣ Very Poor
- ■ Below Average
- □ Average
- □ Meet Expectation
- ■ Oustanding
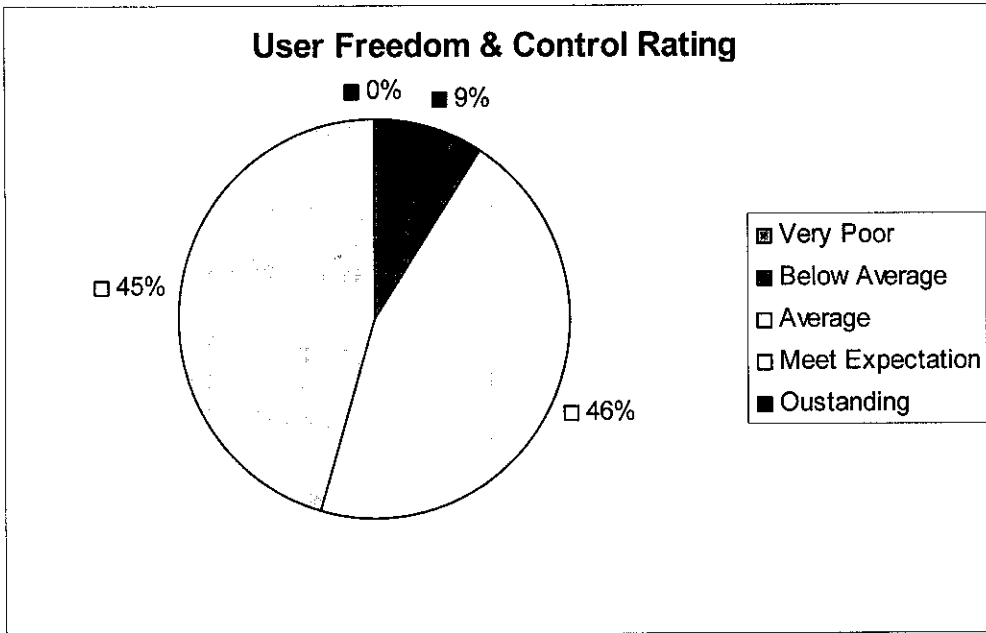
**Figure 25: Sumarry of User Control and freedom criterion**

Most of the users gave the average rating and meet expectation for this crterion. This is perhaps because the system is simple and need to be enhanced later on. They still impressed with the functionality but they claimed that this system need to be more flexible not just giving information to the user, but need to enhance in communicating function such as chat, forum and so on.
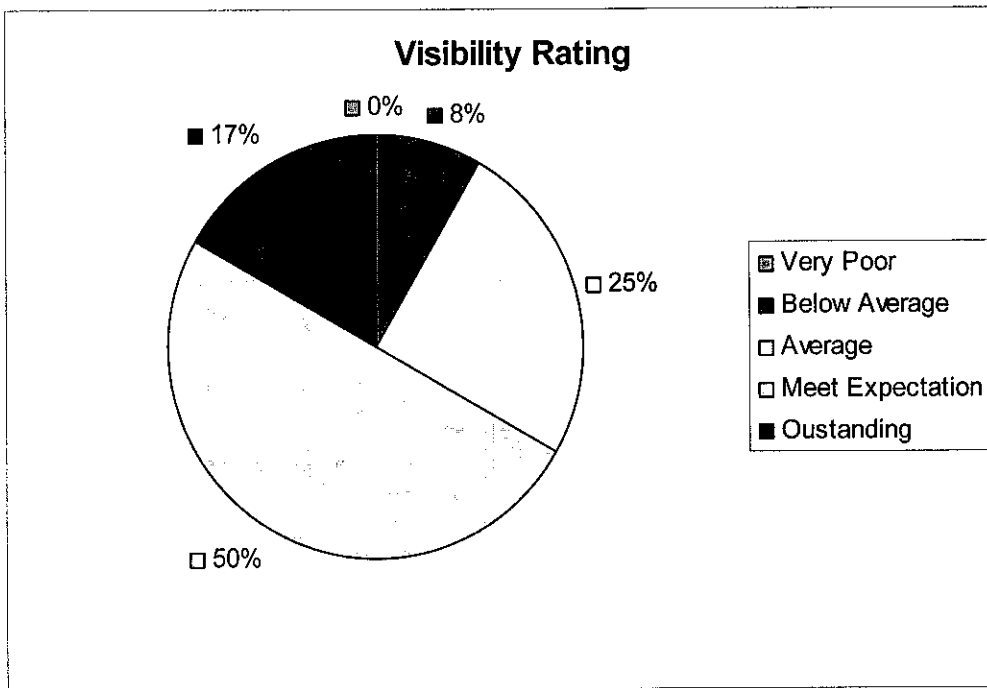
**4.9.4 Visibility**



**Figure 26: Summary of Visibility of System Criterion**

Based on the surveys, more than 90% of the users gave scores of above average for this criterion. This shows that the system has completed its objective, that is, to increase the effectiveness of the system's user friendliness in providing information to the students regarding the information status.

### 4.9.5 Aesthetics and Minimalist Design



**Aesthics and Minimalist Design Rating**

- 11% ■ Below Average
- 11% ▨ Very Poor
- □ 22% Average
- ■ 34% Below Average
- □ 22% Average

Legend:
- ▨ Very Poor
- ■ Below Average
- □ Average
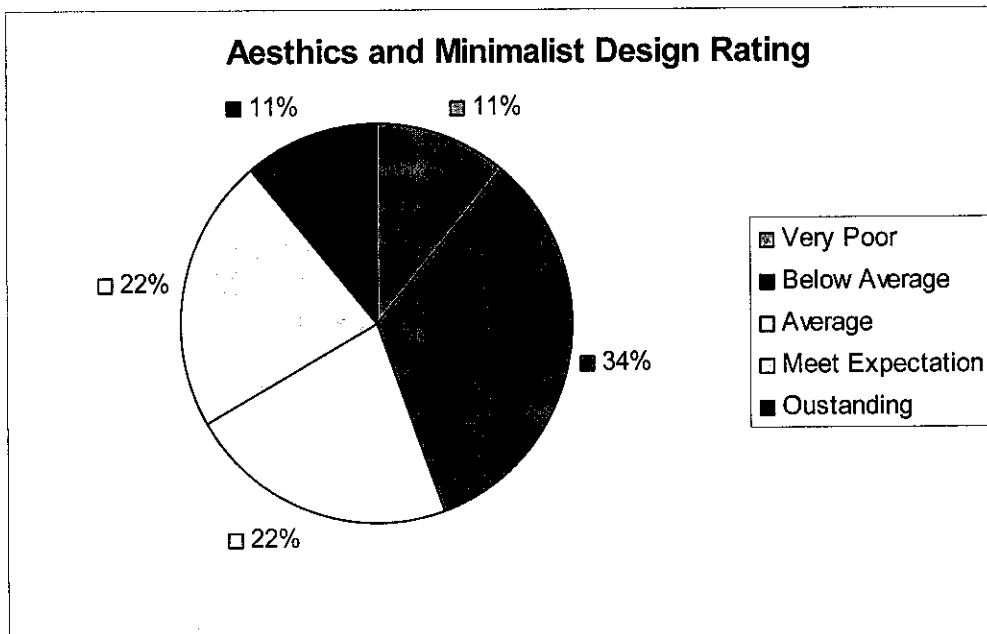- □ Meet Expectation
- ■ Oustanding

**Figure 27: Summary of Aesthetics and Minimalist Design Criterion**

All of the participants agreed that the system does not contain any irrelevant information. All the information presented during both parts of the system containts consistent data that conform to the objective of the system which is to deliver interactibe content for informing.

Overall, the students and administratiors are satisfied with the performance of the system. Although there are some minor drawbacks, they have agreed that this system is very helpful for the students to optimize the facility in the library.

## 4.10 Limitation of the System

Programming is not the main area of the author, as well as for the project, but additional knowledge and basic knowledge proves useful when developing this system. With author limited knowledge in the database area, some section of codes might be unacceptable for expert programmers. There are some limitation that the author cannot avoid because of limited time to enhance the system to make it more effective. But still, this system is very helpful for the students or other developer if they want to enhance the system. Below is the list of the limitation that the author found during the development. Basically the author can overcome the limitation but because of several constraints, the author cannot manage to get through the limitation. The limitations are:

- The system is able to show the information of one book per time only to the students. The more books info need to be shown, the more complicated coding need to be created. Because of the time constraints, the author is only able to do one book per retrieval.

- The security for this system is undefined, even the password is unique for each ogevery user, the security of the wireless communcation cannot be defined. The security of the system is not just the password itself but also the application being used by the author. ( Visual Studio.Net and MySql Server). It depends on the security of the platform that is being used.

- The system is totally focus on giving information to the students. There is no extra function that can make the system more attractive to the students such as forum, chatting session, and so on.

- The system can be operated within the library. It is hard for the author to broad the range of the wireless system since the sytem is using WiFi tehcnology which required a WiFi router in order to transfer the data / information to the students.

- This system required a pocket-pc in order for the student to be able to access the system. It is hard for the student who doesn't have the pocket-pc to keep track with the library's information. The pocket pc also need to have embedded WiFi in order to pull the information from the administration.

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The author has some suggestions to overcome those limitation. These will be discussed more on recomendation in the next chapter (Chapter 5).

# CHAPTER 5

# CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

This report presents the final study and research on pursuing the development of the Mobile Library research project, as a solution to the problem statement stated for this research. The obejctive and scope of study need to address all the problem statements mentioned in this report. The Mobile Library is a application solution that was proposed for this research project as a main solution to the problem statements. The technologies that will build the solution design such as Microsoft .NET Framework development toolkits, Microsoft Mobile Toolkit Extension, MySql Server for databasing, and WiFi technology. These technologies will help build the software system, consisting two modules; which are: (a) Student module, and (b) Administrator module. The design methodologies proposed for the design and development of the software system is System Development Life Cycle which consist six(6) phases: 1) Revise existing system, 2) Planning, 3) Analysis, 4) Design, 5) Build, 6) Testing and Debugging. Let me stress once again, that the research and development of the Mobile Library solution has no intention , whatsoever, to "reinvent the wheel" or reinventing other existing applications or researchs. This is not the purpose or even the motives behind this research. The Mobile Library research and development is a unique research, proposing because of library-based manual environment, making use of the recent mobile tehcnologies, and referencing to some existing researches ans system as a guide (but never to imitate), such as the SmartLibrary[23], the m-mall[5]. Mobile Library is the solution for tomorrow's future library system and hopefully with this new beginning, the system will be enhanced to more sophisticated in the future.

## 5.2 Recomendation (for Expantion and Continuation)

The main focus of this research is to propose a solution to the limitation and to address them in effective matter. Should the system development continue in the future, more functionality are as follows:

- To include user interface personalization, where user are able to choose their preffered color, font and so on after logging in.
- To be able to show more than 1 books in the status box ( pocket-pc)
- To include the usage of multimedia elements such as sound and video in the modules.
- To be able to provide extra function such as forum session, comment for administration, help desk function, chatting session and so on.
- Able to use mobile phone as a medium of this system.
- Enhancing the system by switching from using WiFi to more common wireless medium that is Bluetooth.
- To be able to implement barcode system in the future

The functionalities mentioned above will is basically focused on the students part where it will provide student with more features when dealing with the system, and in the same time will produce better result of using mobility device, hence bring greater value over traditional method

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