Mobile Library System

By

Ms. Panutda Tritham

A Final Report of the Three-Credit Course
CS 6998 System Development Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer Information Systems
Assumption University

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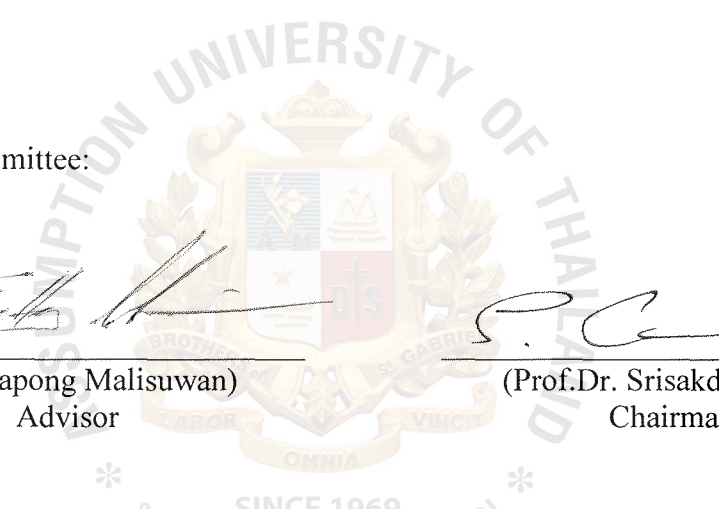CS 6998 System Development Project

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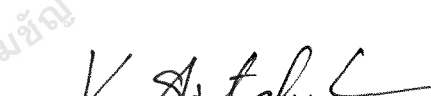Assumption University

July 2004

Project Title	Mobile Library System
Name	Ms. Panutda Tritham
Project Advisor	Dr. Settapong Malisuwan
Academic Year	July 2004

The Graduate School of Assumption University has approved this final report of the three-credit course, CS 6998 System Development Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer Information Systems.

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July 2004

ABSTRACT

With the advance of Internet, e-commerce has now grown to enormous proportions, and On-line Banking and shopping have proven to be such a success that the goal of business has become the provision of services that are available from anywhere and that over half of Internet access will be through non-PC. The mobile phone has become a part of daily life for many people, carry around everywhere with them, all day long.

Over recent years, the trend toward smaller and faster devices, coupled with the need for information access on the move, has paved the way for a new technology that brings together the two worlds of the Web and the mobile phone. The Wireless Application Protocol (WAP) is an industry-wide standard, defining a communications protocol and application environment that allows us to access Internet content and services from mobile phones. Designed from the ground up for low-power, small-screen devices with limited input capabilities and low bandwidth, WAP has enabled the development of a new breed of Internet-ready phones a mass-market price. It introduces a new way of looking at the wireless phenomenon, letting the applications follow their customers and provide them with innovative services.

The proposed system is developed to improve the web search book to access the information of researches from anywhere by the mobile phone. It makes the web search book and view library record support mobility by WAP technology. Furthermore, it provides accurate information of the search result. The proposed system is developed using modern structured system analysis and design techniques.

ACKNOWLEDGEMENTS

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1.1 Background of the Project

Mobile phones are becoming popular in people's daily lives, and it has functioned more than a simple communication device. The new technology of mobile phone enables flexible access to information at online services such as online tickets, e-mail, and so on. This has become possible due to the integration of mobile phone and Internet technologies or commonly called WAP technology. WAP, Wireless Application Protocol, is the protocol that enables mobile phones and PDAs to connect to the Internet and communicate with computer systems.

With this new development trend of mobile technology, one useful application is adopted by library services, whereby searches for traditional written documents and catalogues cards could be serviced through WAP. In this way, library services could be opened for access 24 hours a day from anywhere, even without a computer connection.

Through the integration of wireless technology with that of the Internet, productivity and efficiency could be derived. The usefulness of the Internet is therefore extended to the mobile phone users.

1.2 Objectives of the Project

The objectives of developing the project are as follows:

(1) To provide library book search service by mobile phone in using WAP technology.

(2) To save time on library services.

(3) To increase the efficiency of library work.

(4) To prepare a necessary platform for other services like borrowing and returning books.

(5) To provide a new communication channel to users and give more service alternatives to the users for maximum user' satisfaction.

1.3 Scope of the Project

The project covers major parts of the Mobile Library System which includes:

(1) To search books at the library by mobile phone.

(2) To check current borrowed item by mobile phone users.

1.4 Deliverable

Three components of the system will be delivered. First is System Analysis, which consists of Data Modeling Entity Relationship Diagram (ERD), Process Modeling Functional Decomposition and Data Flow Diagram (DFD), and Network Modeling. The second portion is *System Design*, which includes Feasibility Analysis, Physical Entity Relationship Diagram, Physical Data Flow Diagram, Network Topology Diagram, Interface and input/output design and System Structure. The Third portion is *System Implementation*. The system will be operated in the real production environment of the Central Library of Assumption University.

1.5 Project Plan (Including Gantt Chart)

The Mobile Library System started from the beginning of April till the end of June 2004. The project plan consists of three phases; system analysis phase, system design phase and system implementation phase. See Figure 1.1 Project Plan.

(1) System Analysis Phase

System Analysis is the dissection of a system into its components to study how those components interact and work. This phase surveys the plans of the system and project first. Then the study analyzes of the existing business and information system and the definition of business requirements and priorities for a new or improved system. The models are structured

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pictures that illustrate the processes, inputs, outputs, and files required responding to business events. System and business analysts draw a series of process models called Data Flow Diagram that depicts essential processes of a system along with inputs, outputs, and files.

(2) System Design Phase

System Design is the evaluation of alternative solution and the specification of a detailed computer-based solution. It is also called physical design. Structure design technique that is used for design is modern structured design. Modern structured design is a process-oriented technique for breaking up a large program into an hierarchy of modules that result in a computer program that is easier to implement and maintain. The software model derived from structured design is called a Structure Chart. The Structure Chart is derived by studying the flow of data through the program.

(3) System Implementation Phase

System Implementation is the construction of the new system and the delivery of that system into production. Construction is to build and test a functional system that fulfills business requirement and to implement the interfaces between the new system and existing production system. System Implementation consists of the construction and delivery phase. The construction phase comprises of building and testing networks, building and testing databases, installing and testing new software package, and writing and testing new programs. Delivery phase comprises of conduction of system test, preparation of conversion plan, installation of database, training system and finally conversion to the new system.

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No.	Task Name	September 1	2	3	4	October 1	2	3	4	November 1	2	3	4	December 1	2	3	4
I.	System Analysis																
1	Identify the Existing Problems																
2	Develop Work Flow of the System																
3	Identify the contents of Work Flow																
4	Define the New System Requirement																
5	Cost and Benefit Analysis																
II.	Detail Analysis and Design																
6	Develop ERD of the Proposed System																
7	Develop DFD of the Proposed System																
8	Database Design																
9	Data Dictionary																
III.	System Implementation																
10	Screen Layout																
11	Programming																
12	Data Conversion and Testing																
13	Delivery																

Figure 1.1.   Project Plan of Mobile Library System.

II. THE EXISTING SYSTEM

2.1 Background of the Organization

ABAC, or Assumption University as it is now known, was originally initiated in 1969. It was formally established in June 1972 and accredited by the Ministry of Education and the Ministry of University Affairs in May 1975. This University is administered by the Montfort Brothers of St.Gabriel, a worldwide Catholic Religious Order devoted to education and philanthropic activities. Assumption University has two libraries. St. Gabriel's Library is located at Huamark Campus and Cathedral of Learning is located at Bangna Campus. The organization chart of Central Library of Assumption University is shown in Figure 2.1. Now the library uses new technology for developing the library system by operating a website for searching books on the website, called online catalogue. Users can search for books by various methods.

The Library System offers the following various methods:

(1) Search or browse, by using exact key word.

(2) Search by Title, Author, Subject, Accession Number, ISBN, Series, and Call Number.

(3) Type of Materials.

(4) Search by Location.

(5) Type word(s) in the box.

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                    ┌─────────────────────────┐
                    │   Office of President    │
                    └─────────────────────────┘
                                 │
                                 ▼
                    ┌─────────────────────────┐
                    │     Central Library      │
                    └─────────────────────────┘
                                 │
              ┌──────────────────┴──────────────────┐
              ▼                                      ▼
   ┌───────────────────────────┐      ┌───────────────────────────┐
   │ St. Gabriel's Library     │      │ Cathedral of Learning     │
   │ Department ( Huamark )    │      │ Department ( Bangna )     │
   └───────────────────────────┘      └───────────────────────────┘
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Office of the Secretary	Acquisition and Cataloging Department	Reader's Service Department
· Administrative	· Acquisition Dept.	· Circulation Service
· Training and Development	· Cataloging Dept.	· Information Service
· Policy and Planning	· Serial Dept.	· Electronic & Digital Library Service

Figure 2.1.   Organization Chart of the off-line for Central Library of
Assumption University.

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2.2 Problem in the Existing System

In fact, there are not so many problems in the existing system. The new development for mobile research system aims for the following:

(1) Convenient Service.

At present, users have to connect to the university library network either by home linking or directly by using university computer facility to search for a book. Although the current system functions well, more convenient service is preferred by users. The mobile research system could provide more convenient service to library users at anytime and anywhere without using the computer.

(2) Alternative choice for book search

The new mobile research system provides a different platform for library users in searching books. Nowadays, service quality is an important factor to any organization. Users require good service. In order to provide better service to satisfy the users' requirements, the library has to improve its service by all means. A new search channel would give a new alternative choice in searching of book by library users.
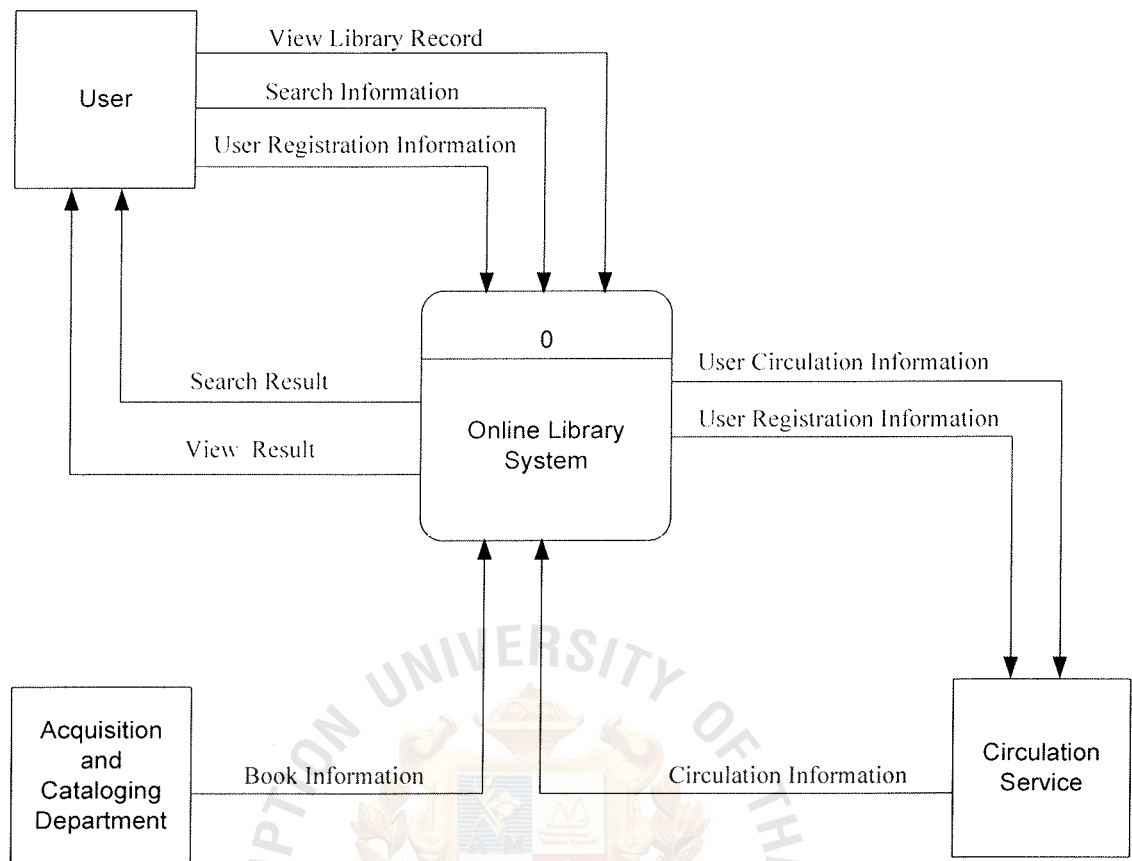
Figure 2.2.   Context Data Flow Diagram of the Existing System

2.3 The Existing Business Function

In the existing system, main business functions are as follows:

(1)   Users can search for books on the website.

        The existing system is able to provide the books available information for users' checking. It also provides basic information of the book. The users can easily find the book by searching the book information, and then look for the book on the bookshelf.

(2)   Users can view current borrowed items on the website.

        To save time in looking for a book, the existing system is able to indicate the borrowed item information. It includes the due date. Users can reserve the book in advance based on the due date of book.
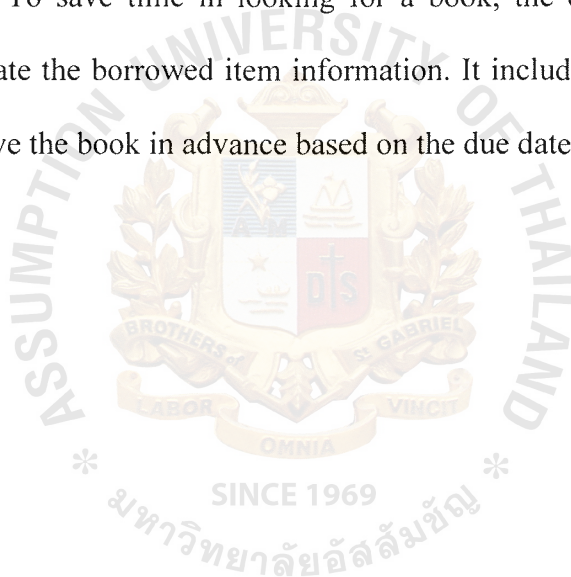
III.   THE PROPOSED SYSTEM

3.1   User Requirement

In developing the Mobile Library System, the most important information is used to analyze and design it. The proposed system meets the user requirements that will assist the system in gaining an achievement.

(1)   The user can search for books on a mobile phone.

(2)   The user can view current borrowed items on a mobile phone.

(3)   Mobile Library System will provide more convenient service to library users.

3.2   The Proposed Business Data

After studying data modeling and process modeling of the existing system and user requirement, a data modeling to depict the proposed system is created.

The figures of data modeling of the proposed system are shown below:

(1)   Context Entity Relationship Diagram.

(2)   Key-Based Entity Relationship Diagram.

(3)   Fully Attributed Entity Relationship Diagram.
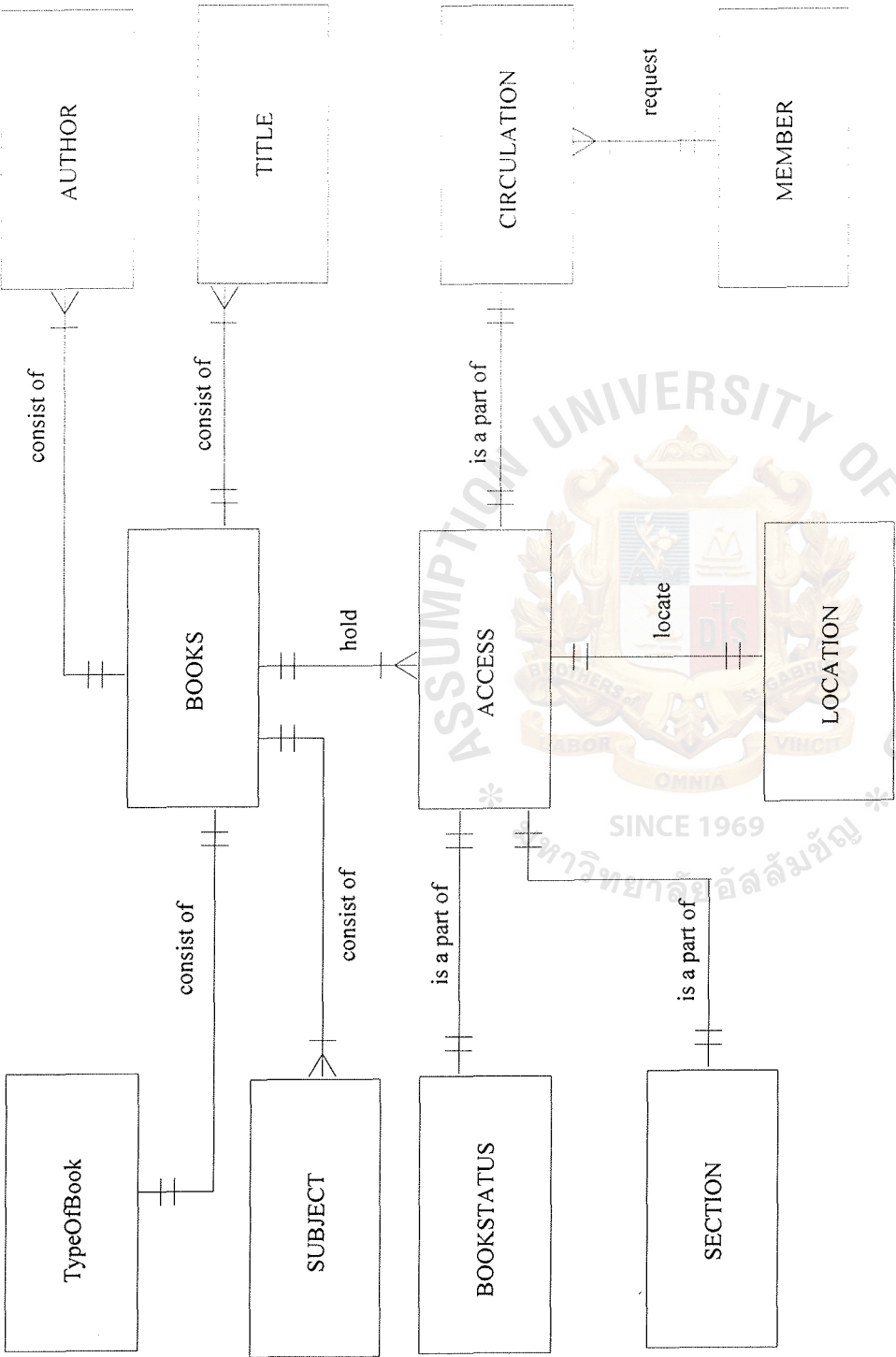
Figure 3.1.   Context Entity Relationship Diagram of the Proposed System.
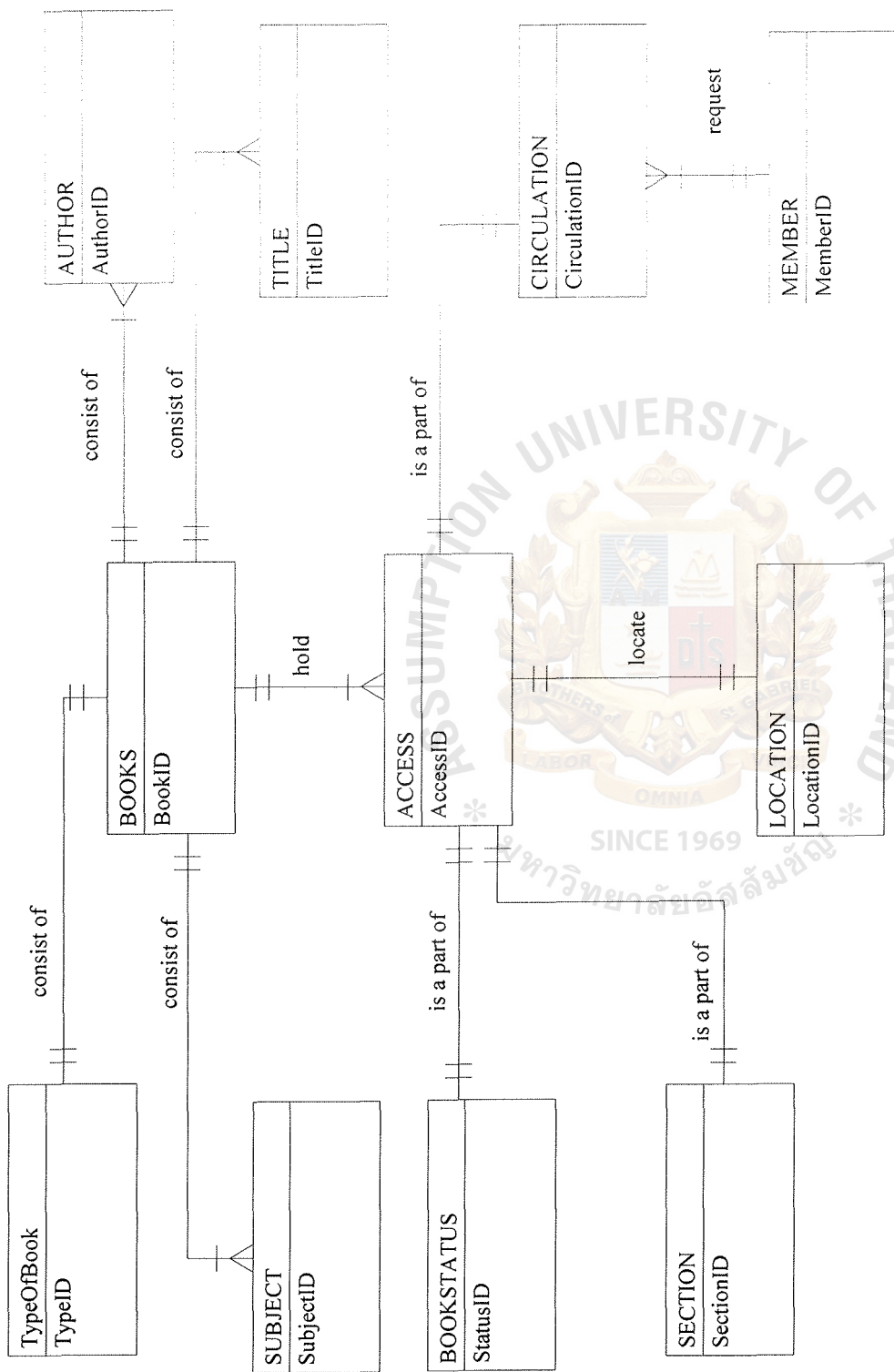
Figure 3.2. Key-Based Entity Relationship Diagram of the Proposed System.

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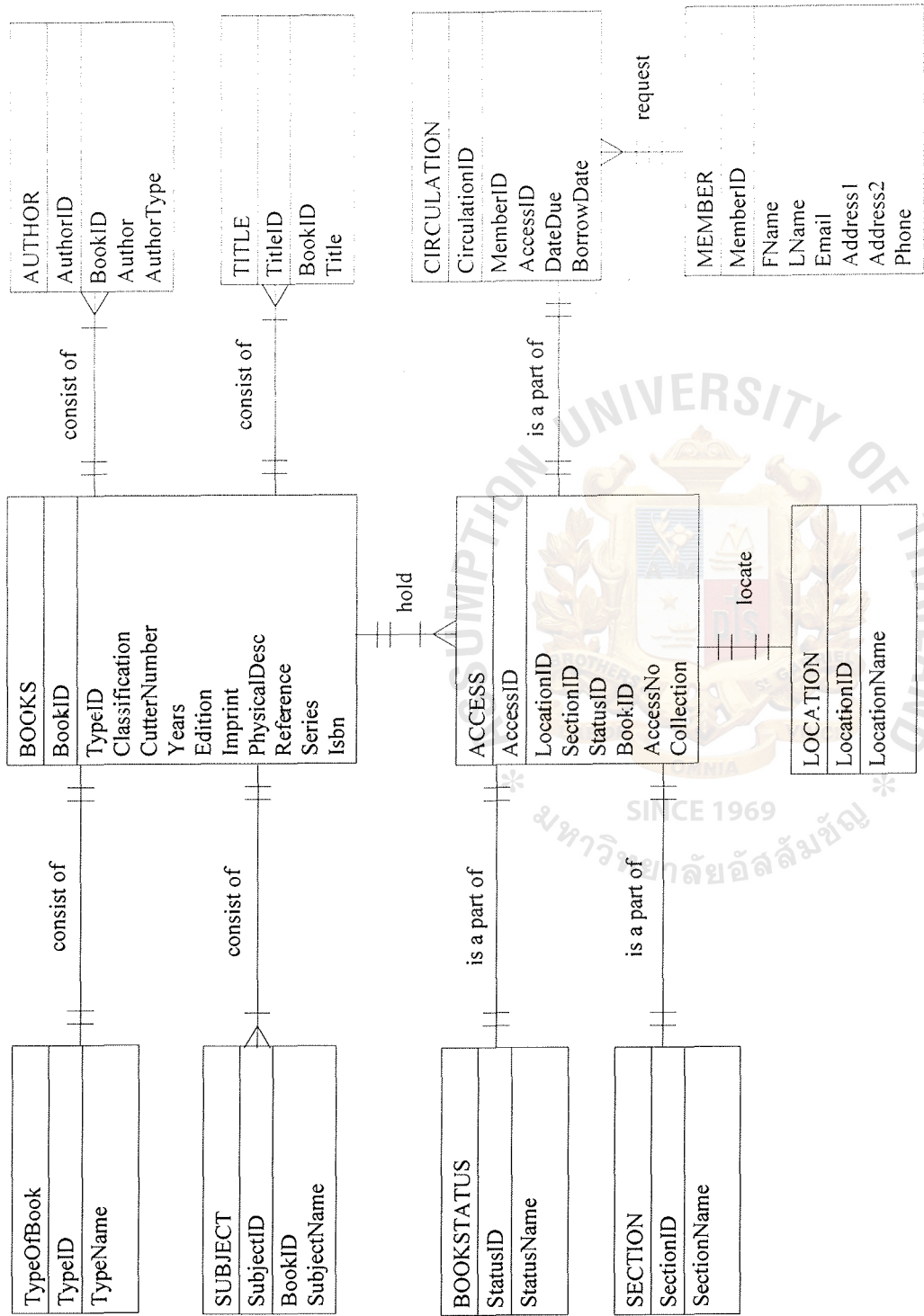
Figure 3.3. Fully Attributed Entity Relationship Diagram of the Proposed System.

3.3 The Proposed Business Processes

After developing data modeling, process modeling which meets user requirements to depict the process of the proposed system will be created.

The figures of process modeling of the proposed system are as follows:

(1) Context Data Flow Diagram.

(2) Functional Decomposition Diagram of Mobile Library System.

(3) Data Flow Diagram (1st, 2nd, …) level

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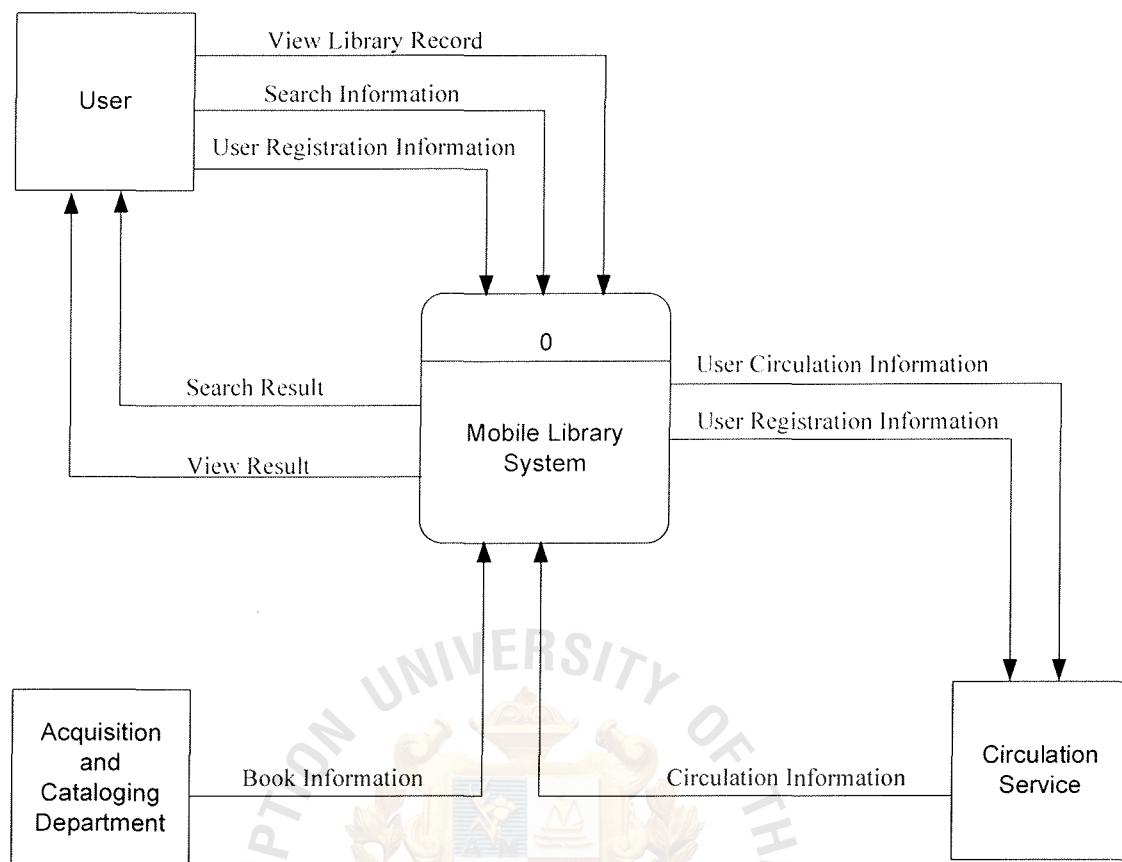
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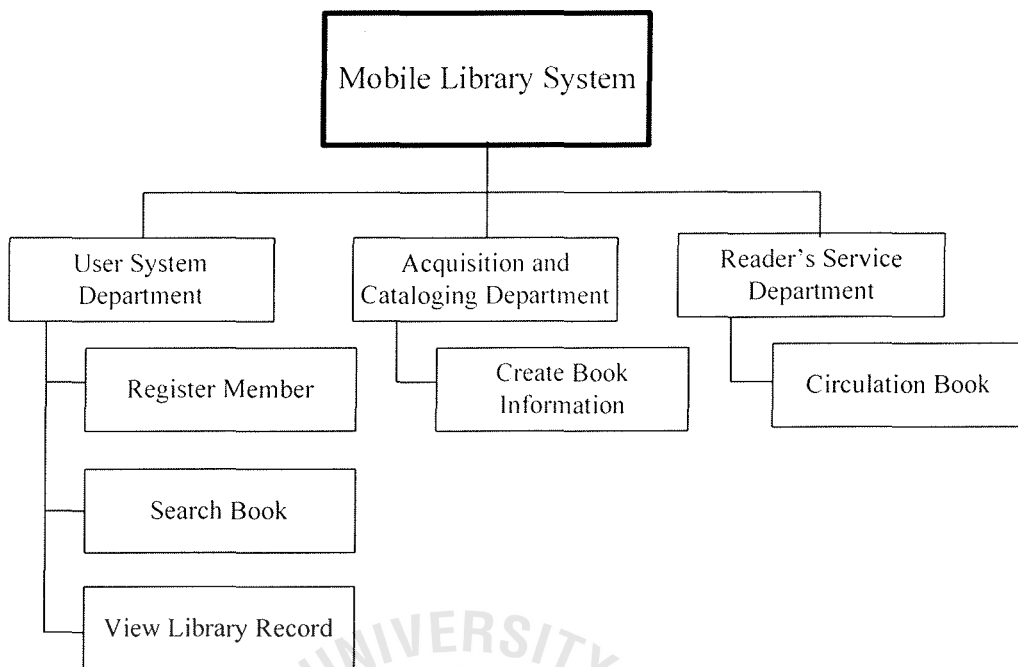
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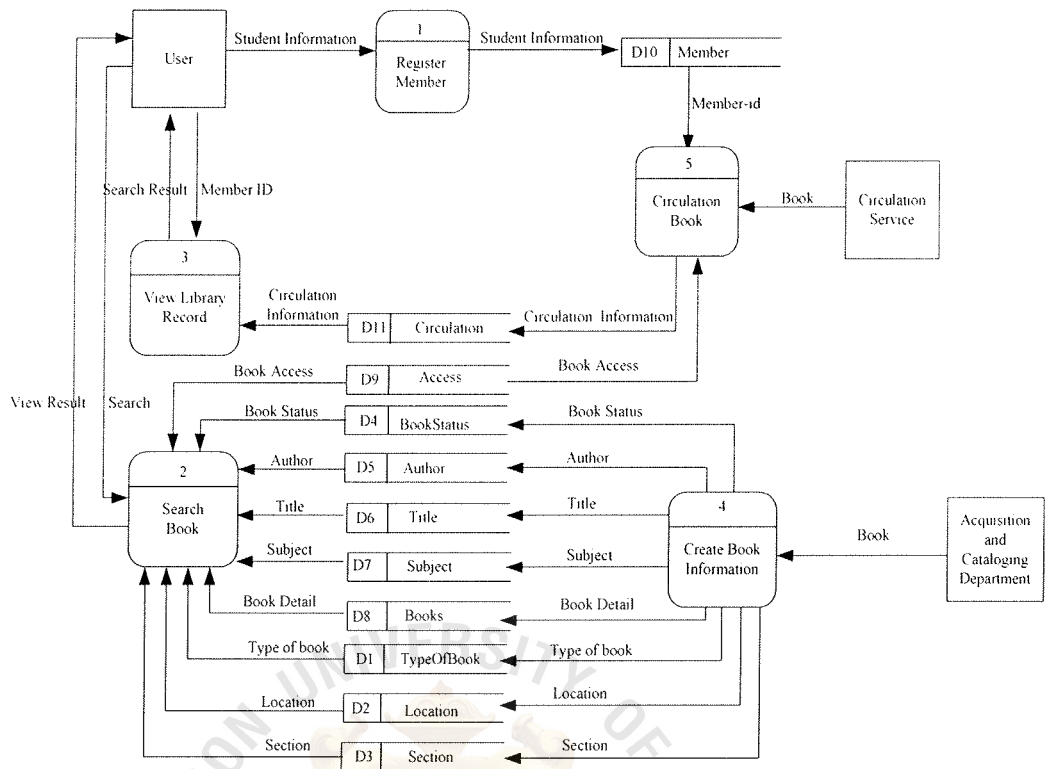
Figure 3.6. Data Flow Diagram (Level 1) of the Proposed System.

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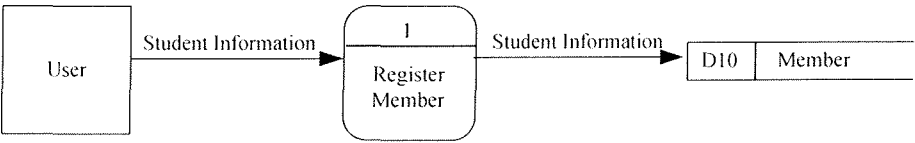
Figure 3.7.   Data Flow Diagram (Level 2) of the Proposed System.
Process 1 Register Member.
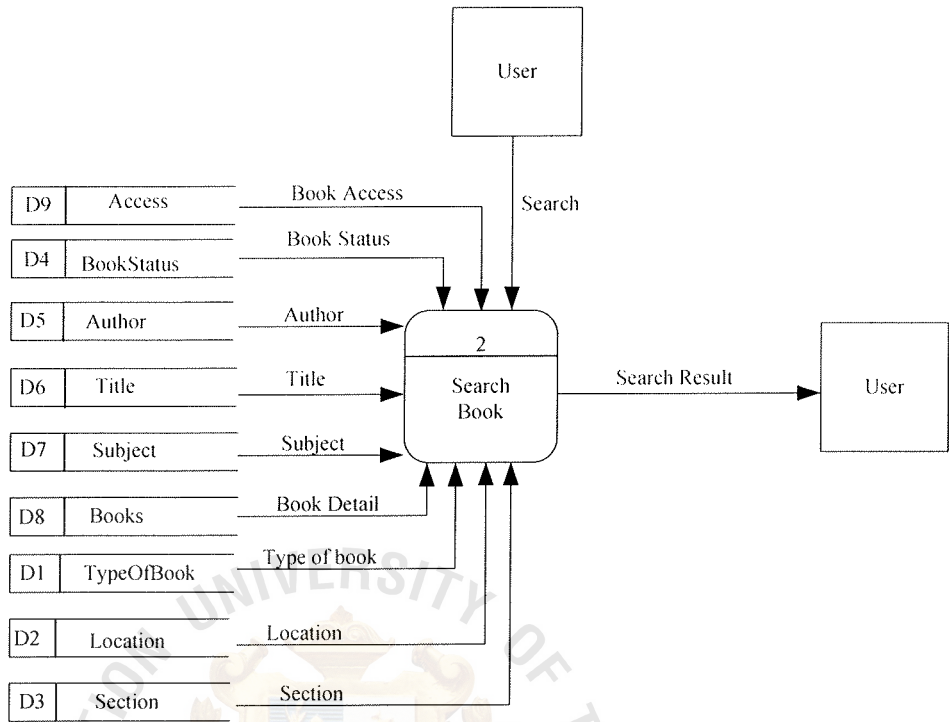
Figure 3.8.   Data Flow Diagram (Level 2) of the Proposed System.
Process 2 Search Book.

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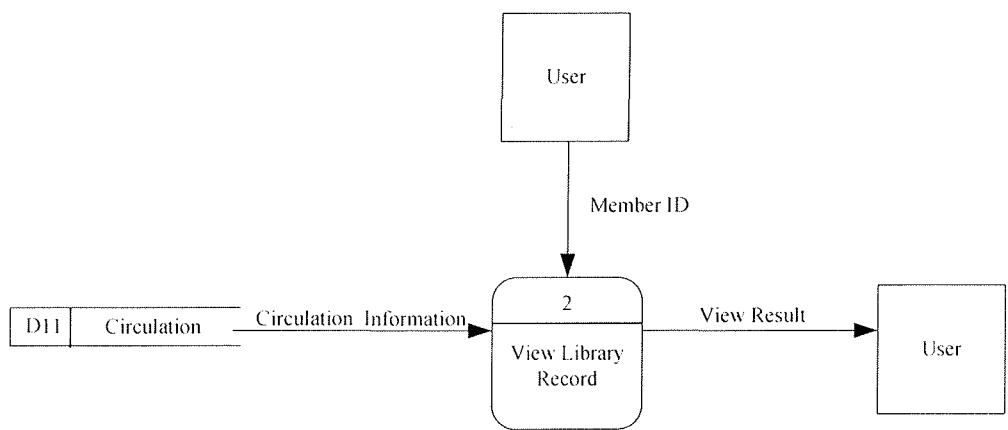
Figure 3.9.   Data Flow Diagram (Level 2) of the Proposed System.
Process 3 View Library Record.
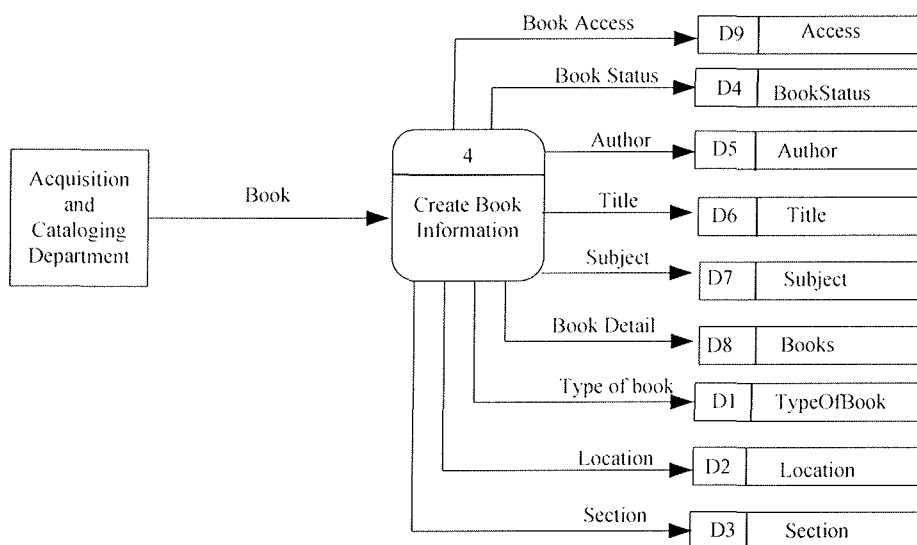
Figure 3.10. Data Flow Diagram (Level 2) of the Proposed System.
Process 4 Create Book Information.
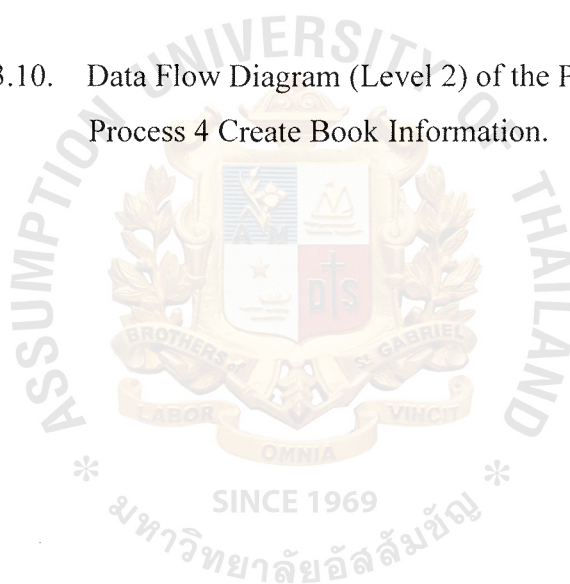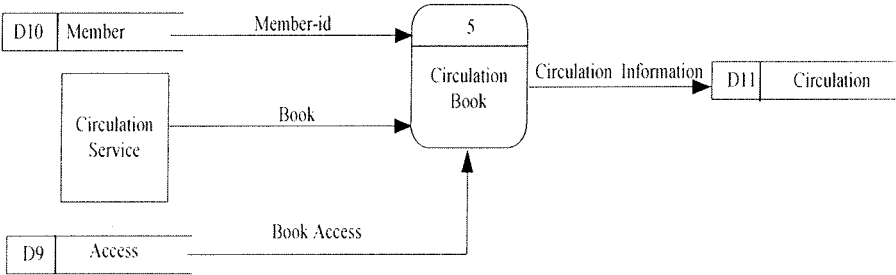
Figure 3.11.   Data Flow Diagram (Level 2) of the Proposed System.
Process 5 Circulation Book.

3.4 System Design

3.4.1 Candidate Solution

Candidate 1

Cost to develop:

Software:

License Windows 2000 Advance Server	70,000	Baht
WinWAP	5,000	Baht
MS SQL Server version 2000	125,000	Baht
Total cost of software	200,000	Baht

Hardware:

WAP Application Server	93,035	Baht
Database Server	132,000	Baht
UPS 1 Set	16,500	Baht
Total cost of hardware	241,535	Baht
Total cost of development	441,535	Baht

Candidate 2

Cost to develop:

Software:

License Windows 2000 Advance Server	70,000	Baht
TigerII WAP Tools 1.0	3,500	Baht
MS SQL Server version 2000	125,000	Baht
Total cost of software	198,500	Baht

Hardware:

WAP Application Server	93,035	Baht
Database Server	132,000	Baht
UPS 1 Set	16,500	Baht
Total cost of hardware	241,535	Baht
Total cost of development	440,035	Baht

3.4.2 Candidate System Matrix

The candidate systems matrix, which documents similarities and differences between candidate systems, is a useful tool for effectively capturing, organizing, and communicating the characteristics of candidate solutions. The characteristics of candidate system matrix consists of portion of system computerization, benefits, server and workstations, software tools needed, application software, methods of data processing, Output devices and implications, Input devices and implications and storage devices and implications.

Table 3.1. Candidate Systems Matrix.

Characteristics	Candidate 1	Candidate 2
Portion of System Computerized	Develop mobile library system for Library Center.	Same as candidate 1
Benefit	This solution can fulfill user requirements because of the following: - Having specific commands help and correct in writing WML Code.	This solution can fulfill user requirements because of the following: - Having specific commands help and correct in writing WML Code and WBMP image editor.
Servers and Workstations	Intel Xeon 2.8 GHz (WAP Application Server) Intel Xeon 3.06 GHz (Database Server)	Same as candidate 1
Software Tools Needed	WinWAP	TigerII WAP Tools 1.0
Application Software	Custom Solution	Custom Solution
Method of Data Processing	Windows 2000 Advance Server	Same as candidate 1
Input Devices and Implications	Keyboard, Mouse	Same as candidate 1
Storage Devices and Implications	Harddisk 36.4 GB	Same as candidate 1

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3.4.3 Feasibility Analysis

The proposed system is considered on feasibility analysis. The benefits or activities that occur in developing the proposed system will be measured. There are four general categories of feasibility tests which are as follows:

(1) Operational feasibility: Determines whether a proposed system is desirable within the existing managerial and organization framework.

(2) Technical feasibility: Determines whether a proposed system can be implemented with the available hardware, software, and technical resources.

(3) Scheduled feasibility: Determines whether how reasonable the timetable of a proposed system is.

(4) Economic feasibility: Determines whether the benefits of a proposed system outweigh the costs.

All three candidates, shown in Table 3.1, which depend on Feasibility Study shown in Table 3.2, are called feasibility analysis matrix. It determines which candidate solution referred to the candidate systems matrix is feasible, or achievable, given the organization's resources and constraints. There are four major areas of feasibility. They must be addressed, as operational feasibility, technical feasibility, economic feasibility, and schedule feasibility. The candidates will be given scores for each criterion. After scoring, a final score is recorded in the last row for assessment. This matrix format can be most useful in defending our management reputation.

After analyzing the feasibility analysis matrix of each candidate, the second candidate is selected to propose to the managing director for approval so that the system design will be initiated.

Table 3.2. Feasibility Analysis Matrix.

Feasibility Criteria	Weight	Candidate 1	Candidate 2
Operational Feasibility	25%	Fully supports user required functionality but less than candidate 2 Score : 90	Fully support user required functionality Score : 100
Technical Feasibility	30%	Easy to create complex WML code but difficult to create image format. And easy to expand system without affecting the system. Score : 90	Easy to create complex WML code and image format supported by all WAP based software and hardware. And easy to expand system without affecting the system the same as candidate 1 Score : 95
Economic Feasibility Cost to develop: Payback period (discounted): Net present value: ROI: Detailed calculations:	25%	~441,535 baht. ~ 2 years and 4 months ~1,513,213.91 baht 27% Appendix D. Score: 80	~ 440,035 baht. ~ 2 years and 3 months ~ 1,773,722.11 baht 59% Appendix D. Score : 90
Schedule Feasibility	20%	5 months Score : 90	4 months Score : 100
Ranking	100%	87.50	96

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3.4.4 Hardware for the WAP Application Server

The proposed system will use Internet and WAP system, therefore the server must have the hardware specification which can support the function of Web Application Server. It should be stable and reliable for serving multiple users. The hardware specification should be Intel Xeon 2.8 GHz used as WAP Application Server run on Window 2000 Advance Server operating system and Internet Information Server 5.0 for the Web Server. The details of hardware specifications for the WAP Application Server are shown in Tables 3.3.

Table 3.3.   Hardware Specification for the WAP Application Server.

Software	Specification
Processor	Intel Xeon 2.8 GHz
Cache Memory	Upgradeable to dual processing
Memory	512MB Advance ECC PC2100 DDR SDRAM (MAX 8 GB)
Storage Controller	Integrated Dual Channel Wide Ultra3 SCSI Controller
Hard Drive	36.4GB Ultra320 Hot Plug SCSI HDD standard
Network Controller	NC7760 PCI Gigabit NIC 10/100/1000 WOL
Diskette Drives	1.44 MB
CD-ROM	High Speed IDE
Tape Backup	20/40 GB DDS-4 DAT Drive
Graphics	Integrated ATI Rage IIC Video Controller with 4 MB Video Memory
UPS	1000 VA

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3.4.5 Hardware for the Database Server

The proposed system separates the database for other servers to increase performance. It will be installed with the SQL server 2000, so it should be stable and reliable to support transaction of the database. The hardware should be Intel Xeon 3.06 GHz used as database server to run on Window 2000 Server operating system and SQL Server 2000 for the database server. The details of hardware specifications for the Database Server are shown in Table 3.4

Table 3.4. Hardware Specification for the Database Server.

Software	Specification
Processor	Intel Xeon 3.06 GHz
Cache Memory	Upgradeable to dual processing
Memory	512MB Advance ECC PC2100 DDR SDRAM (MAX 12 GB)
Storage Controller	Integrated Dual Channel Wide Ultra3 SCSI Controller
Hard Drive	36.4 GB Ultra 320 Hot Plug SCSI HDD Standard
Network Controller	NC7781 PCI-X Gigabit NIC 10/100/1000 WOL
Diskette Drives	1.44 MB
CD-ROM	High Speed IDE
Tape Backup	20/40 GB DDS-4 DAT Drive
Graphics	Integrated ATI Rage IIC Video Controller with 4 MB Video Memory
UPS	1000 VA

3.4.6 Software

Mobile Library System will be developed using WML to display the content to the WAP browsers on mobile devices. The details of software specifications for the WAP Application Server are shown in Table 3.5.

Table 3.5.   Software Specification for WAP Application Server.

Software	Specification
Microsoft Windows 2000 Advanced Server	Operating System
Internet Information Server	WAP Server

In order to enable a web server to host WAP applications, we merely need to add the MIME types for WAP files in the configuration setting of the server. MIME (Multipurpose Internet Mail Extensions) is a method used to convert and transmit files over the Internet. Most WAP browsers accept only WAP MIME types, and sending a file with the wrong type in the header will generate an error.

On the part of database server, we develop database on the SQL server version 2000 and it runs on Windows 2000 Server. The details of software specifications for the WAP Application Server is shown in Table 3.6.

Table 3.6.   Software Specification for Database Server.

Software	Specification
Microsoft Windows 2000 Advanced Server	Operating System
SQL Server 2000	Database Server

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3.4.7 Network Configuration

WAP has three elements of network, which have different functions as follows:

(1)   Content/Origin/Application Server: This is the element in the network where the information or web/WAP applications reside. (Web servers belong to this category)

(2)   Proxy: This is an intermediary element, acting both as a client and as a server in the network. It is located between clients and original servers; the clients send requests to it and it retrieves and catches the information needed by contacting the original servers.

(3)   Gateway: This is an intermediary element usually used to connect two different types of network. It receives requests directly from the clients as if it actually were the original server from where the clients want to retrieve the information. The clients are usually unaware that they are speaking to the gateway.

In this system, we choose the first element for the solution of network configuration. To access an application stored on the server, the client initiates a connection with the WAP gateway, and sends a request for content. The gateway converts the request coming from the WAP client into the format used over the Internet (HTTP), and then forwards it to the original server. On the way back, the content is sent from the server to the gateway, which then translates it to WAP format, and then sends it to the mobile device. The gateway allows the Internet to talk to the wireless network. As with the database server solution, business logics could be distributed to the WAP application server. The network configuration is shown in Figure 3.12.
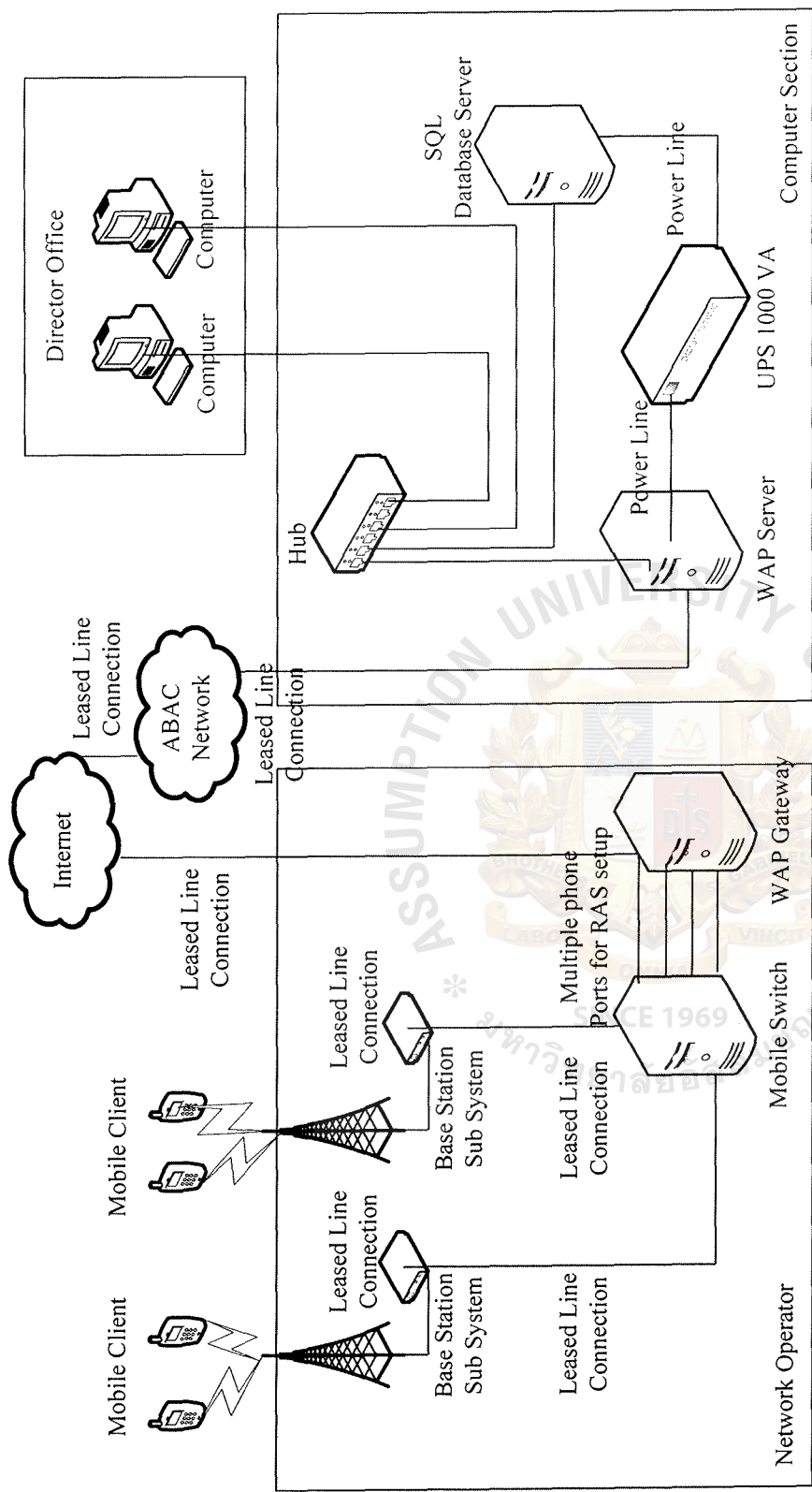
Figure 3.12.   Network Configuration of the Proposed System.

3.5 Security and Control

The basic concepts of security are as follows:

(1)   Authentication

(2)   Confidentiality

(3)   Integrity

(4)   Authorization

(5)   Non-repudiation

Authentication is the process of making sure that another party is actually who they claim to be. There are many different ways of authenticating parties to a transaction organization. The participants in the transaction need to agree an authentication protocol that they are capable of using and that meets their requirements. Confidentiality is one of the most important aspects of security. While authentication may have conclusively identified the participants in a transaction, the information that the two parties are communicating will be sensitive or intercepted. It is necessary to assume that communications will be intercepted and take steps to ensure that when the information is intercepted it cannot be understood or used. It is usually encrypted.

Integrity assumes that messages can be interfered with along the way. We need to be able to make sure that the message was not tampered with during transmission. Authorization is the process of determining whether a particular party has the right to perform a particular action with respect to a particular object, in a particular situation. For authorization to be meaningful there has to be, at the very least, an effective mechanism of authentication. Authentication is, therefore, a necessary prerequisite for authorization. Non-repudiation means implementing some sort of mechanism so that it is impossible for the parties to a transaction to deny either that the transaction took place, or that they were party to it.

Achieving security of database environment means identifying the threats and choosing the proper policies (what the security system is expected to do) and mechanisms (how the security system should achieve the security goals). Therefore, Information Security Policies and Standard have been established in order to lay down corporate-wide guideline for the protection of information asset. These are described in the following sections.

3.5.1 Data Security

(1)   Provisions are made for the recovery and restoration of information lost due to computer failure, loss, and disaster or operator's error.

(2)   Back-up copies of processing data/software must be made at least daily. The WAP application server includes the tape backup device for backing up the system and data. Other micro-based information must be backed up on a schedule that reasonably reflects the risk associated with losing it.

3.5.2 Physical Security

(1)   Uninterruptible Power Supply (UPS): UPS system will supply power to the system controller (WAP application server and database server) to continue some processing job for a short period of time after the outage of the main power.

(2)   Hot Plug Redundant Power Supply: When the main power supply is damaged, we can swap the new power supply to the system immediately without having to down the system.

3.6 System Cost Evaluation and Comparison

(1) Cost of Existing System

Table 3.7. Existing System Cost Analysis, in Baht.

	Years					
	1	2	3	4	5	6
Hardware Cost:	175,000	15,000	15,000	15,000	15,000	15,000
Software Cost:	130,000	20,000	15,000	15,000	15,000	15,000
Maintenance Cost:	0	25,000	32,500	42,250	54,925	71,403
Training Cost :	20,000	15,000	18,000	21,600	25,920	31,104
Staff Cost:	150,000	180,000	216,000	259,200	311,040	373,248
Utility Costs:	15,000	15,000	15,000	15,000	15,000	15,000
Miscellaneous Cost:	15,000	18,000	21,600	25,920	31,104	37,325
Total Costs:	505,000	288,000	333,100	393,970	467,989	558,079
Cumulative Cost:	505,000	793,000	1,126,100	1,520,070	1,988,059	2,546,138

(2)   Cost of Computerized System

Table 3.8.   Computerized System Cost Analysis, in Baht.

Items	Years					
	1	2	3	4	5	6
Hardware Cost:	241,535	25,000	25,000	25,000	25,000	25,000
Software Cost:	198,500	20,000	20,000	20,000	20,000	20,000
Maintenance Costs:	0	30,000	33,000	36,300	39,930	43,923
Training Cost :	40,000	30,000	20,000	15,000	10,000	10,000
Staff Cost:	90,000	108,000	129,600	155,520	186,624	223,949
Utility Costs:	10,000	7,500	7,500	7,500	7,500	7,500
Miscellaneous Cost:	8,000	8,000	8,000	8,000	8,000	8,000
Total Costs:	588,035	228,500	243,100	267,320	297,054	338,372
Cumulative Cost:	588,035	816,535	1,059,635	1,326,955	1,624,009	1,962,381

(3)   Comparison of System Costs between Existing System and Proposed System

Table 3.9.   Comparison of System Costs between Existing System and Proposed
System.

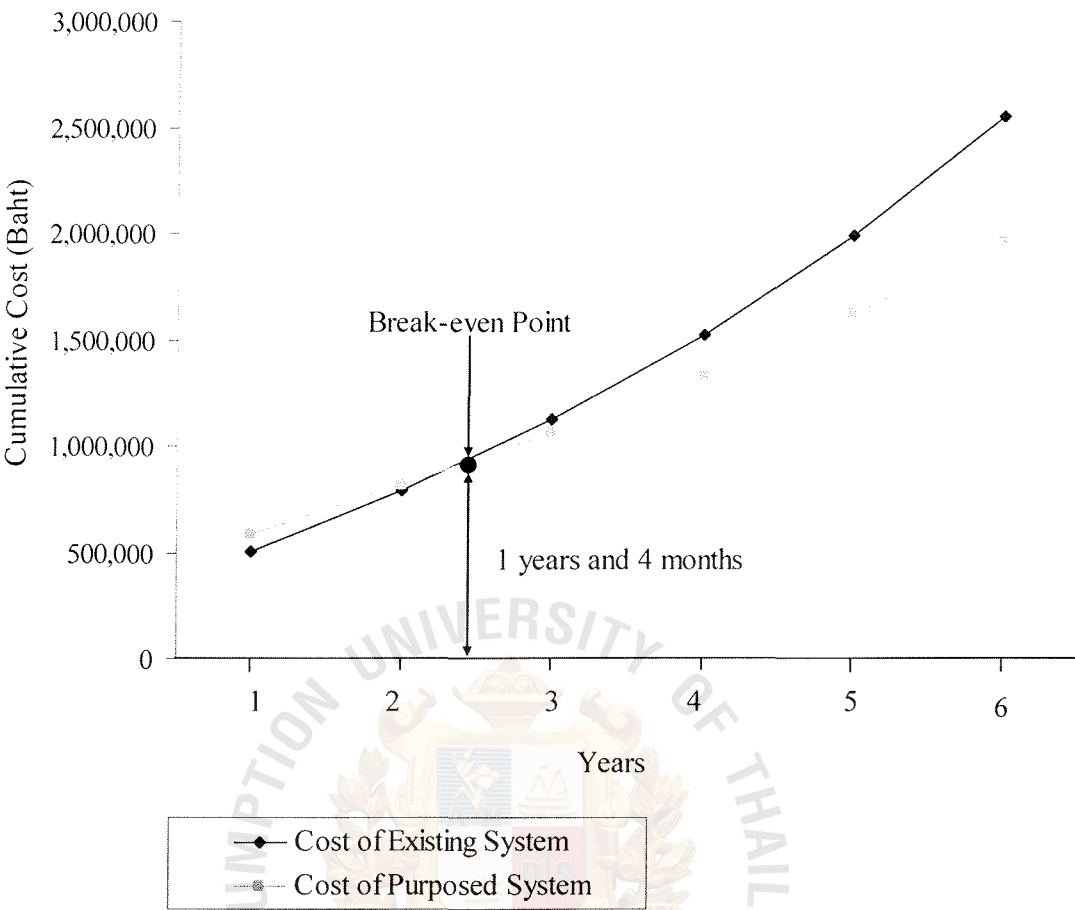| Items	Years					
	1	2	3	4	5	6
Existing System	505,000	793,000	1,126,100	1,520,070	1,988,059	2,546,138
Proposed System	588,035	816,535	1,059,635	1,326,955	1,624,009	1,962,381
Different Cost	-270,035	-28,100	34,980	133,926	270,216	446,950

Figure 3.13.   Cost Comparison between the Existing and the Proposed System.

IV. PROJECT IMPLEMENTATION

4.1 Overview of Project Implementation

The proposed system will be implemented after we pass through system analysis and system design phase. In each phase where considerable work and time are represented, the phases are usually broken down into activities and tasks that can be more easily managed and accomplished. To develop the Mobile Library System it takes four months. It starts from the beginning of April till the end of June 2004.

System implementation is the planned and orderly conversion from a current existing system to the new proposed information system. The proposed system should meet the desired objectives. System Implementation consists of Construction and Delivery Phases.

Construction Phase

The construction phase is actually part of design/construction loop. The purposes of the construction are to build and test a functional system that fulfills the business requirements and to implement the interfaces between the new system and the existing production system. To implement the proposed system, we set up two new servers. First is the Wireless Application Protocol application server and the other is SQL database server. For the Wireless Application Protocol application server, it is the Intel Xeon 2.8 GHz, 512 MB memory, and 36.4 GB hard drive. Windows 2000 advanced server is installed with service pack 2 for an operating system. Later we set up the Internet Information Server 5.0 (ISS 5.0), which is provided as standard web server with Windows 2000 advanced server to know about MIME types of Wireless Application Protocol standard. After that we need to configure demo Wireless Application Protocol Site on Internet Information Server to test the proposed system. In addition, Mobile

Library System program is installed in the virtual directory of Wireless Application Protocol Site that we set. Third, we setup the database server with Window 2000 advanced server operating system and install SQL server 2000. Then, we create database for testing on SQL Server.

Delivery Phase

Delivery Phase means delivering the new system into operation. We can test the proposed system via the WAP browser on mobile devices or the WAP emulator such as Nokia Wireless Application Protocol Toolkit, UP.simulator, WapIDE of Ericsson, etc. Then a manual document is made for training users.

4.2 Test Plan

Testing is an important skill that includes Unit testing, System testing and Regression testing.

(1) Unit or program testing is a test whereby all the modules have been coded and stub tested as an integrated unit. The test data and current performance that are benchmarked are used here.

(2) System testing ensures that the entire application, of which the modified program was a part, still works. Again, the test data and current performance are used here.

(3) Regression testing extrapolates the impact of the changes on program and application throughput and response time from the before and after results using the test data and current performance.

4.3 Training

Training is provided for both system administrator and functionary in IT department. System administrator and functionary have to operate the system in their

daily work. So training of proper use of the system will reduce errors in data entering and reduce time in searching data.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The project study concerns the Mobile Library System for a well established concrete organization, Central Library of Assumption University. The area under study describes the use of Wireless Application Protocol architecture to handle and improve the efficiency in searching book and viewing library record.

The Mobile Library System is conducted to improve the activity of Central Library of Assumption University and to ease the process for users who want to search book and view library record. They can use the system anywhere, anytime by their mobile phones.

In depth analysis, design and implementation are on Central Library of Assumption University according to Central Library of Assumption University's requirement. The reason why the Mobile Library System is so important is the need for improving efficiency and reducing process time.

This proposed system is designed and implemented in a way to solve the existing problems and result in satisfying the user requirement and improving the management of Central Library of Assumption University. Mobile Library System will be a base system that brings the development trend of mobile user; one useful application to library services. Through the integration of wireless technology with that of the Internet, productivity and efficiency could be derived. The usefulness of the Internet is therefore extended to the mobile phone users.

The proposed system operates in less time than the existing system that needs many unnecessary steps. Table 5.1 shows the time performance on each process of the proposed system compared to the existing system.

Table 5.1. Degree of Achievement of the Proposed System.

Process	Existing System	Proposed System
Search Book	5 Minutes	3 Minutes
View Library Record	3 Minutes	1 Minutes

5.2   Recommendations

Normally, whenever starting a WAP session on the mobile phone, the following steps are executed.

(1)   A connection is created via WSP (Wireless Session Protocol) between the mobile device and the WAP gateway.

(2)   On entering the address of WAP site (By typing it or by selecting a bookmark) the gateway sends a request from the device's micro browser using WSP. WSP is the WAP protocol in charge of starting and ending the connections from the mobile devices to the WAP gateway.

(3)   The gateway translates the WSP request into an HTTP request and sends it to the appropriate original server.

(4)   The original server sends back the requested information to the gateway via HTTP.

(5)   The gateway translates and compresses the information and sends it back to micro browser in the mobile phone.

(6)   The gateway takes care of translating all the requests that are sent and received by client using WSP to the protocol.

(7)   The WAP gateway is presented in the operator network such as Advance Info Service that provides the interface for accessing some of the network service the operator wants to provide. Nevertheless, the companies can have their

own gateway, especially Internet network that is the best solution to install their own gateway.

Security Control Section

WTLS (Wireless Transport Layer Security) is the solution to security, which in turn is based on SSL. SSL delivers methods to encrypt the data content and to make it accessible only to entrusted users. Furthermore, it gives the users the ability to check whether the content they are requesting really comes from the original server it is supposed to. WTLS provides the same grade of security that is supplied by SSL. It provides services that ensure privacy, server authentication, client authentication, and data integrity.

(1) Privacy guarantees that the data sent between the server and the client is not accessible to anyone else. No one can read the encrypted message, although they can see the encrypted message.

(2) Server authentication ensures that the server really is who it claims to be, and that it is not an imposter.

(3) Client authentication provides a way for the original server to limit access to the content it provides. Just those subscribers that are recognized as trusted ones can gain access to the site.

(4) Data integrity takes care that no one can alter the content as message begins transmitting between server and client without one of them noticing.

In the diagram that follows, we show how the WAP gateway handles secure sessions. A standard SSL session is opened between the web server and the WAP gateway and a WTLS session is initialized between the gateway and the mobile device. The encrypted content is sent it to the mobile phone. Figure 5.1 shows secure sessions on WAP gateway.
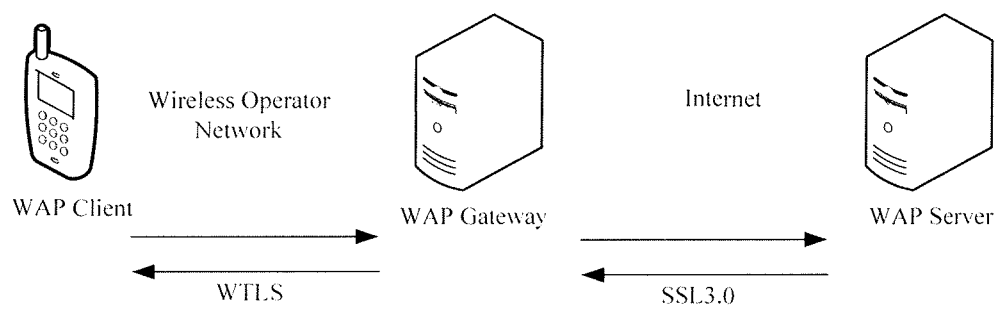
Figure 5.1.   How the WAP Gateway Handles Secure Sessions.

In the future, the proposed system will be adapted to the other wireless equipments such as PDAs, Pocket PC, and Tablet PC since all of these equipments support WAP.

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APPENDIX   A

PROCESS SPECIFICATION

PROCESS SPECIFICATION

Table A.1.   Process Specification of Process 1.

Item	Description
Process Name:	Register Member
Data In:	User Information
Data Out:	User Information
Process:	(1) Receive user information from user. (2) Collect user to Member Database.
Attachment:	Member Database.

Table A.2.   Process Specification of Process 2.

Item	Description
Process Name:	Search Book
Data In:	Search Information
Data Out:	Result
Process:	(1) Receive search information from user e.g. Author name, Title. (2) Retrieve book information from Access Database. (3) Display result.
Attachment:	(1) User (2) Access Database (3) Book Status Database (4) Author Database (5) Title Database (6) Subject Database (7) Books Database (8) Type of Book Database (9) Location Database (10) Section Database

Table A.3.　Process Specification of Process 3.

Item	Description
Process Name:	View Library Record
Data In:	Member ID
Data Out:	Result
Process:	(1) Receive member id from user. (2) Retrieve library record from Circulation Database. (3) Display result.
Attachment:	(1) User (2) Circulation Database

Table A.4.　Process Specification of Process 4.

Item	Description
Process Name:	Create Book Information
Data In:	Book
Data Out:	Book Information
Process:	(1) Receive book from Acquisition and Cataloging Department. (2) Assign book information related to a book. (3) Collect to Database.
Attachment:	(1) Acquisition and Cataloging Department. (2) Database e.g. Author, Title, etc.

Table A.5.　Process Specification of Process 5.

Item	Description
Process Name:	Circulation Book
Data In:	(1) Member ID (2) Book
Data Out:	(1) Book Information (2) Access Information
Process:	(1) Receive book from Circulation Service. (2) Retrieve member id from Member Database. (3) Retrieve access information from Access Database.
Attachment:	(1) Circulation Service (2) Member Database (3) Access Database

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APPENDIX   B

DATA DICTIONARY

DATA DICTIONARY

System: Mobile Library System

Description: MEMBER INFORMATION

Table B.1.   Member.

Name	Type	Length	Description
MEMBERID	Varchar	10	Member ID
FNAME	Varchar	50	First Name
LNAME	Varchar	50	Last Name
EMAIL	Varchar	50	E-mail Address
ADDRESS1	Varchar	255	Address

PRIMARY KEY: MEMBERID

Description: TYPE OF BOOK INFORMATION

Table B.2.   Type of book.

Name	Type	Length	Description
TYPEID	Varchar	10	Type ID
TYPENAME	Varchar	100	Name of type

PRIMARY KEY: TYPEID

Description: SUBJECT INFORMATION

Table B.3.   Subject.

Name	Type	Length	Description
SUBJECTID	Varchar	10	Subject ID
BOOKID	Varchar	10	Book ID
SUBJECTNAME	Varchar	255	Subject Name

PRIMARY KEY: SUBJECTID

Description: BOOK STATUS INFORMATION

Table B.4. Book Status.

Name	Type	Length	Description
STATUSID	Varchar	10	Status ID
STATUSNAME	Varchar	20	Status Name

PRIMARY KEY: STATUSID

Description: SECTION INFORMATION

Table B.5. Section.

Name	Type	Length	Description
SECTIONID	Varchar	50	Section ID
Section Name	Varchar	100	Section Name

PRIMARY KEY: SECTIONID

Description: LOCATION INFORMATION

Table B.6. Location.

Name	Type	Length	Description
LOCATIONID	Varchar	10	Location ID
LOCATION NAME	Varchar	60	Location Name

PRIMARY KEY: LOCATIONID

Description: AUTHOR INFORMATION

Table B.7.   Author.

Name	Type	Length	Description
AUTHORID	Varchar	50	Author ID
BOOKID	Varchar	10	Book ID
AUTHOR	Varchar	255	Author Name
AUTHOR TYPE	Varchar	100	Type of Author

PRIMARY KEY: AUTHORID

Description: TITLE INFORMATION

Table B.8.   Title.

Name	Type	Length	Description
TITLEID	Varchar	10	Title ID
BOOKID	Varchar	10	Book ID
TITLE	Varchar	880	Title Name

PRIMARY KEY: TITLEID

Description: ACCESS INFORMATION

Table B.9.   Access.

Name	Type	Length	Description
ACCESSID	Varchar	10	Access ID
LOCATIONID	Varchar	10	Location ID
SECTIONID	Varchar	10	Section ID
STATUSID	Varchar	10	Status ID
BOOKID	Varchar	10	Book ID
ACCESS NO	Varchar	50	Accession Number
COLLECTION	Varchar		Collection

PRIMARY KEY: ACCESSID

Description: CIRCULATION INFORMATION

Table B.10.   Circulation.

Name	Type	Length	Description
CIRCULATIONID	Varchar	10	Circulation ID
MEMBERID	Varchar	10	Member ID
ACCESSID	Varchar	10	Access ID
DATEDUE	Date/Time	8	Date Due
BORROWDATE	Date/Time	8	Date Borrow

PRIMARY KEY: CIRCULATIONID

Description: BOOKS INFORMATION

Table B.11.   Books.

Name	Type	Length	Description
BOOKID	Varchar	10	Book ID
TYPEID	Varchar	10	Name of type
CLASSIFICATION	Varchar	30	Classification
CUTTERNUMBER	Varchar	30	Cutter Number
YEARS	Varchar	20	Years
EDITION	Varchar	150	Edition
IMPRINT	Varchar	255	Imprint
PHYSICALDESC	Varchar	255	Description
REFERENCE	Varchar	150	Reference
SERIES	Varchar	255	Series
ISBN	Varchar	300	Isbn

PRIMARY KEY: BOOKID

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APPENDIX   C

INTERFACE DESIGN

Figure C.1.   Menu Online Catalogue.
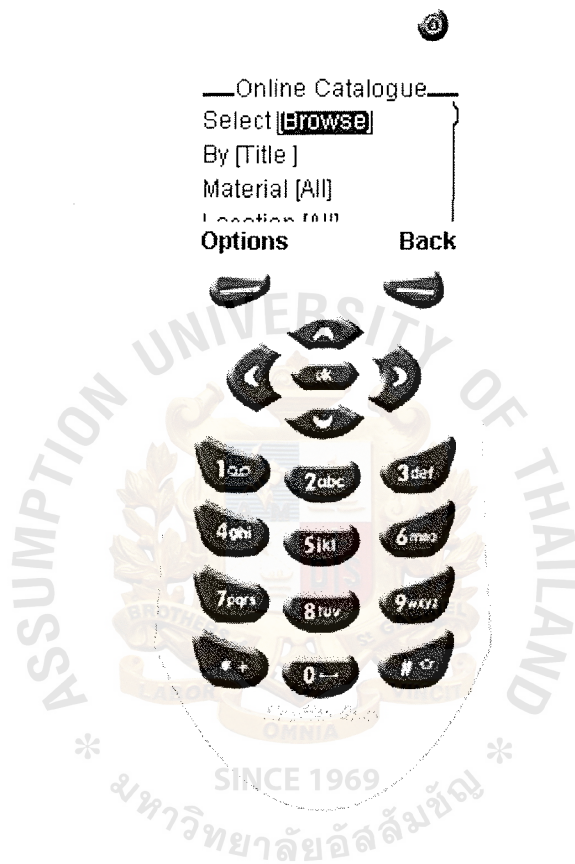
Figure C.2. Select Type of Search Interface.
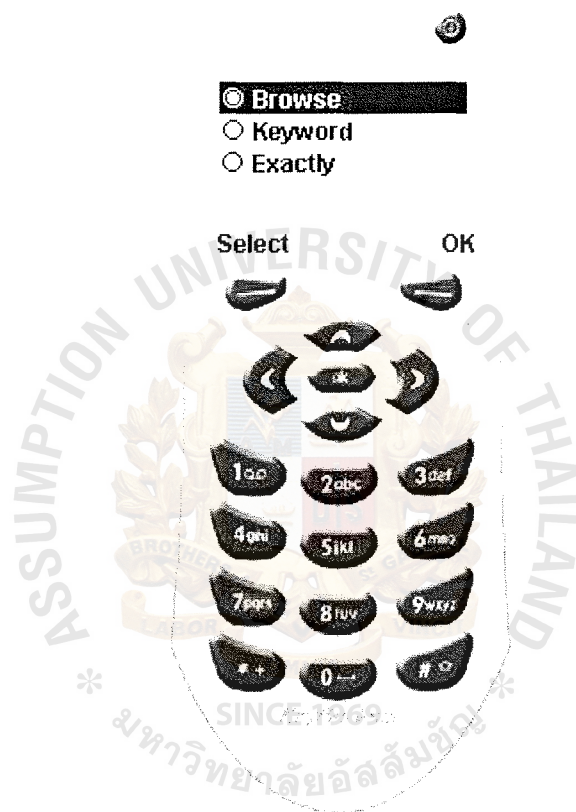
Figure C.3.   Select Type of Search Interface (Continued).
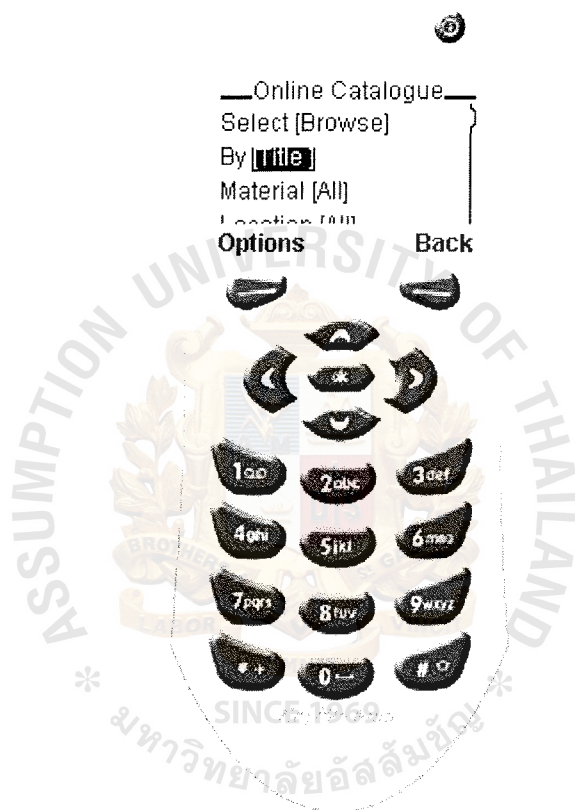
Figure C.4.   Select Search By Interface.
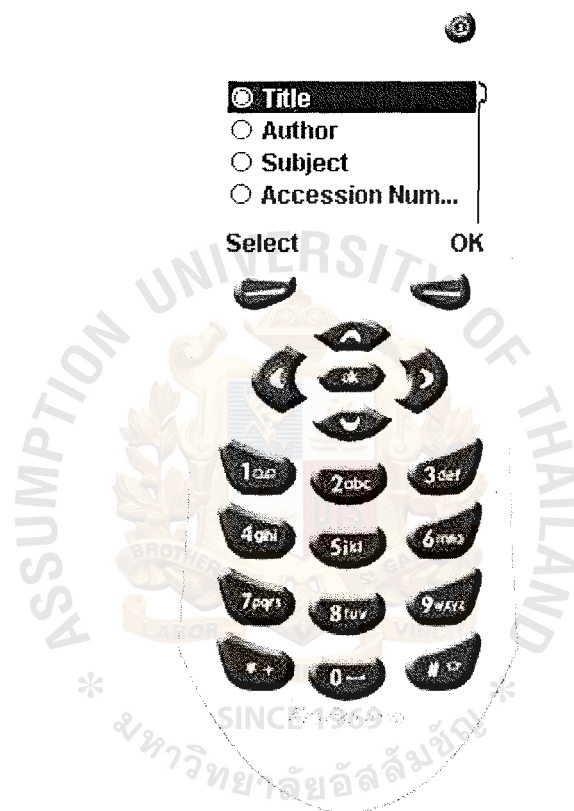
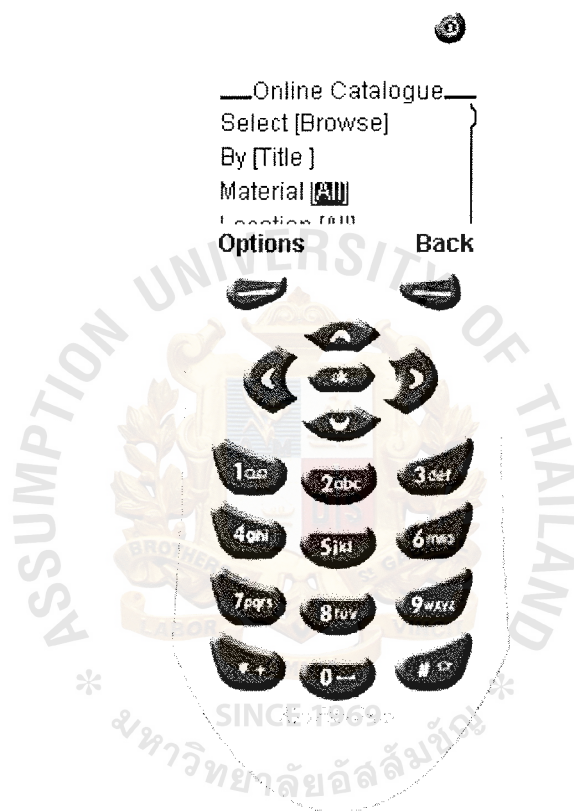Figure C.5.   Select Search By Interface (Continued).
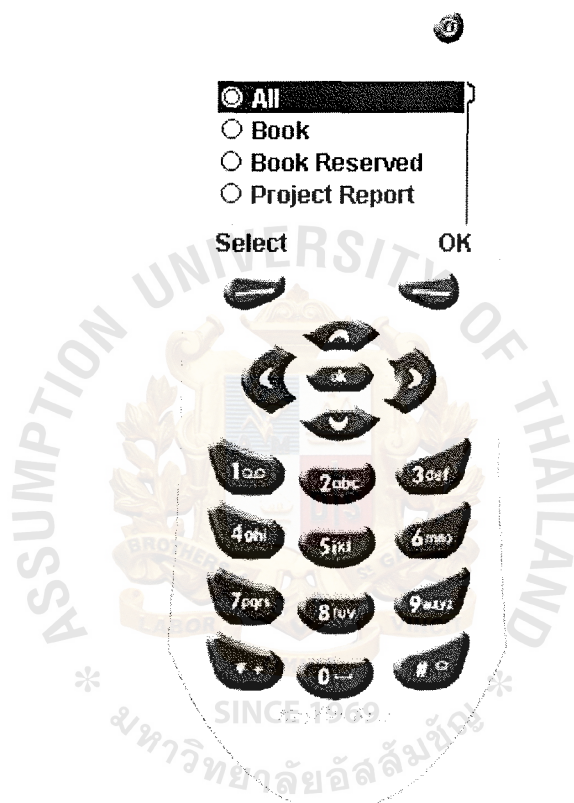
Figure C.6.   Select Material Interface.
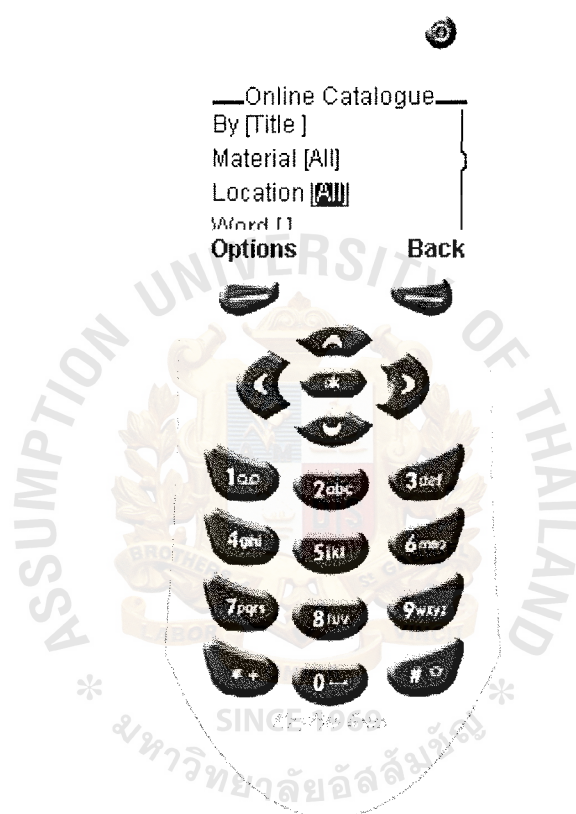
Figure C.7.   Select Material Interface (Continued).
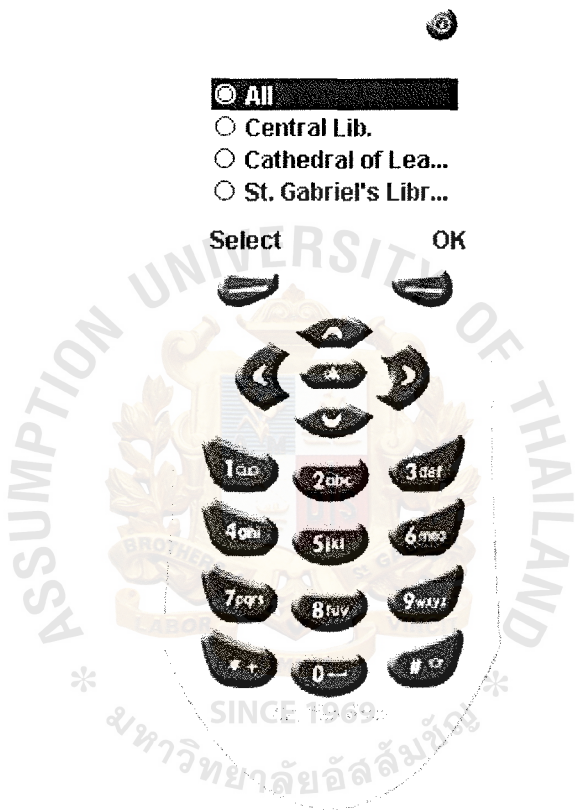
Figure C.8.   Select Location Interface.
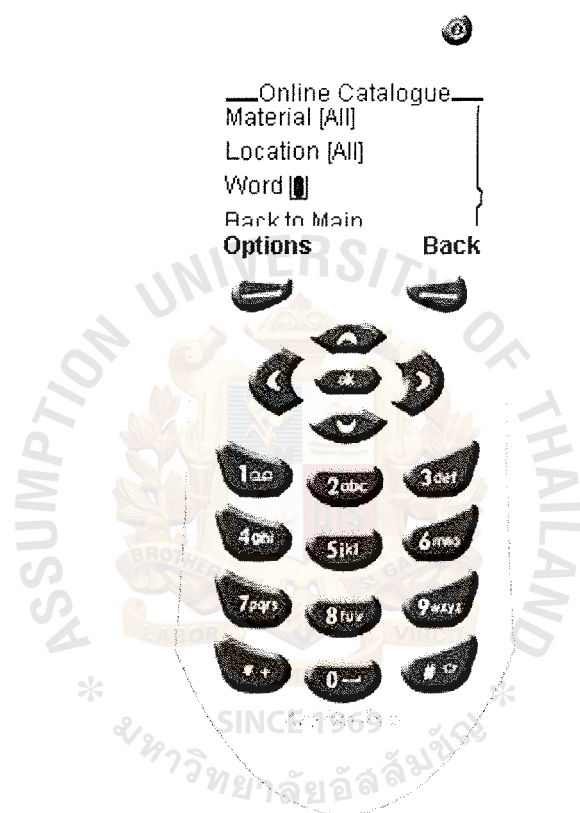
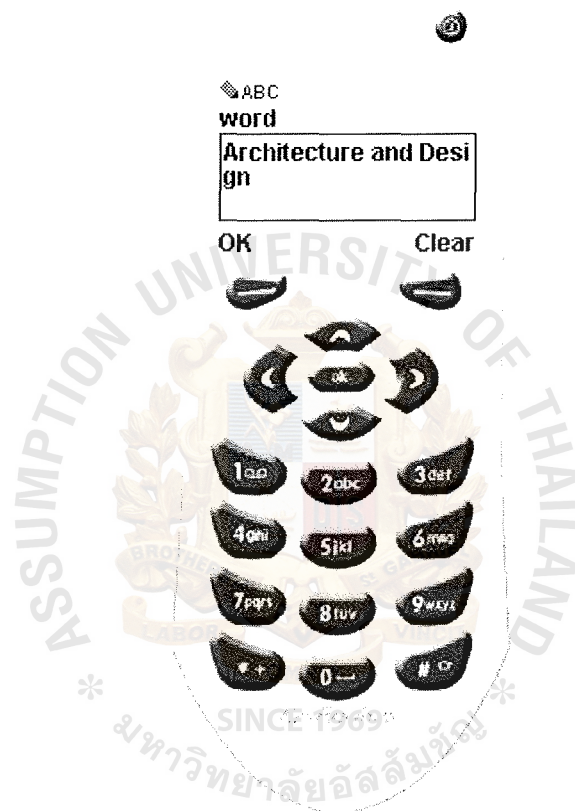Figure C.9.   Select Location Interface (Continued).

Figure C.10.   Entry Word(s) Interface.

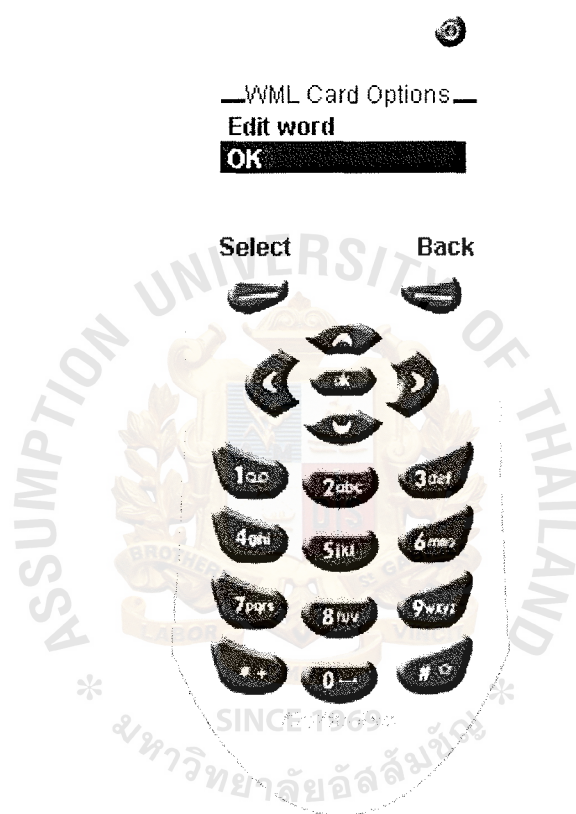Figure C.11.   Entry Word(s) Interface (Continued).

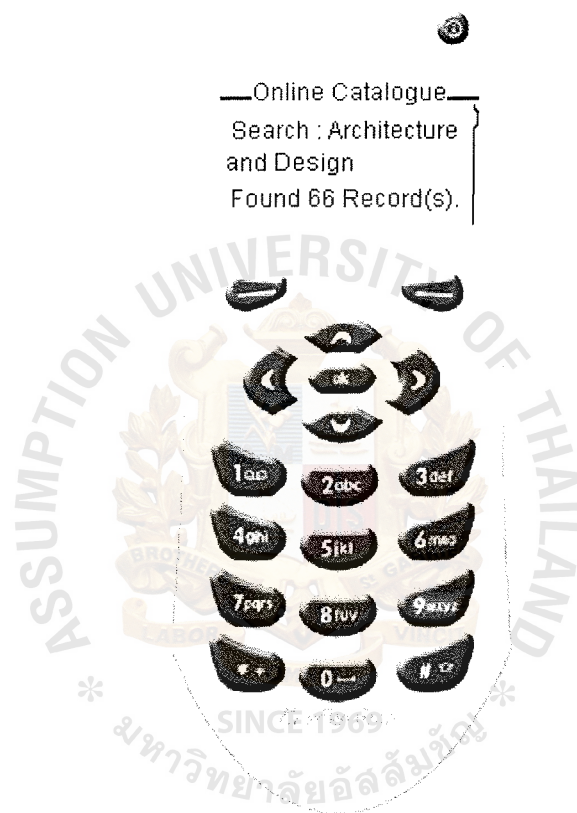Figure C.12. Select OK Interface.

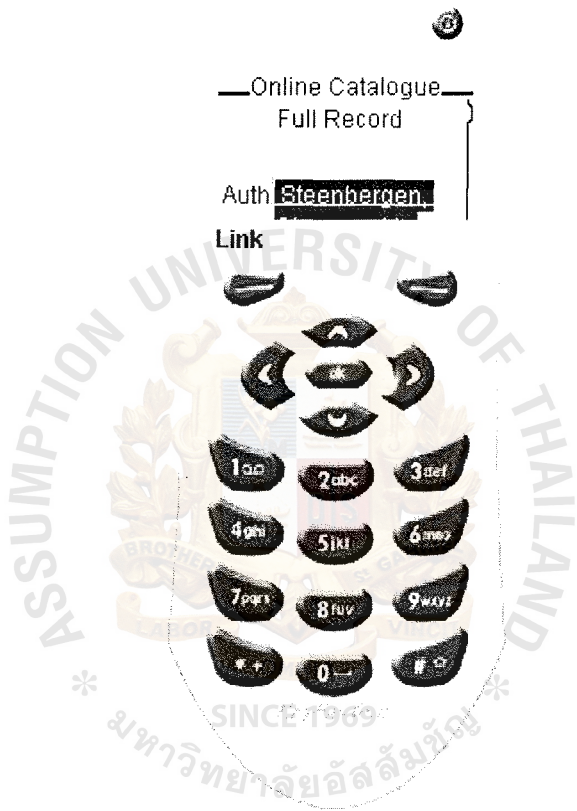Figure C.13.   Display Search Result Interface.

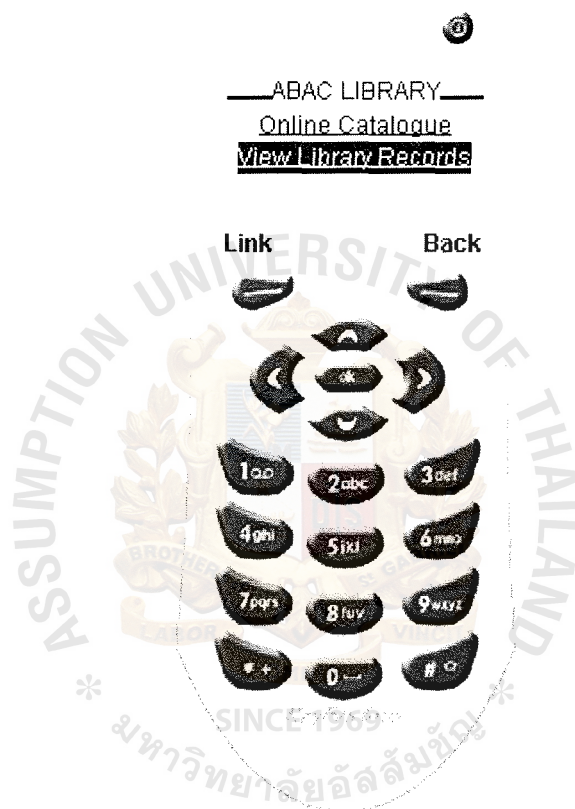Figure C.14.   Display Full Record Interface.

Figure C.15.   Menu View Library Records.

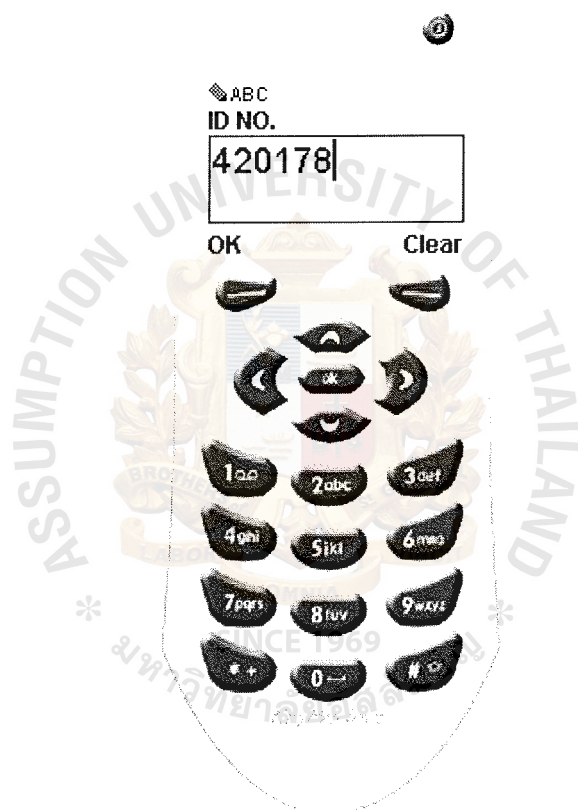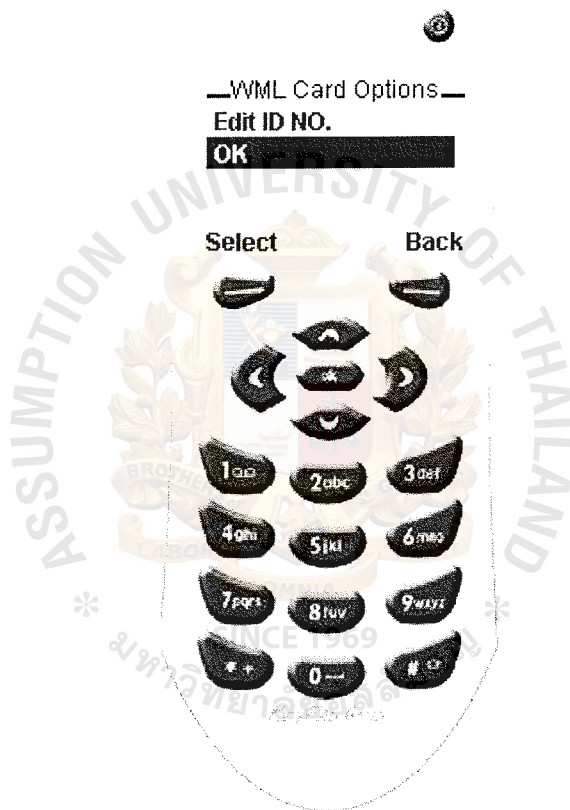Figure C.16.   Entry ID No.

Figure C.17.   Entry ID No (Continued).

Figure C.18.   Select OK Interface.
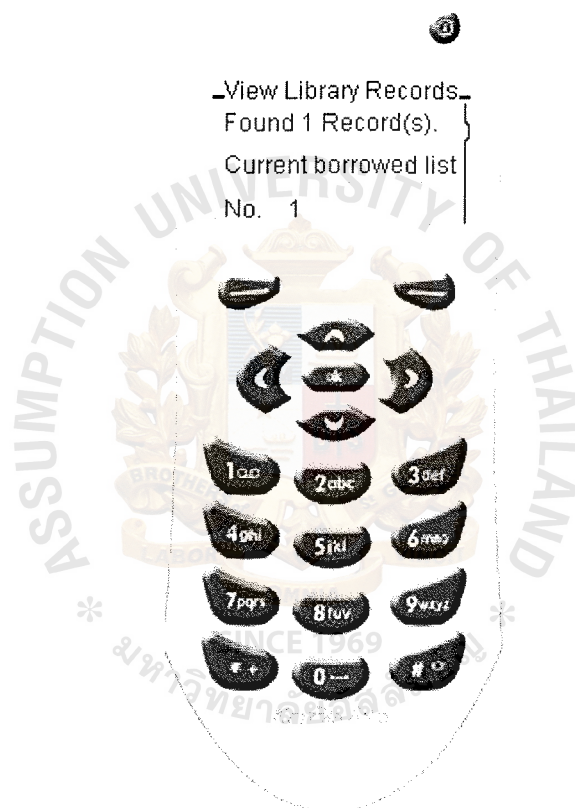
Figure C.19.   Display View Result Interface.

Figure C.20.   Display View Result Interface (Continued).

APPENDIX   D

FEASIBILITY ANALYSIS

Table D.1.   Payback Analysis for Client-Server System Alternative (Candidate 1), Baht.

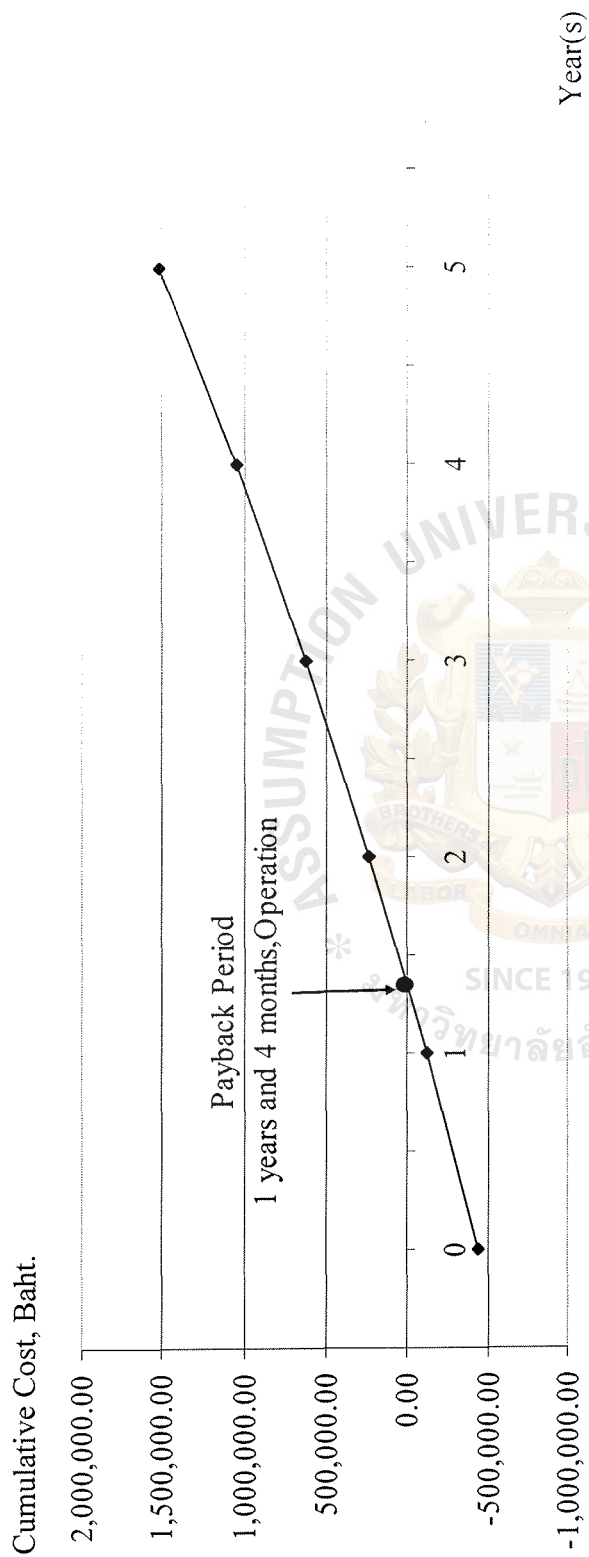| Cost Items	Year(s)					
	0	1	2	3	4	5
Development Costs :	-441,535.00					
Operation and Maintenance Costs:		-37,600.00	-42,208.00	-47,184.00	-52,559.00	-57,364.00
Discount Factor for 5% :	1.00	0.95	0.91	0.86	0.82	0.78
Time-Adjusted Costs (Adjusted to Present Value):	-441,535.00	-35,720.00	-38,409.28	-40,578.24	-43,098.38	-44,743.92
Cumulative Time-Adjusted Costs over Lifetime :	-441,535.00	-477,255.00	-515,664.28	-556,242.52	-599,340.90	-644,084.82
Remark: Operating and Maintenance Cost Estimated Annual Growth Rate of 5 %						
Benefits Derived from Operating of New System: increase 15% per year	0.00	375,500.00	431,825.00	496,598.75	571,088.56	656,751.84
Discount Factor for 5 %	1.00	0.95	0.91	0.86	0.82	0.78
Time-Adjusted Costs (Adjusted to Present Value):	0.00	356,725.00	392,960.75	427,074.93	468,292.62	512,266.44
Cumulative Time-Adjusted Costs over Lifetime:	0.00	356,725.00	749,685.75	1,176,760.68	1,645,053.29	2,157,319.73
Remark : Operating and Maintenance Cost Estimated Annual Growth Rate of 5 %						
Cumulative Lifetime Time – Adjusted Costs + Benefits:	-441,535.00	-120,530.00	234,021.47	620,518.16	1,045,712.39	1,513,234.91

Figure D.1.   Payback Analysis for Client-Server System Alternative (Candidate1).

Table D.2. Payback Analysis for Client-Server System Alternative (Candidate 2), Baht.

| Cost Items	Year(s)					
	0	1	2	3	4	5
Development Costs :	-440,035.00					
Operation and Maintenance Costs:		-37,600.00	-42,208.00	-47,184.00	-52,559.00	-57,364.00
Discount Factor for 5% :	1.00	0.95	0.91	0.86	0.82	0.78
Time-Adjusted Costs (Adjusted to Present Value):	-440,035.00	-35,720.00	-38,409.28	-40,578.24	-43,098.38	-44,743.92
Cumulative Time-Adjusted Costs over Lifetime :	-440,035.00	-475,755.00	-514,164.28	-554,742.52	-597,840.90	-642,584.82
Remark: Operating and Maintenance Cost Estimated Annual Growth Rate of 5 %						
Benefits Derived from Operating of New System: increase 21% per year	0.00	375,500.00	454,355.00	549,769.55	665,221.15	804,917.59
Discount Factor for 5 %	1.00	0.95	0.91	0.86	0.82	0.78
Time-Adjusted Costs (Adjusted to Present Value):	0.00	356,725.00	413,463.05	472,801.81	545,481.34	627,835.72
Cumulative Time-Adjusted Costs over Lifetime:	0.00	356,725.00	770,188.05	1,242,989.86	1,788,471.21	2,416,306.93
Remark : Operating and Maintenance Cost Estimated Annual Growth Rate of 5 %						
Cumulative Lifetime Time – Adjusted Costs + Benefits:	-440,035.00	-119,030.00	256,023.77	688,247.34	1,190,630.31	1,773,722.11
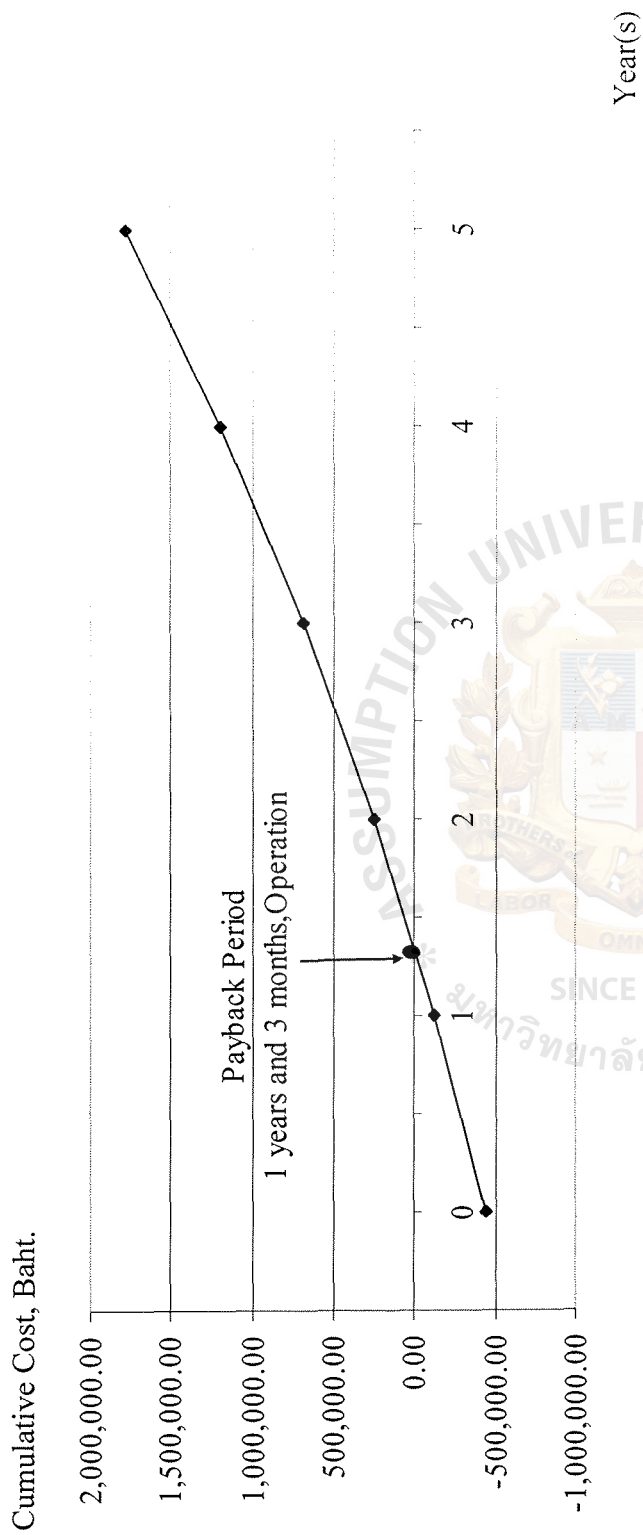
Figure D.2.   Payback Analysis for Client-Server System Alternative (Candidate2).

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APPENDIX   E

ABBREVIATION

ABBREVIATION

WAP   Wireless Application Protocol

PDA   Personal Digital Assistant

MIME   Multipurpose Internet Mail Extensions

HTTP   Hypertext Transfer Protocol

WSP   Wireless Session Protocol

WTLS   Wireless Transport Layer Security

SSL   Secure Sockets Layer

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