A DOCUMENT IMAGE DATABASE SYSTEM APPLICATION IN A SECURITIES COMPANY

by

Ms. Chongkolnee Sukitvannee

A Final Report of the Three - Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
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Project Title	A Document Image Database Database System Application in a Securities Company
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Academic Year	November 2001

The Graduate School of Assumption University has approved this final report of the three-credit course. CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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November 2001

ABSTRACT

The main objectives of this project are twofold: to analyze the best candidate solution of Document Imaging system especially for Kim Eng Securities (Thailand) Co., Ltd. and to improve the customer information management by reducing the problem of existing paper work system.

To utilize a Document Imaging system instead of existing manual systems will solve these problems. However, the Document Imaging system available in the markets may not match with the user's requirement. Therefore, the criteria of analysis in the best candidate solution have been proceeded in order to obtain the most efficient system with saving and quick subjects. There are 4 feasibilities concerned technical feasibility, Economic feasibility (cost to develop, payback period, net present value, ROI), Operational feasibility and Schedule feasibility.

The main result of the project can be highlighted as follows. The Document Imaging system is developed by Kim Eng' s internal staffs that reaches the highest score from the feasibility analysis matrix. The extensions of the analysis after the implementation are evaluated in the same consequence which the summary of the operating times have been reduced in high ratio such as to maintain customer information, to store, to fetch and to deliver the documents.

However, to bring the Document Imaging system into use is just the beginning of applying supplementary IT system with the documentation management in the organization which have to be developed further regarding work flow utilized for internal submit starting from the clients document proposal and registration, then the scanning of document for record and being passed on to relevant divisions for electronic approvals.

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I am indebted to the following people and organizations. Without them, this project would not have been possible.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

1.1 Background of the Project

The purpose of project, document imaging is to present the overall system. Since there is a time consuming task to manage all the customers' document manually for some request, some of them is lost or damaged so it will be beneficial to all to have a systematic system to handle these documents. In addition, it is the ability to explore and analyze data to reveal trends within a business. To apply real business knowledge and insights to determine and analyze the factors that drives business performance.

The existing problems still remain in this issues as follows:

(1) Some documents cannot duplicate or make a copy because of the limitations under the laws and regulations. Therefore, different department cannot share the same information at the same time.

(2) It takes a lot of time to search for information, less security, inflexible for multiple users and required more storage.

Hence, all the above mentioned will be removed from our business when the document imaging has been implemented.

Throughout business history, seemingly unknown companies have come out of nowhere to overtake established market leaders without appearing to even break into a sweat. The new comer has a superior method of managing costs across the integrated supply chain to the customer. What we learned from these companies is that they have brought about a significant change in the way they view their business models. They replaced the traditional emphasis on products and revenue with more customer and profit-centric business models.

Moving to these new business models requires an enabling technology. To shift

an entire company to customer and profit-centric business models required a technology that dispersed these new measurements quickly and cheaply.

1.2 Objectives of the Project

The objectives of Document Image are as follows:

(1) To describe the meaning and concept of document image

(2) To study the existing system in the process of document management

(3) To analyze the problems and users requirements

(4) To design the new system for easy usage

(5) To reduce the cost of raw materials as the papers and storages

(6) To support multiple users when access information at the same time

(7) To increase the multi-level securities

(8) To maximize the utilities and increase the cost effectiveness

1.3 Scope of the Project

The scope of the project are as follows:

(1) The study will analyze current problems, user requirements and area for improvement.

(2) The study will design new system supports scanning, searching, maintain, securities for multiple users.

(3) The study will include testing and implementation.

1.4 Deliverables

The deliverables for the Document Image Database System are as follows:

(1) Provide the sufficient information related to project management for document image.

(2) Screen layout and menu layout for user interaction

(3) A project report.

II. DOCUMENT IMAGING

2.1 Introduction

As Paper-based documents are increasing in volume, it has become very important in the areas of automated document delivery, document archiving, electronic publishing, computer-aided design, and other document-related application to convert paper-based document information to electronic format for computer storage, access, and processing. Even though paper documents remain widely used, the electronic versions of paper documents offer many advantages over paper, such as fast distribution, efficient storage, no degradation, fast and effective searching, easy modification, and decreasing cost of document maintenance, storage, and transmission.

Instead of manually keying document information into a computer, paper documents can be electronically scanned and stored as computer image bitmap files. The scanned image bitmap files consist of lines of black and white or gray-scale pixels, which when treated independently do not yield useful information.

2.2 How Scanners Get Images into the Computer

The basis for image processing is getting images into the computer. Electronic devices that look at or scan a three-dimensional scene or two-dimensional picture enable you to turn a visual scene full of color into information the computer can understand. This process is called scanning. . There are many different methods of scanning available, so this project will discuss only the most popular methods.

(1) Manual scanning

Manual scanning is the manual feeding of document into a scanner. It is a slow process that improves verification. The utility decreases as the volume of document input increases. Yet for lower density inputs, it is still the mode of choice.

(2) Batch scanning

Batch scanning is when a mechanical feeder is attached to the scanner. Out of necessity, verification shifts to a greater emphasis on automation, but minor errors can multiply. This mode is probably the most economical. If documents require extensive attribute input, it can be done by personnel at workstations offer acquisition.

The most common device used to input images into a computer is a Scanner. Scanners are similar to copy machines, except they store the image electronically instead of transferring it to another piece of paper. They are available in many shapes, sizes, speeds, reliabilities, prices. There are many different types of scanners from hand-held units that look like a mouse to drum scanners that can fill an entire room. Most scanners expose the image to a bright light. Then electronic receptors called charged-coupled device (CCD) sensors pick up that light and convert it to electronic pulses. Those pulses get translated to the computer's favorite type of data numbers. There a black-and-white as well as color scanners. The resolution of scanners range from 100 dots per inch (dpi) to 2,000 dpi and beyond. The scanner carefully monitors exactly where it gets each sample of color so it knows where the pixel belongs in the image. Optical resolution refers to the number of colors the scanner can squeeze out of one square inch. The output resolution of the image may be different from the optical resolution of the scanner. Some scanners scan in at a certain optical resolution and then increase that resolution by interpolating adding averaged pixels. Interpolating increases the output resolution of the scanners

2.2 How the Computer Stores the Image

The same way computers store any other type of information: they use memory. Some of the early computer memory was magnetic in nature. It consisted of a grid of

vertical wires intersecting horizontal wires. It was similar to an ordinary window screen. At the junction of each wire was a small metal ring. By sending an electrical pulse down any two crossing wires, the ring where they crossed could be magnetized or demagnetized. It could also be detected whether a given ring anywhere on the grid was magnetized. This was the early beginning to magnetic memory. Later, the large screens became smaller Still, each magnetic ring has only two states: on or off. These states were represented by the computer with the numbers 0 and 1. This unit of storing information is called the bit. A bit is considered to be off if it contains the number 0. The bit is on if it contains the number 1. The actual numbers are not stored they are just a way of expressing the state of the magnetic bit. Electronic memory works the same way. An electronic circuit can be either on or off, depending on whether electricity is flowing through it. So, a system was developed to combine a group of bits together. That way, different combinations of bits could represent a letter or number. Even though you can have four different combinations when you have two bits together, this isn't enough. By adding six more bits, for a total of eight bits, you could get up to 256 combinations, called a byte. A byte is a collection of eight bits. You can come up with 256 different combinations by turning some of these bits off and some on. The byte is really the foundation of all computer storage. The byte is used for both magnetic as well as electronic memory. A standard method of coding these eight bits is known as the American Standard Code for Information Exchange, commonly known as ASCII(Pronounced As-key). Having the ASCII code helps computers of all makes to communicate with each other. The ASCII standard covers upper-and lowercase letters, special characters, and numbers.

2.4 Common Image File Format

The Tagged Image File Format(TIFF) was created jointly by Aldus and Microsoft. It was designed for importing images into desktop publishing programs and quickly became accepted by a variety of software developers as a standard. Its built-in flexibility is both a blessing and a curse, because it can be customized in a variety of ways to fit a programmers needs. However, the flexibility of the format resulted in many versions of TIFF, some of which are so different that they are incompatible with each other.

III. THE EXISTING SYSTEM

3.1 Background of the Organization

Kim Eng Securities (Thailand) Co., Ltd. is one of the leading securities companies in Thailand. The company has built a diversified business base across product and service areas for corporate and individual clients; moreover, the company provides a wide range of investment and securities services. The organization of the company is presented in Figure 3.1.

The company offers securities services through our sixteen trading offices around Bangkok and the upcountry. The company has seven operating securities business licenses: securities brokering, securities trading, securities underwriting, investment advisory, private fund management, corporate finance advisory and securities registrar; the company is one of the top five brokerage houses among 28 active brokers on the Thai stock exchange.

3.2 Existing Business Function

The existing business functions of Document are processes in manual. The existing business functions can be summarized as follows:

Process 1: A customer submits all related documents to marketing staff such as:

(1) New account form

(2) Brokerage & agency agreement

(3) Deposit instruction form

(4) Withdrawal instruction form

(5) Transfer instruction form

(6) Copy of personal ID card

(7) Client's photo, etc.

These above documents are kept in the strong room.

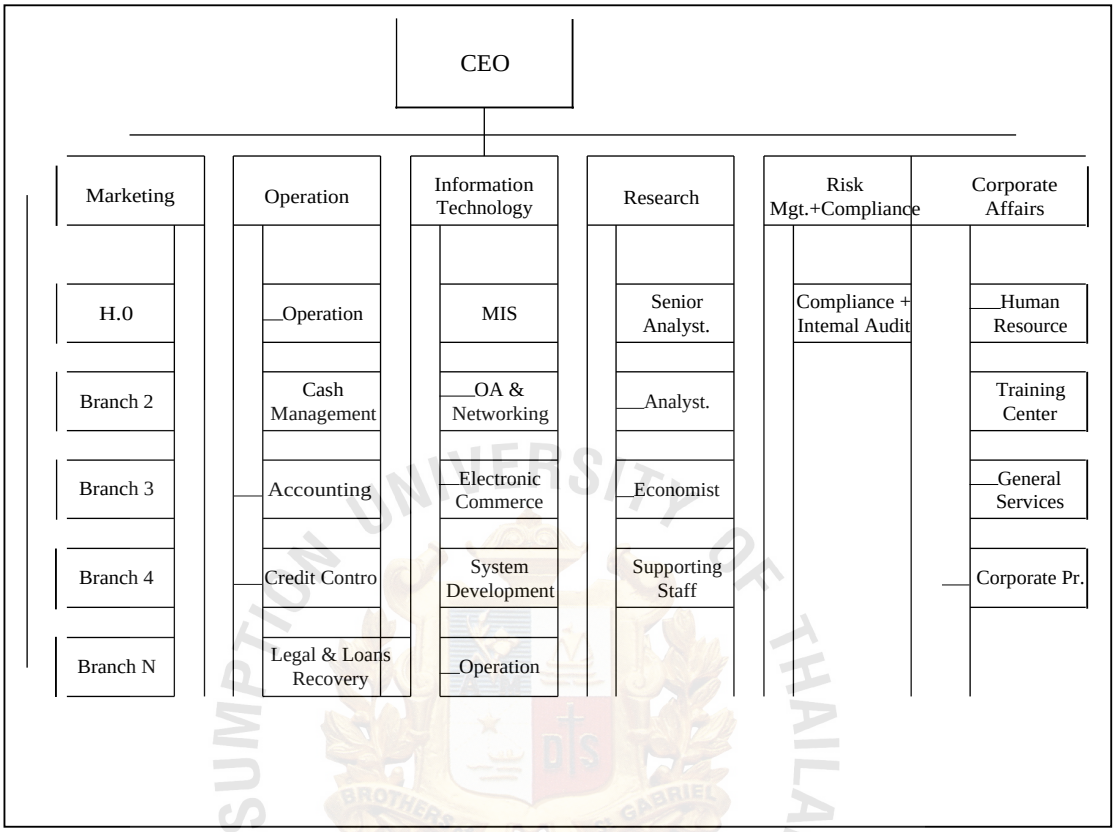

Figure 3.1. Organization Chart.

Process 2: The Credit Control department verifies the documents in process 1 and brings them back in the strong room.

Process 3: In case that the other departments require to have these documents revised as an intention to trade the stocks, the authority in verifying customer's profiles will be required. Sometimes the documents will be copied in case that the auditor proceeds checking with documents from various departments. On the other hand, the documents will be copied in case that various departments require these documents at the same time.

3.3 Current Problems and Areas for Improvement

3.3.1 Current Problems

The existing document imaging is manage the customers' document manually for service customer that cause many problems. The problems are the following:

(1) Spend more time to keep and search information.

(2) The document cannot support multi-user at the same time.

(3) Less security in document filling system.

(4) Use more papers in operation manual.

(5) Use more storages for filling the document.

3.3.2 Areas for Improvement

(1) To reduce time to search the information.

(2) To reduce the document management cost.

(3) To improve the effectiveness of staff working.

(4) To Create better service.

(5) To decrease research time and paper handing costs.

(6) To provide multi-level document security.

(7) Significantly reduces the need for copies of document information.

(8) Centralized control for all documents.

3.4 Existing Computer System

In the existing system, all computers are connected to LAN & WAN for using only share printer. The main hardware are required 26 computer sets, peripherals, and communication equipments. A file server will be used to manage shared printer. The rest, 25 computer sets are used as clients.

3.4.1 Hardware Configuration

Server configuration is specified as follows:

Intel Pentium III 800 MHz COMPAQ PCs 1 Unit

(1) Intel Pentium III 800 MHz CPU

(2) 512 MB RAM

(3) 40 GB Hard disk

(4) 15" Monitor

(5) 40X CD-ROM

(6) 1.44" Floppy Disk Drive

(7) Keyboard & Mouse

(8) 3Com EtherLink 10/100 PCI LAN CARD

(9) Tape backup (DDS 3) 24 GB

Client configuration is specified as follows:

Intel Celeron 800 MHz COMPAQ PCs 25 Units

(1) Intel Celeron 800 MHz CPU

(2) 96 MB RAM

(3) 4.3 GB Hard disk

(4) 15" Monitor

(5) 1.44" Floppy Disk Drive

(6) Keyboard & Mouse

(7) 3Com EtherLink 10/100 PCI LAN CARD

Printer configuration is specified as follows:

(1) LaserJet 2100 TH Hewlett Packard 1 Unit

Copier configuration is specified as follows:

(1) Copier (Document Center 400) 1 Unit

3.4.2 Software Configuration

Software configuration at server is specified as follows:

(1) Windows NT 4.0

(2) SQLServer 7.0 Enterprise RDBMS

Software configuration is specified as follows:

(1) Microsoft Window 98

(2) ODBC for SQLServer

(3) Client for Microsoft Networks

(4) TCP/IP

3.4.3 Network Configuration

Communication equipment configuration is specified as follows:

(1) Router 16 Units

(2) Hub & ports 1 Unit

(3) Cables

(4) Leased Line 128 Kbps 16 Units

IV. THE PROPOSED SYSTEM

4.1 User Requirements

The user requirements for the proposed system are as follows:

(1) Designing the system that provides faster response time for more efficient and effective process.

(2) Providing the system that scans documents to keep information; the purpose for decreasing the investment cost in handling paper work.

(3) Designing and developing the computerize system to be able to shared and search the document of customers for more efficient and effective process.

(4) Designing the system that produces meaningful documents to support marketing and various departments

(5) Designing the system that is able to consolidate the customer's documents information of the company.

(6) Designing the system that is able to define the user authorization under the company policy.

(7) Reducing redundant tasks in some manual processes for better performance and improving work control.

4.2 Candidate Solutions

To identify the candidate solutions, it can be done by system analysts by brainstorming among themselves, or gathering technology information from external company such as computer suppliers and software providers.

The candidate solution can be specified into 3 candidate solutions which are:

(1) Candidate 1: The manual solution(existing system) manages all documents in papers. It takes a lot of time to search information, less security, inflexible for multiple users and required more storage.

(2) Candidate 2: The solution uses application software. It will make faster the construction and implementation phase but the features of this software does not reach all user requirements and unsuitable for business in the future, expensive and inflexible to develop programs.

(3) Candidate 3: The solution is to develop by internal staffs of information technology department.

The candidate system matrix is a useful tool for effective organizing and explanation for candidate solutions. So it is used to explain each candidate in details as shown in Table 4.1.

Table 4.1. Candidate Systems Matrix.

Characteristics	Candidate 1	Candidate 2	Candidate 3
Proposed system computerization	All part of the system uses manual for keep documents.	Uses Smartdoc application software.	Development using SQLServer database and Visual Basic by system Analysts and programmers.
Benefits	Not need to invest as the staffs can use the existing technology.	The developers in company do not need to develop by themselves.	This solution fulfills all requirements at much cheaper cost than candidate 2.
Servers and Workstations	-	Windows NT for server and Microsoft Windows for client.	Same as candidate 2.
Software tools needed	-	Smartdoc application software.	SQLServer RDBMS and Visual Basic 6.0
Application software	Not applicable.	Smartdoc software solution.	Custom solution.
Method of Data processing	-	Real-time processing on client/server architecture.	Same as candidate 2.
Output devices	Photo Copier	- HP2100 LaserJet Printer - Screen	Same as candidate 2.
Input devices	-	Scanner, Keyboard & mouse	Same as candidate 2.
Storage devices and Implications	-	SQLServer RDBMS with 40 GB disk store on server side and 100 MB disk store on client side.	Same as candidate 2.

4.3 Feasibility Analysis

There are 4 feasibility studies to concern for the best candidate solution which are:

(1) Technical feasibility is a measure of the practicality of a specific technical solution and the availability of resources. It can be divided into 2 sub parts as well.

Technology: to explain in the computer technology needed to support each candidate solution.

Expertise: to explain in the technical expertise needed to develop, operate, and maintain the candidate solution system.

(2) Economic feasibility is a measure of the cost-effectiveness of the candidate or solution. It is often called the cost-benefit analysis.

(3) Operational feasibility is a measure of how well the solution will work in the company and also how people feels about the system. It can be divided into 2 sub parts as functionality and political.

Functionality: to describe the details of what degree the candidate will benefit the organization and how well the system does.

Political: to describe the detail of how well the system is accepted from user management and organization perspective.

(4) Schedule feasibility is a measure of how reasonable the project schedule is or how long the candidate solution will take to design and implement.

The detail of the feasibility analysis are in 4 parts that are described in Table 4.2. In addition, the criteria and score are described in Table 4.3.

Table 4.2. Feasibility Analysis Matrix.

Feasibility Criteria	Wt.	Candidate 1	Candidate 2	Candidate 3
Technical Feasibility	20%	Current procedures are hard to deal with the whole information and customer's documents. Score: 40	Smartdoc application are well known but the need of training staffs is required with high cost. The need of consultant also is required when problems occur. Problems solving consulting may take more time and more expensive than solving by the technical staff of the company. Score: 81	Visual Basic is flexible well known developing tool. (smaller size and encryplable) for support TIFF methodology. The programmers can build the application rapidly and easy to maintain. Score: 95
Economic Feasibility Cost to develop: Payback Period: Net Present Value: Details Calculation:	40%	 Approximately 3,852,000 Can't measure Approximately -10,372,669 See in Table 4.4. to Table 4.7. Score: 30	 Approximately 4,660,000 Approximately 4.37 Years Approximately 642,139 See in Table 4.8. to Table 4.11. Score: 44	 Approximately 3,852,000 Approximately 3.61 Years Approximately 1,424,291 See in Table 4.12. to Table 4.15. Score: 72
Operational Feasibility	30%	Manual procedures take more effort to search customer's information and possible to get loss of the original document. Score: 40	The customized application would not fulfill all user requirements and can't modify in the future. Score: 84	The customized application would fulfill all user requirements. Score: 95
Schedule Feasibility	10%	Already implement. Score: 100	1 month Score: 96	3 months Score: 90
Ranking	100%	42.0	68.6	85.3

Table 4.3. The Criteria and Score Feasibility Analysis.

Feasibility Criteria (5 = Excellent, 4 = Good, 3 = Moderate, 2 = Fair, 1= Poor)	**Score**	**Candidate 1**		**Candidate 2**		**Candidate 3**	
		Score	**Result**	**Score**	**Result**	**Score**	**Result**
Technical Feasibility (Wt. 20%)							
(1) Easy to develop and maintain by company staff	3	1	**3**	2	6	5	**15**
(2) Online real time access	3	1	**3**	5	**15**	**4**	**12**
(3) Support feature technology	2	1	2	5	**10**	5	10
(4) System liability	2	2	4	5	10	5	10
(5) Support two-tire client server	2	1	2	5	10	4	8
(6) Support multi-level security	2	1	**2**	5	10	5	10
(7) Technical manual	2	5	10	4	8	5	10
(8) Internal technical training	2	5	10	1	**2**	5	10
(9) Document can be store in soft copy	2	1	2	5	10	5	**10**
Sub Total			**40**		**81**		**95**
Economic Feasibility (Wt. 40%)							
(1) Cost to develop	8	3	24	1	8	3	24
(2) Payback Period	6	1	6	2	12	3	**18**
(3) Net Present Value	6	1	6	4	24	5	**30**
Sub Total			**30**		**44**		**72**
Operational Feasibility (Wt. 30%)							
(1) Document can be store in hard copy	2	5	10	5	10	5	10
(2) Fast response to search document	3	1	**3**	5	**15**	5	**15**
(3) Fast response to delivery document	3	1	**3**	5	**15**	5	**15**
(4) Able can be share to multi-user	3	2	**3**	5	**15**	5	**15**
(5) Less human error	2	3	6	4	8	5	10
(6) Less paper usage	2	2	4	4	8	4	8
(7) Fulfill user requirements	3	3	9	1	**3**	4	**12**
(8) To be able to consolidate the customer information of the company	2	1	2	5	10	5	**10**
Sub Total			**40**		**84**		**95**
Schedule Feasibility (Wt. 10%)							
(1) System Design &Develop	4	5	20	5	20	4	16
(2) Testing	4	5	20	5	**20**	5	**20**
(3) Training	2	5	10	3	6	5	**10**
(4) Conversion	4	5	20	5	20	5	20
(5) Implementation	6	5	30	5	30	4	24
Sub Total			**100**		**96**		**90**
Ranking		(40*20%)+ (30*40%)+ (40*30%)+ (100*10%) **= 42.0**		(81*20%)+ (44*40%)+ (84*30%)+ (96*10%) **= 68.6**		(95*20%)+ (72*40%)+ (95*30%)+ (90*10%) **= 85.3**	

Table 4.4. Estimated Implementation Costs of Candidate 1.

Cost items	Quantity	Unit Price (Baht)	Amount (Baht)
Hardware & Software			
(1) Server	1	70,000	70,000
(2) Clients	25	30,000	750,000
(3) Laser Printer	1	35,000	35,000
(4) Hub	1	3,000	3,000
(5) Cable and Network Interface	27	2,000	54,000
(6) Router	16	40,000	640,000
(7) Leased Line 128 Kbps	16	120,000	1,920,000
(8) Copier	1	380,000	380,000
Grand Total			3,852,000

Source of Data: Quotation of Hardware from PantipPrice.com, As of 08/2001.

Quotation of Copier from Thai Fuji Xerox Co., Ltd., As of 08/2001.

Quotation of Leased Line from Talecom Asia, As of 08/2001.

Table 4.5. Estimated Annual Operation Costs of Candidate 1.

Cost Items	Amount (Baht)
1. Staff Cost	
Credit Control Manager	240,000
Credit Control Supervisor	120,000
Credit Control Staff	60,000
Account Officers	900,000
Messengers	240,000
Service to Other Departments	240,000
(The Detail of Amount for Staff Cost is described in Table 4.6.)	
Sub Total	1,800,000
2. Operation Cost	324,000
Paper ((20 ream * 100/ream = 2,000/ month) * 12 = 24,000)	
Copier ((Cost 0.50/Paper * 10,000 Papers/ month) * 12 = 60,000)	
Vehicle Expense & Mailing ((1,000/ Day * 20 Days) * 12 = 240,000)	
3. Utility Cost	100,000
Electric City Cost 90,000/per year	
Telephone Cost 10,000/per year	
4. Maintenance Cost	-
Grand Total	2,224,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.6. The Detail of Amount for Staff Cost of Candidate 1.

ManPower Item	Man	Usage (Per Month)	Man Day Cost	Man Day Amount Cost	Total Amount (Per Year)
Credit Control Manager	1	20	1,000	20,000	240,000
Credit Control Supervisor	1	20	500	10,000	120,000
Credit Control Staff	1	20	250	5,000	60,000
Account Officers	30	20	125	75,000	900,000
Messengers	10	20	100	20,000	240,000
Service to Other Depai intents	20	10	100	20,000	240,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.7. Payback Period Matrix of Candidate 1, in Baht.

Cost Items	Years					
	0	1	2	3	4	5
Development cost	-3,852,000					
Operation maintain cost		-2,224,000	-2,446,400	-2,691,040	-2,960,144	-3,256,158
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs adjusted to present value	-3,852,000	-1,986,032	-1,949,781	-1,916,020	-1,882,652	-1,846,242
Cumulative time-adjusted cost over lifetime	-3,852,000	-5,838,032	-7,787,813	-9,703,833	-11,586,485	-13,432,727
Benefits derived from operation of new system	0	693,120	762,432	838,675	922,543	1,014,797
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits adjusted to present value	0	693,120	607,674	597,137	586,737	575,390
Cumulative time-adjusted benefits over lifetime	0	693,120	1,300,794	1,897,931	2,484,668	3,060,058
Cumulative lifetime time-adjusted — cost + benefits	-3,852,000	-5,144,912	-6,487,019	-7,805,902	-9,101,817	-10,372,669

We can not measure the payback period of candidate 1.

Net Present Value = -10,372,669 Baht.

Table 4.8. Estimated Implementation Costs of Candidate 2.

Cost items	Quantity	Unit Price (Baht)	Amount (Baht)
Hardware & Software			
(1) Server	1	70,000	70,000
(2) Clients	25	30,000	750,000
(3) Laser Printer	1	35,000	35,000
(4) Scanner (Networking Flexibility)	16	10,000	160,000
(5) Hub	1	3,000	3,000
(6) Cable and Network Interface	27	2,000	54,000
(7) Router	16	40,000	640,000
(8) Leased Line 128 Kbps	16	120,000	1,920,000
(9) SmartDoc Application			
(1) For Server	1	600,000	600,000
(2) For Client Scan&View	16	20,000	320,000
(3) For Client View	9	12,000	108,000
(4) Training & Documentation (Include)			
(5) Implementation (Include)			
Grand Total			4,660,000

Source of Data: Quotation of Hardware from PantipPrice.com, As of 08/2001.

Quotation of Leased Line from Talecom Asia, As of 08/2001.

Quotation of Software from Smart Office Ltd. Bth Floor, ITF Tower 140/7 Silom Road, Bangkok 10500 Thailand., As of 08/2001.

Table 4.9. Estimated Annual Operation Costs of Candidate 2.

Cost Items	Amount (Baht)
1. Staff Cost	
Credit Control Manager	84,000
Credit Control Supervisor	42,000
Credit Control Staff	30,000
Account Officers	180,000
Messengers	-
Service to Other Departments	48,000
(The detail of Amount for Staff cost is described in Table 4.9.)	
Sub Total	384,000
2. Operation Cost	7,200
Paper ((1 ream * 100/ream = 100/ month) * 12 = 1,200)	
Printer ((Cost 1/Paper * 500 Papers/ month) * 12 = 6,000)	
3. Utility Cost	105,000
Electric City Cost 100,000/ year	
Telephone Cost 5,000/ year	
4. Maintenance Cost	60,000
(Software Service 60,000/year)	
Grand Total	556,200

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.10. The Detail of Amount for Staff Cost of Candidate 2.

ManPower Item	Man	Usage (Per Month)	Man Day Cost	Man Day Amount Cost	Total Amount (Per Year)
Credit Control Manager	1	20	350	7,000	84,000
Credit Control Supervisor	1	20	175	3,500	42,000
Credit Control Staff	1	20	125	2,500	30,000
Account Officers	30	20	25	15,000	180,000
Messengers	-	-	-	-	
Service to Other Depaitments	20	10	20	4,000	48,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.11. Payback Period Matrix of Candidate 2, in Baht.

Cost Items	Years					
	0	1	2	3	4	5
Development cost	-4,660,000					
Operation maintain cost		-502,000	-552,200	-607,420	-668,162	-734,978
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs adjusted to present value	-4,660,000	448,286	-440,103	-432,483	424,951	-416,733
Cumulative time-adjusted cost over lifetime	-4,660,000	-5,108,286	-5,548,389	-5,980,872	-6,405,823	-6,822,556
Benefits derived from operation of new system	0	1,732,800	1,906,080	2,096,688	2,306,357	2,536,992
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits adjusted to present value	0	1,547,390	1,519,146	1,492,842	1,466,843	1,438,474
Cumulative time-adjusted benefits over lifetime	0	1,547,390	3,066,536	4,559,378	6,026,221	7,464,695
Cumulative lifetime time-adjusted — cost + benefits	-4,660,000	-3,560,896	-2,481,853	-1,421,494	-379,602	642,139

Payback Period = Last year of negative + $\frac{\text{Cumulative difference last negative year}}{\text{Absolute value of cumulative difference}}$

$$= 4 + \frac{379{,}602}{(379{,}602 + 642{,}139)}$$

$$= 4.37 \text{ Years}$$

Net Present Value = 642,139 Baht.

Table 4.12. Estimated Implementation Costs of Candidate 3.

Cost items	Quantity	Unit Price(Baht)	Amount (Baht)
Hardware & Software			
(1) Server	1	70,000	70,000
(2) Clients	25	30,000	750,000
(3) Laser Printer	1	35,000	35,000
(4) Scanner (Networking Flexibility)	16	10,000	160,000
(5) Hub	1	3,000	3,000
(6) Cable and Network Interface	27	2,000	54,000
(7) Router	16	40,000	640,000
(8) Leased Line 128 Kbps	16	120,000	1,920,000
(8) SQLServer 7.0 RDBMS	1	100,000	100,000
(9) Visual Basic 6.0	1	40,000	40,000
Sub Total			3,772,000
Development & Implementation	Man	Usage (Days)	
(1) System Analysis (Man Day @2,000/Day)	1	10	20,000
(2) System Design (Man Day @2,000/Day)	1	10	20,000
(3) Programming (Man Day @1,000/Day)	1	31	31,000
(4) Testing (Man Day @1,000/Day)	1	2	2,000
(5) Training & Documentation			5,000
(Duration 1 Days Course Fee 5,000)			
(6) Implementation (Man Day@1,000/Day)	1	2	2,000
Sub Total			80,000
Grand Total			3,852,000

Source of Data: Quotation of Hardware from PantipPrice.com, As of 08/2001.

Quotation of Leased Line from Talecom Asia, As of 08/2001.

Source of Data: Quotation of Software from Kim Eng Securities (Thailand) Co., Ltd., Information Technology Department, As of 08/2001.

Table 4.13. Estimated Annual Operation Costs of Candidate 3.

Cost Items	Amount (Baht)
1. Staff Cost	
Credit Control Manager	84,000
Credit Control Supervisor	42,000
Credit Control Staff	30,000
Account Officers	180,000
Messengers	-
Service to Other Departments	48,000
(The Detail of Amount for Staff cost is described in Table 4.13.)	
Sub Total	384,000
2. Operation Cost	7,200
Paper ((1 ream * 100/ream = 100/ month) * 12 = 1,200)	
Printer ((Cost 1/Paper * 500 Papers/ month) * 12 = 6,000)	
3. Utility Cost	105,000
Electric City Cost 100,000/ year	
Telephone Cost 5,000/ year	
4. Maintenance Cost	12,000
Maintenance Software by Internal Staff 1 Man	
(Man Day @ 1,000 * 12 = 12,000)	
Grand Total	508,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.14. The Detail of Amount for Staff Cost of Candidate 3.

ManPower Item	Man	Usage (Per Month)	Man Day Cost	Man Day Amount Cost	Total Amount (Per Year)
Credit Control Manager	1	20	350	7,000	84,000
Credit Control Supervisor	1	20	175	3,500	42,000
Credit Control Staff	1	20	125	2,500	30,000
Account Officers	30	20	25	15,000	180,000
Messengers	-	-	-	-	-
Service to Other Departments	20	10	20	4,000	48,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.15. Payback Period Matrix of Candidate 3, in Baht.

Cost Items	Years					
	0	1	2	3	4	5
Development cost	-3,852,000					
Operation maintain cost		-508,000	-558,800	-614,680	-676,148	-743,763
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted costs adjusted to present value	-3,852,000	-453,644	-445,364	437,652	-430,030	-421,714
Cumulative time-adjusted cost over lifetime	-3,852,000	4,305,644	-4,751,008	-5,188,660	-5,618,690	-6,040,404
Benefits derived from operation of new system	0	1,732,800	1,906,080	2,096,688	2,306,357	2,536,992
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits adjusted to present value	0	1,547,390	1,519,146	1,492,842	1,466,843	1,438,474
Cumulative time-adjusted benefits over lifetime	0	1,547,390	3,066,536	4,559,378	6,026,221	7,464,695
Cumulative lifetime time-adjusted — cost + benefits	-3,852,000	-2,758,254	-1,684,472	-629,282	407,531	1,424,291

Payback Period = Last year of negative + $\frac{\text{Cumulative difference last negative year}}{\text{Absolute value of cumulative difference}}$

$$= 3 + \frac{629{,}282}{(629{,}282 + 407{,}531)}$$

= 3.61 Years

Net Present Value = 1,424,291 Baht.

4.4 Target System

How to select the best candidate solution is to look for a solution that has the highest score from feasibility analysis matrix (All Criteria and score are finalized by Information Technology committee presented in Table 4.3). For this project, the candidate 3 has the highest score, so it is the most appropriate solution. The proposed system will be implemented regarding to the information explained in feasibility analysis matrix. We have to invest money and time in order to achieve the proposed system and to get maximum benefits from the investment. Therefore, the target system characteristics can be classified into three categories:

(1) Response time

To reduce time and effort to maintain, store, fetch and deliver the document.

(2) Information accuracy and integrity

To reduce the human error in document work manually.

To increase the multi-levels security and support multi-users at the same time.

(3) Document reduction

To reduce the cost of copied papers.

To reduce the cost of storages of original and copied documents in other department users.

4.5 System Analysis and Design

The system analyst needs to make use of the conceptual freedom afforded by Data Flow Diagrams (DFD), which graphically characterize data processes and flows in a business system. In there original state data flow diagrams depict the broadest possible overview of system inputs, processes, and outputs. When systems analysts attempt to

understand the information requirements of users, they must be able to conceptualize how data moves through the organization, the processes or transformation that the data undergoes, and what the outputs are. Although interviews and the investigation of hard data provide a verbal narrative of the system, a visual depiction can crystallize this information in a useful way. Through a structured analysis technique called data flow diagrams (DFD), the systems analyst can put together a graphical representation of data processes throughout the organization. The data flow approach emphasized the logic underlying the system. By using combinations of only four symbols, the systems analyst can create a pictorial depiction of processes that will eventually provide solid system documentation. Data flow diagrams can and should be drawn systematically. First, the systems analyst needs to conceptualize data flows from a top-down perspective. To begin a data flow diagram, collapse the organization's system narrative into a list with the four categories of external entity, data flow, process and data store. This list in turn helps determine the boundaries of the system you will be describing. Once a basic list of data elements has been complied, begin drawing a context diagram. Diagram 0 is the explosion of the context diagram and may include up to nine processes. Including more processes at this level will result in a cluttered diagram that is difficult to understand. Each process is numbered with an integer, generally starting from the upper left-hand corner of the diagram and working toward the lower right-hand corner. The major data stores of the system (representing master files) and all external entities are included on Diagram 0.

Data flow diagrams are categorized as either logical or physical. A logical data flow diagram focuses on the business and how the business operates. It is not concerned with how the system will be constructed. Instead, it describes the business events that take place and the data required and produced by each event. Conversely, a

physical data flow diagram shows how the system will be implemented, including the hardware, software, files and people involved in the system. Ideally, systems are developed by analyzing the current system (the current logical DFD), then adding features that the new system should include (the proposed logical DFD). Finally, the best methods for implementing the new system should be developed (the physical DFD). This project will use the logical model for the current system as a basis for the proposed system provides for a gradual transition to the design of the new system.

The details of system analysis and design on the Document Image System have been presented in the form of graphical presentation which includes:

(1) Context Diagram

(2) Data flow diagram

The detail of existing system is presented in Figure 4.1. to Figure 4.2. and described in the following:

Process 1: Maintain Branch

Keep detail information of each branch for reference such as Branch Code or Branch Name.

Process 2: Maintain User

Credit control department keep users' information and their authority of accessing information from the system such as account officer is able to access only their responsible customer's information.

Process 3: Maintain Customer

Keep customer information such as name and address for controlling customer's file by alphabetic of name.

Process 4: Collect Document

Keep customer information or company information such as government new or public announcement.

Process 5: Fetch Document

User accessing information such as credit control or other authorized users are able to retrieve the information from the system.

Process 6: Move Account Officer/ Customer/ Branch

Transfer customers' information to other account officer or account officer relocation and rearrange information according to account officer requirement.

Process 7: Closed Account

Keep customers' closed account information separately form current account in order to maintain efficiency of the system.

Process 8: Requested Document

Account officer and other departments access customer data from credit control.

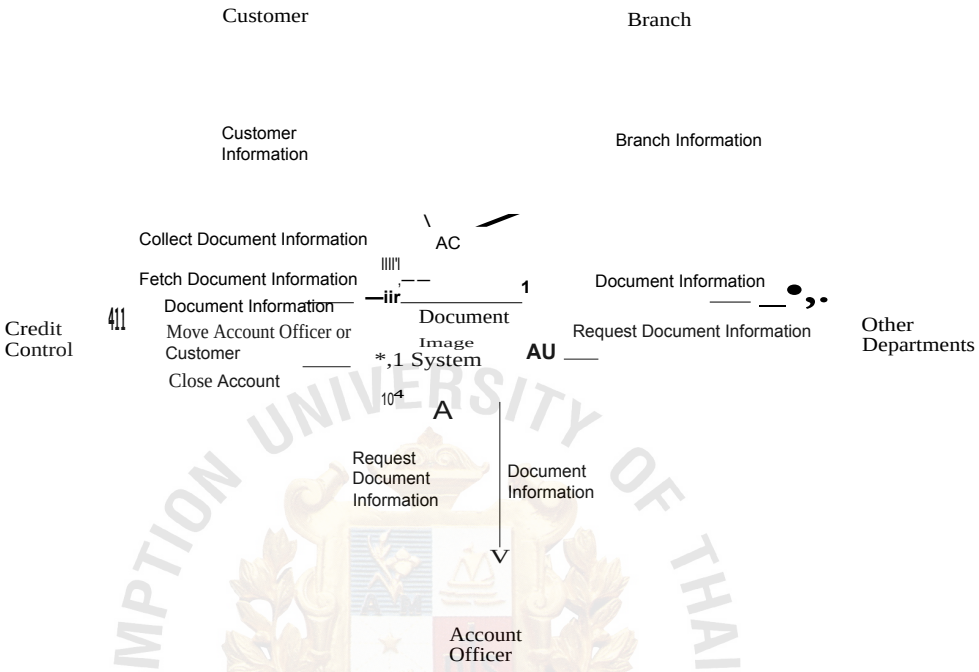

Figure 4.1. Context Data Flow Diagram of the Existing System.

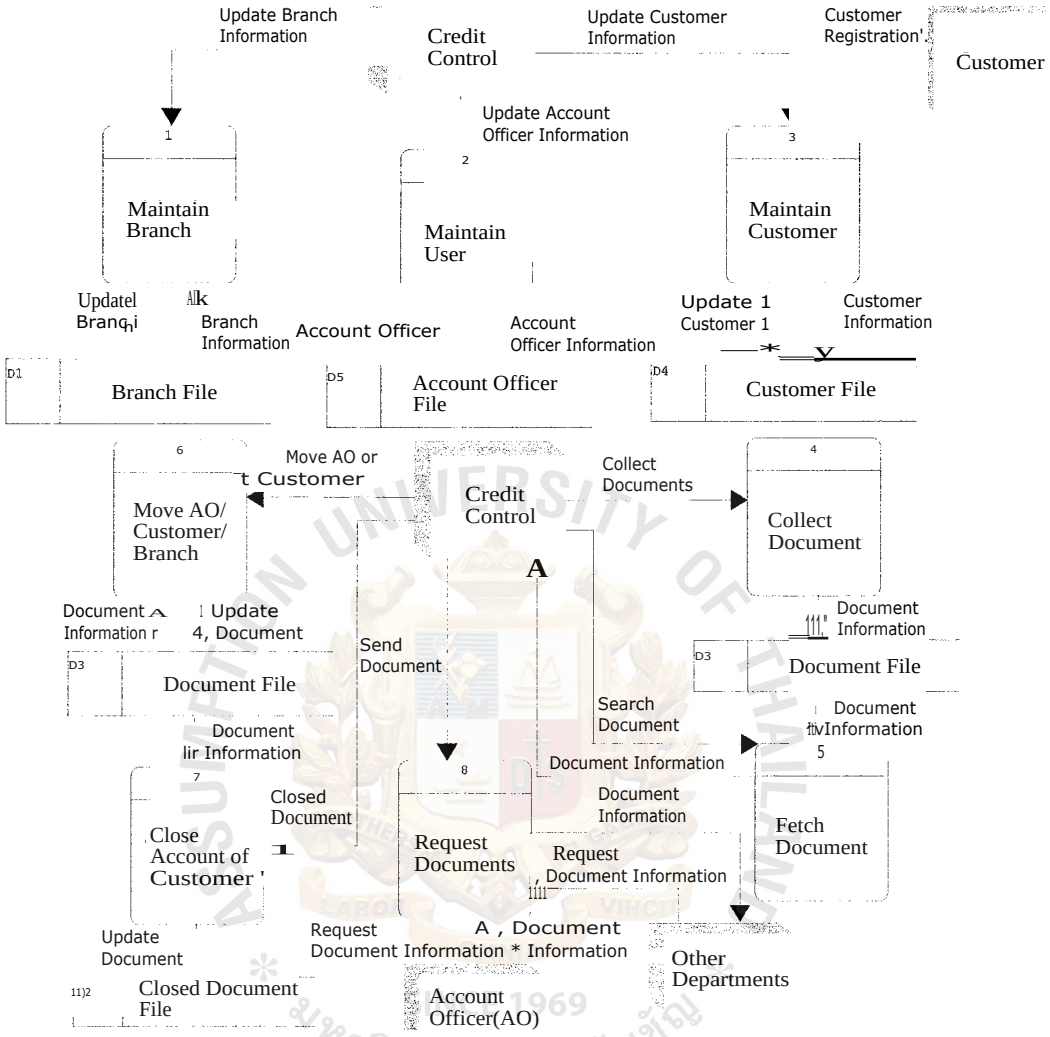

Figure 4.2. Data Flow Diagram Level 0 of the Existing System.

The detail of proposed system is presented in Figure 4.3. to Figure 4.12. and described in the following:

Process 1: Maintain Branch

Keep detail information of each branch for reference such as Branch Code or Branch Name.

Process 2: Maintain User

Credit control department keep users' information such as name, position, department, branch, permission and classification user.

Process 3: Maintain Document

Keep detail of document such as name or classification of the document.

Process 4: Maintain Customer

Keep customer information such as name and other information in which account officer responsible for.

Process 5: Scan Document

Keep customers' information in database according to customer classification.

Process 6: Fetch Document

Access customer information on screen or print out by account officer or branch or type of document.

Process 7: Move Account Officer/ Customer/ Branch

Transfer customers' information from this account officer to others account officer or the other branch.

Process 8: Closed Account

Keep status of closed customer account.

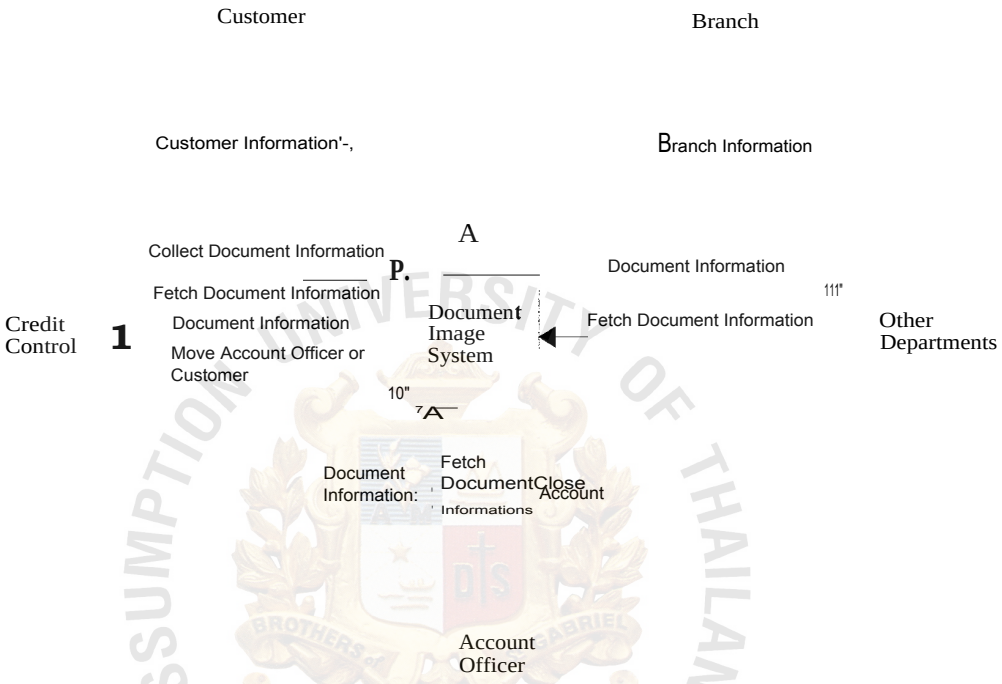

Figure 4.3. Context Data Flow Diagram of the Proposed System.

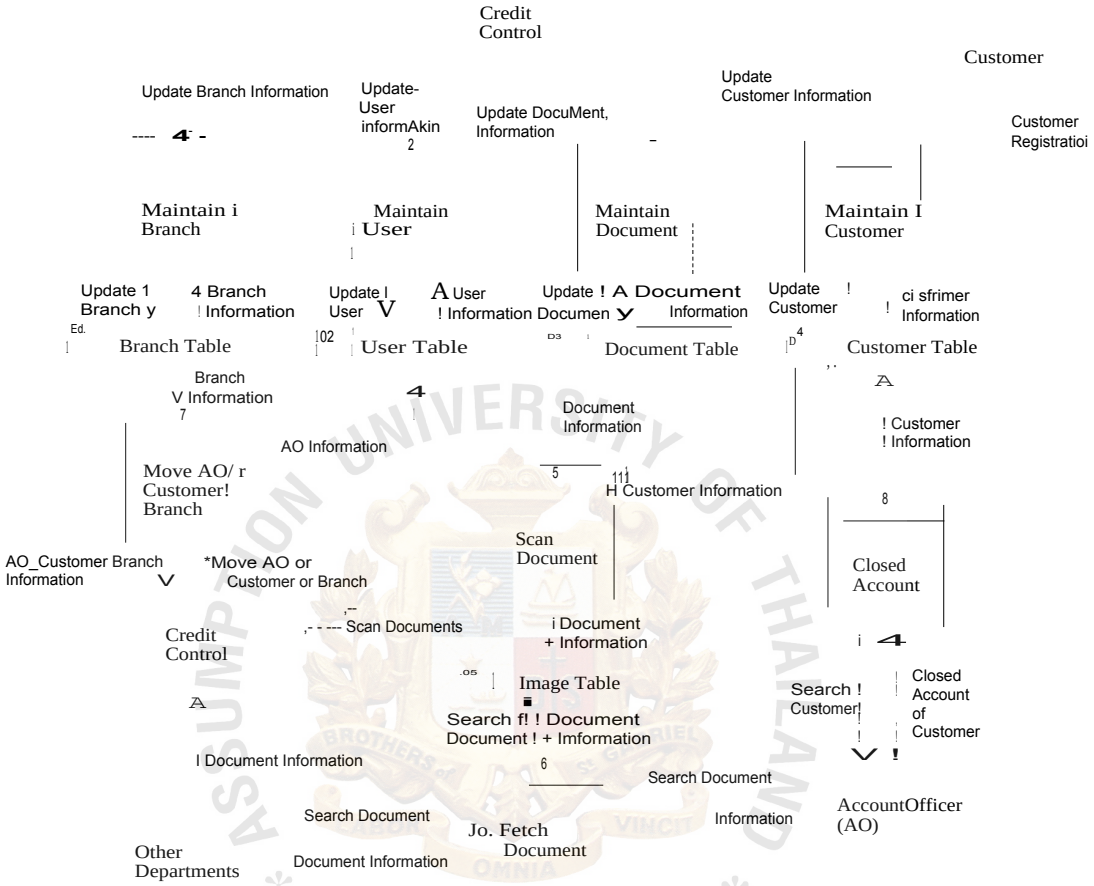

Figure 4.4. Data Flow Diagram Level 0 of the Proposed System.

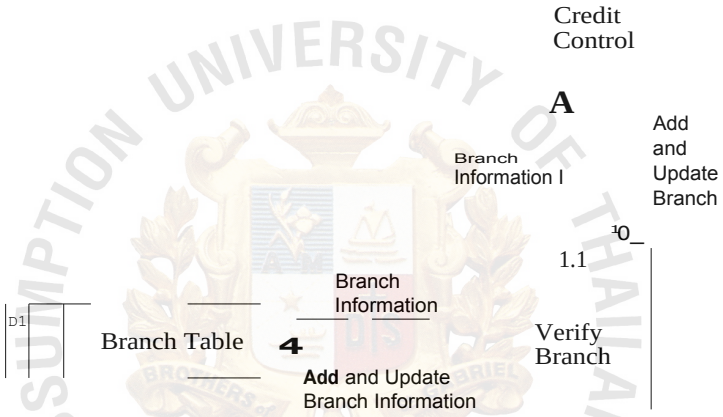

Figure 4.5. Data Flow Diagram Level 1 Process 1 of the Proposed System.

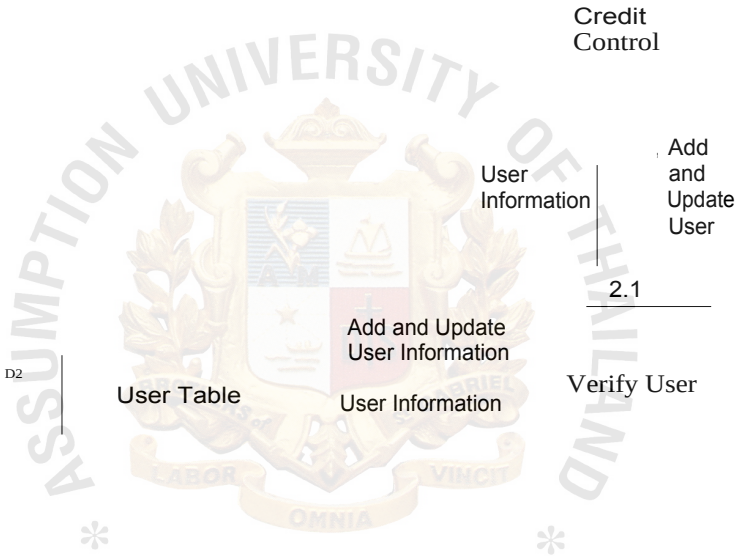

Figure 4.6. Data Flow Diagram Level 1 Process **2** of the Proposed System.

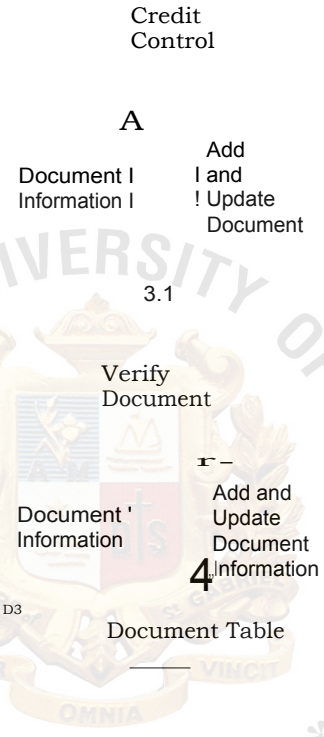

Figure 4.7. Data Flow Diagram Level I Process 3 of the Proposed System.

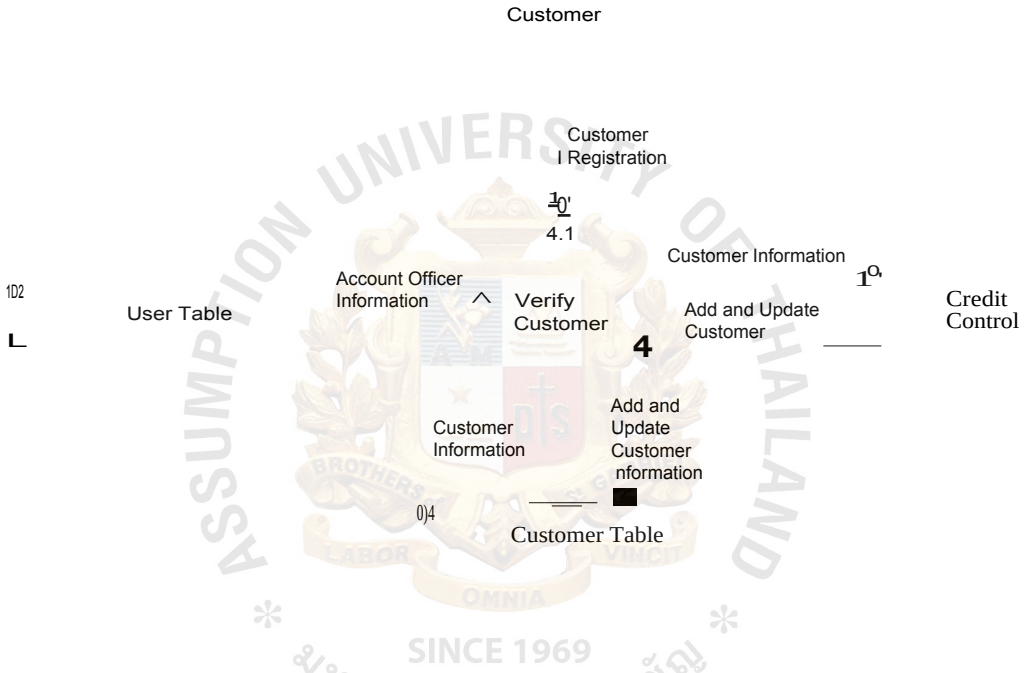

Figure 4.8. Data Flow Diagram Level 1 Process 4 of the Proposed System.

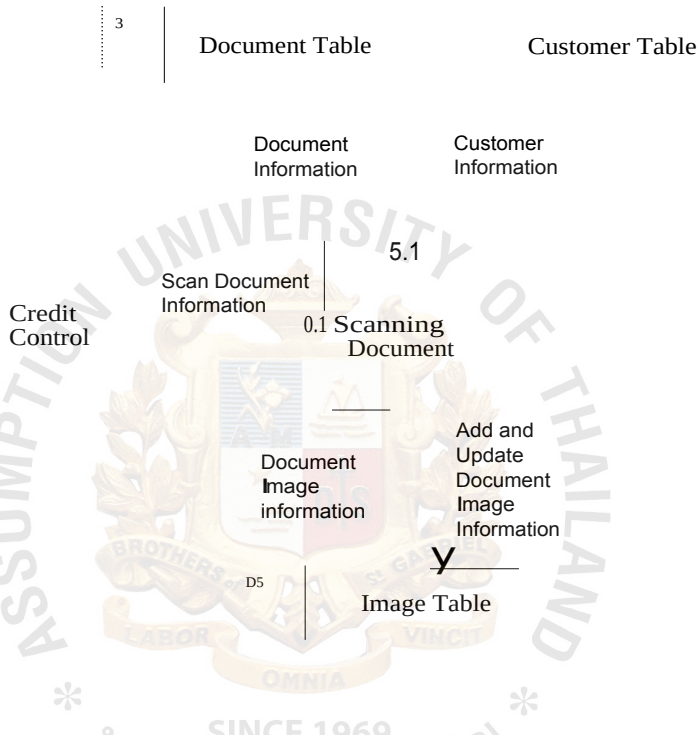

Figure 4.9. Data Flow Diagram Level 1 Process 5 of the Proposed System.

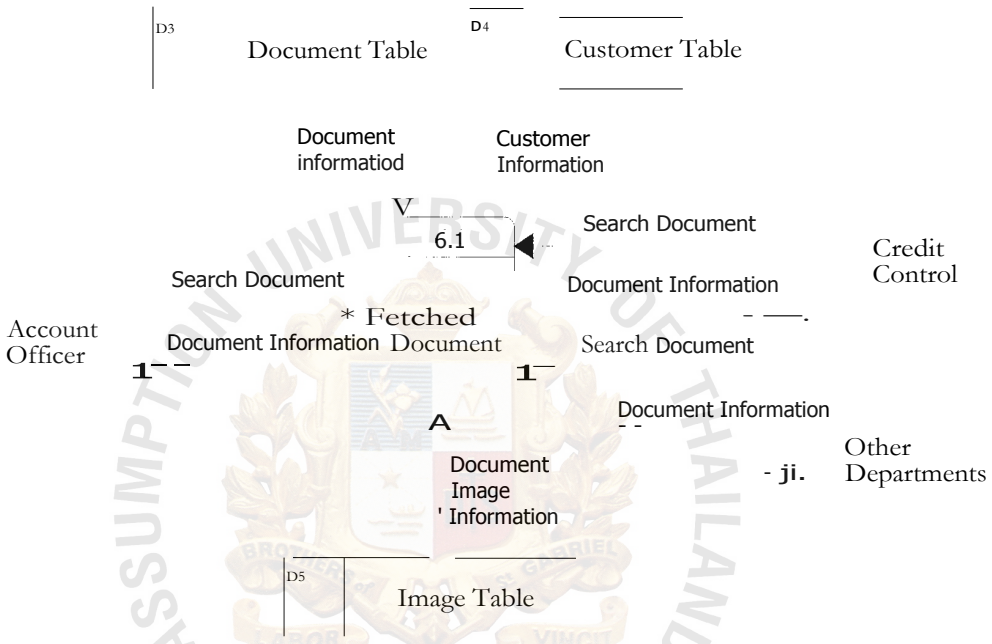

Figure 4.10. Data Flow Diagram Level 1 Process 6 of the Proposed System.

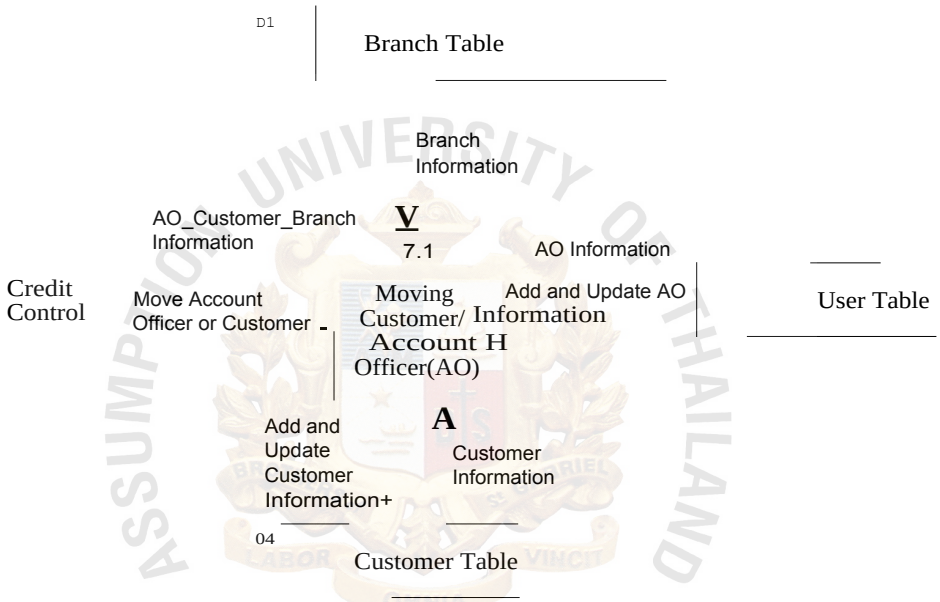

Figure 4.11. Data Flow Diagram Level 1 Process 7 of the Proposed System.

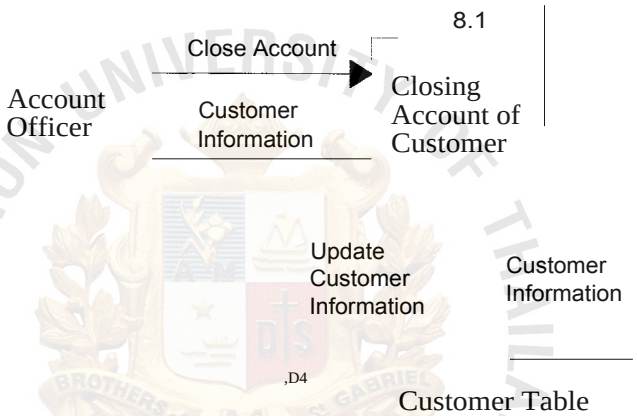

Figure 4.12. Data Flow Diagram Level 1 Process 8 of the Proposed System.

4.5.1 Application Architecture

After the logical model for the new system has been designed, we will next prepare a design for the physical application system that consists of Network Architecture, Data Architecture, Interface Architecture, and Process Architecture, The design will cover technologies to be used and information system of data, process, interface, and network components. The application architecture of Document Image System are as follows:

(1) Network Architecture

The system will apply two-tiered Client/Server computing concept. On the NT server's side, data stored using SQLServer (Database Server) and business logic (Application Server). On the clients' side, the clients will be kept in windows98 and compatible. The proposed LAN design is based on Ethernet topology. All nodes of this topology interconnected directly to the central system. It is meant that each client can communicate only with the central server via hub, network communication lines, and protocol TCP/IP. WAN design is based on existing high speed links, leased line 128 Kbps, between head office and all branches. Network configuration of the proposed system is presented in Figure 4.13.

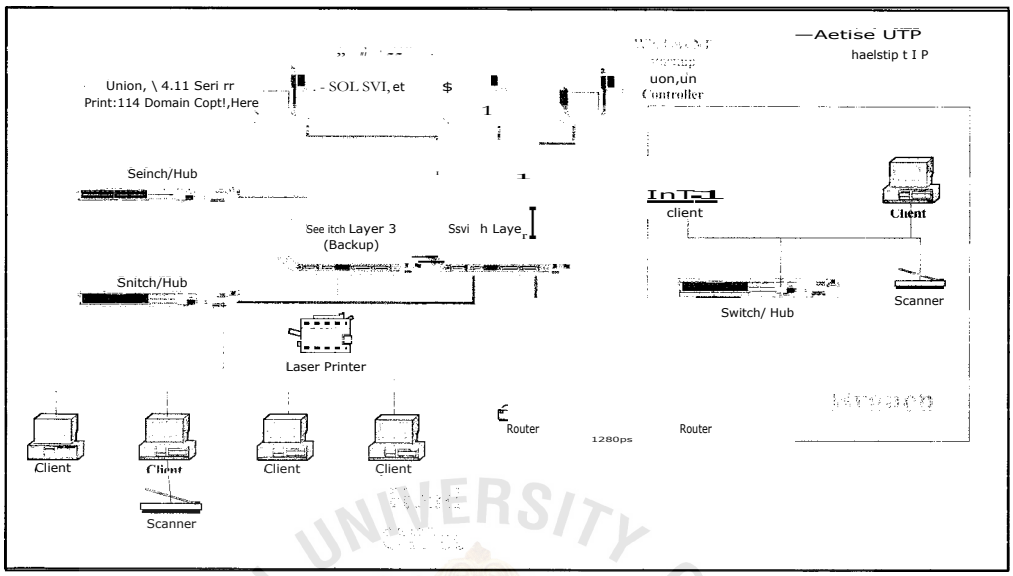

Figure 4.13. Network Configuration of the Proposed System.

(2) Data Architecture

We use SQLServer product, which applied a Relational Database Management System (RDBMS) in our system. All data will be kept in a tabular form, every file is implemented as a table, and have data distribution.

(3) Interface Architecture

We will use Graphical User Interface (GUI) technology to communicate with the users. We will use GUI base on Microsoft Window and develop by Visual Basic. Distributed on-line computers (on-line processing will manage data input and editing.

(4) Process Architecture

The architecture will be defined in term of software languages and tools. The Visual Basic 6.0 will be applied in our system. The Software development system is a language and tool kit. We will use Software Development Enhancement (SDE) for two-tier client/server application consist of client-based programming language.

4.5.2 Database Design

According to the logical data model derived from System Analysis phase, we can transform such data model to physical database schema by using normalization methodology. After normalization was done, the normalized tables are clearly defined. They guarantee data consistency, integrity and also reduce redundancy. The normalized can be done step by step following the rules, which are:

(1) Each entity will be converted to a table.

(2) Each attribute will be transformed to a field.

(3) Each primary and secondary key will be transformed to an index into the table.

(4) Each foreign key will be implemented as a relationship between instance of the table.

After transforming, we might achieve only the first normal form (1NF) which each attribute in every row can contain only a single value and needs to be normalized to reach second normal form (2NF) which no attribute is functionally dependent on only part of the primary key; that is, each non-key attribute is fully functionally dependent on the primary key, and then third normal form (3NF) which no non-key attribute is functionally dependent on another non-key attribute later.

We can claim that all entities in the logical data model have been mapped to tables, which have already been third normal form. The reason is that they contain no repeating groups and every non-key attribute fully depend on the primary key and no non-key attributes which depend on any other non-key attributes. Moreover, all tables provide database integrity: key integrity, domain integrity and referential integrity. By this, we ensure that the physical database schema of the proposed system presented in Figure 4.14 to Figure 4.16 also decreases redundancy.

All tables are as follows:

(1) Customer

(2) Document

(3) Image

(4) Branch

(5) User

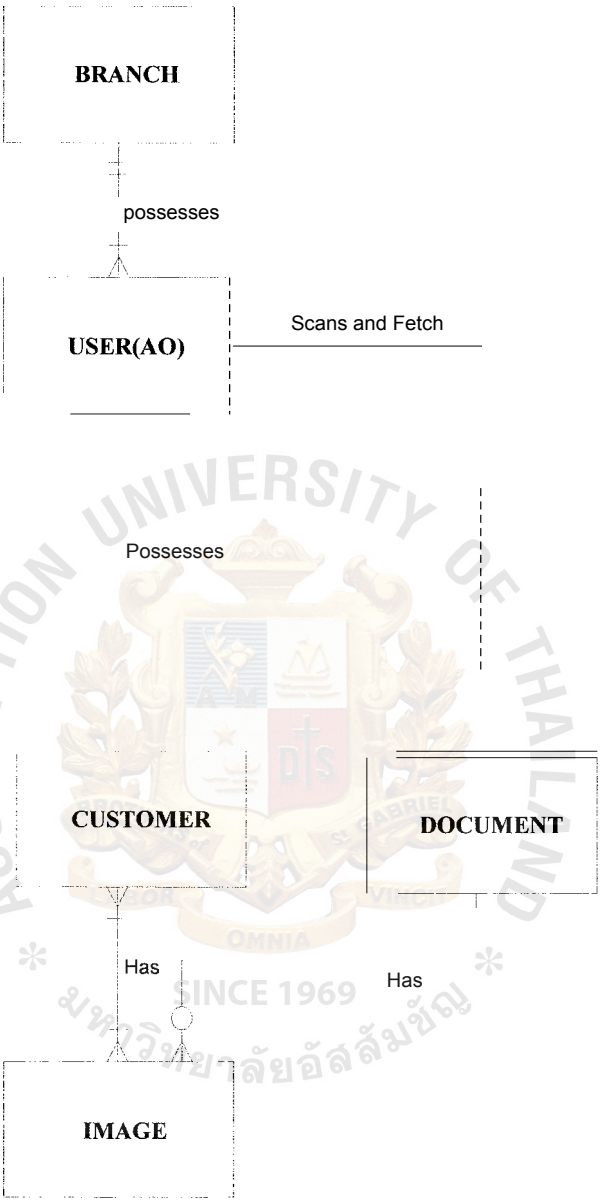

Figure 4.14. Context Data Model of the Proposed System.

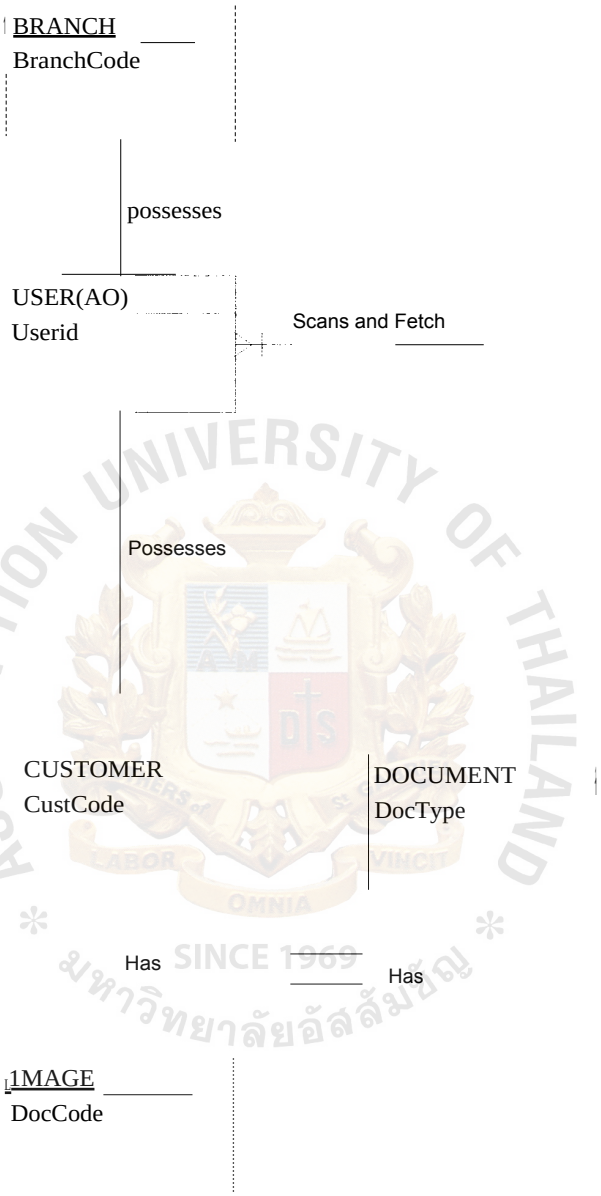

Figure 4.15. Key-Based Data Model of the Proposed System.

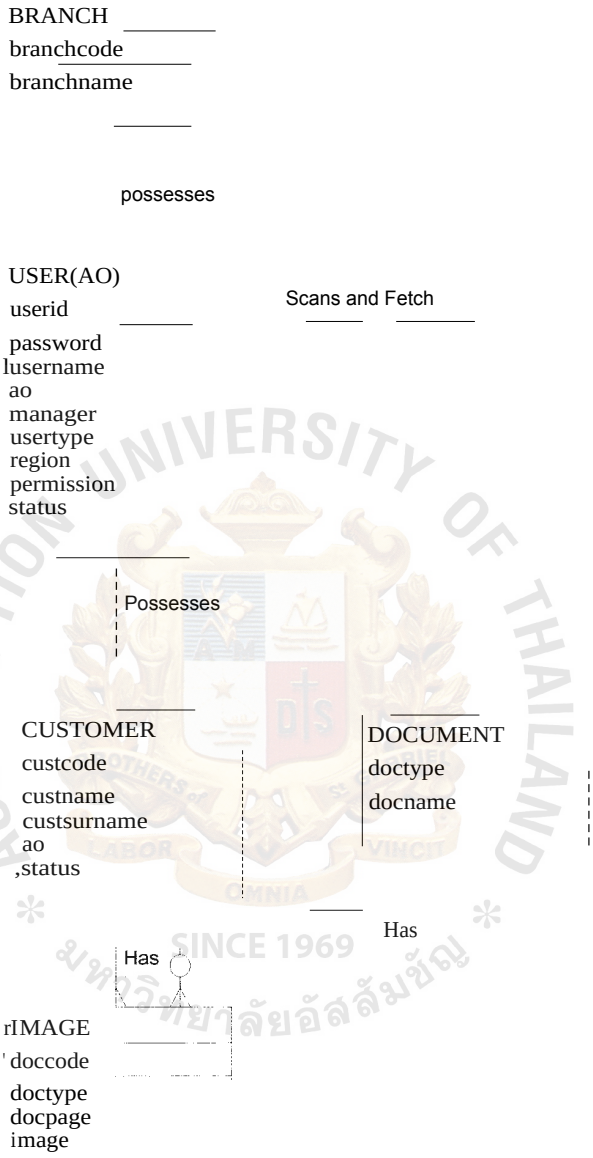

Figure 4.16. Fully-Attributed Data Model of the Proposed System.

4.5.3 Structure Design

The concept of structured design is simple design, a program as a top-down hierarchy of modules. The primary tool used in structured design is the structure chart.

Structure charts are used to graphically depict a modular design of a program. Structure chart modules are presumed to execute in a top-to-bottom and left-to-right sequence. Two types of arrows are used to indicate the kinds of parameters that are passed between the modules. The first is called a data couple; the second is called a control flag. This particular structure chart served the main objectives of drawing structure charts that is:

(1) To encourage a top-down design.

(2) To support the concept of modules and identify the appropriate modules.

(3) To identify and limit as much as possible the data couples and control flags that pass between modules.

Once the data flow diagram has been revised, a structure chart can be derived. There are two strategies for developing the structure chart from data flow diagrams as follows:

(1) Transform analysis is an examination of the DFD to divide the processes into those that perform input and editing (called Afferent), those that do processing or data transformation (called Central Transform), and those that do output (called Efferent).

(2) Transaction analysis is an examination of the DFD to identify processes that represent transaction centers. Transaction center is a process that does not do the actual transformation on the incoming data (data flow): rather, it serves as router to route data to two or more processes.

For the Document Image System, we revised and redraw the logical DFD in order to include more details need to be used by the programmer. We use the transform analysis approach to convert logical DFD to structure charts. All DFDs reflecting transform analysis structure charts are presented process by process sequentially in Figure 4.17. to Figure 4.22.

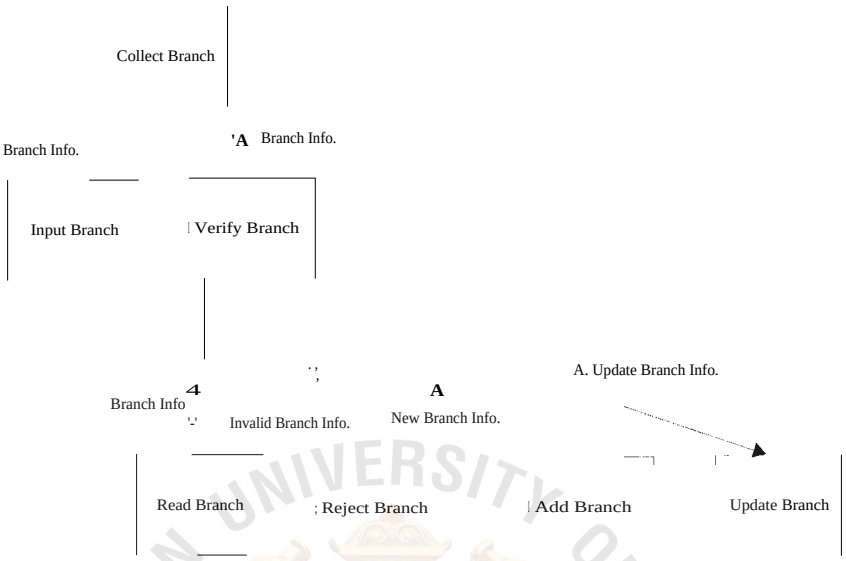

Figure 4.17. Structure Chart of Collect Branch Process.

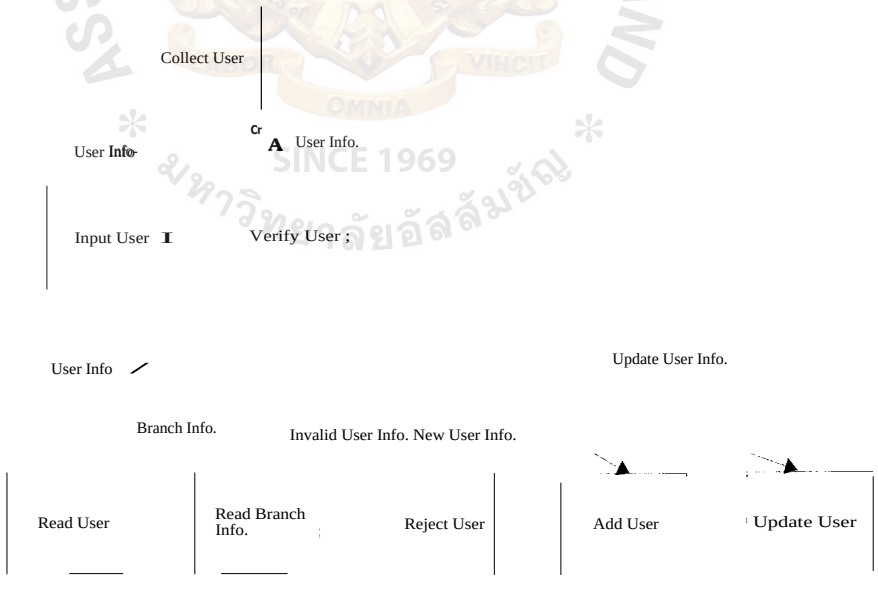

Figure 4.18. Structure Chart of Collect User Process.

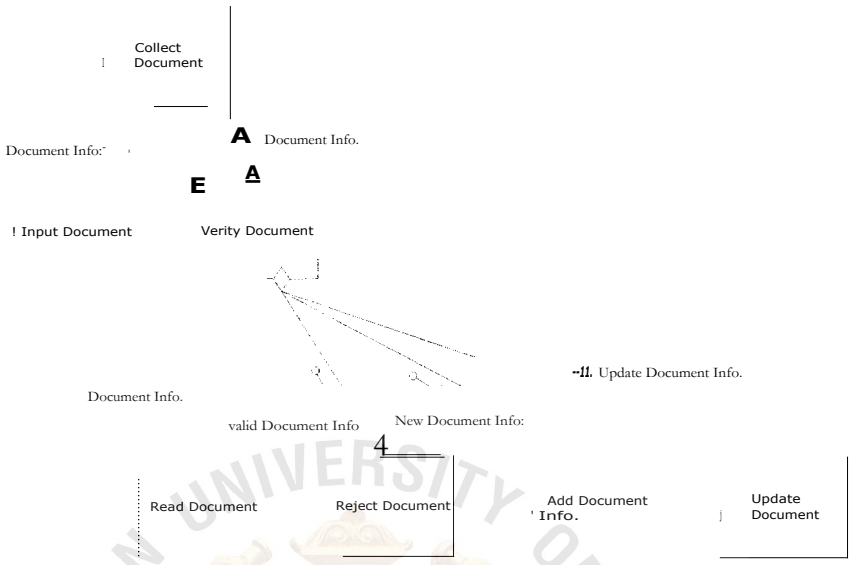

Figure 4.19. Structure Chart of Collect Document Process.

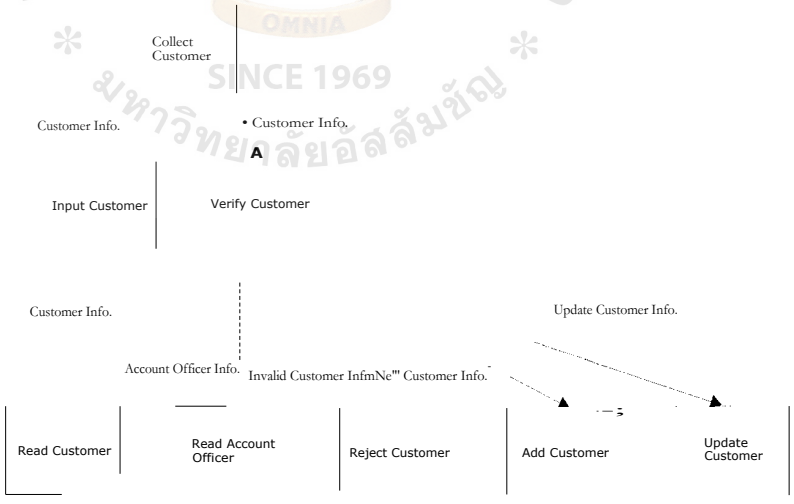

Figure 4.20. Structure Chart of Collect Customer Process.

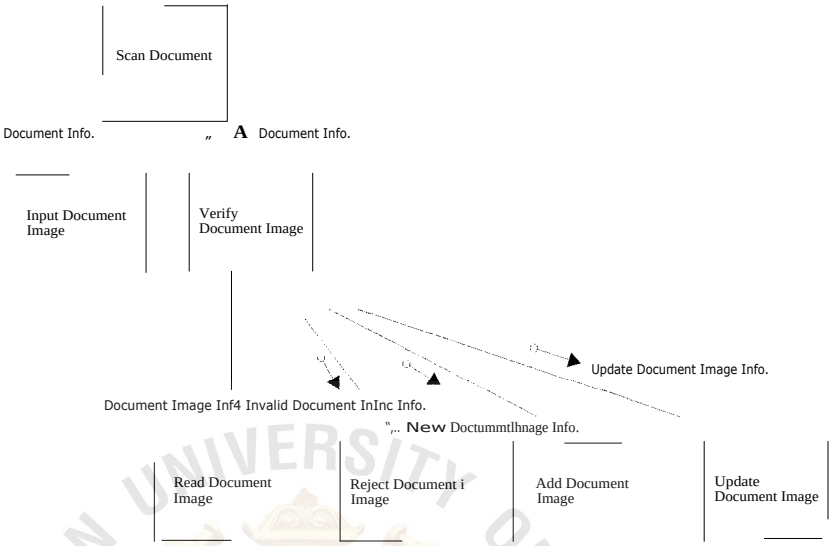

Figure 4.21. Structure Chart of Scan Document Process.

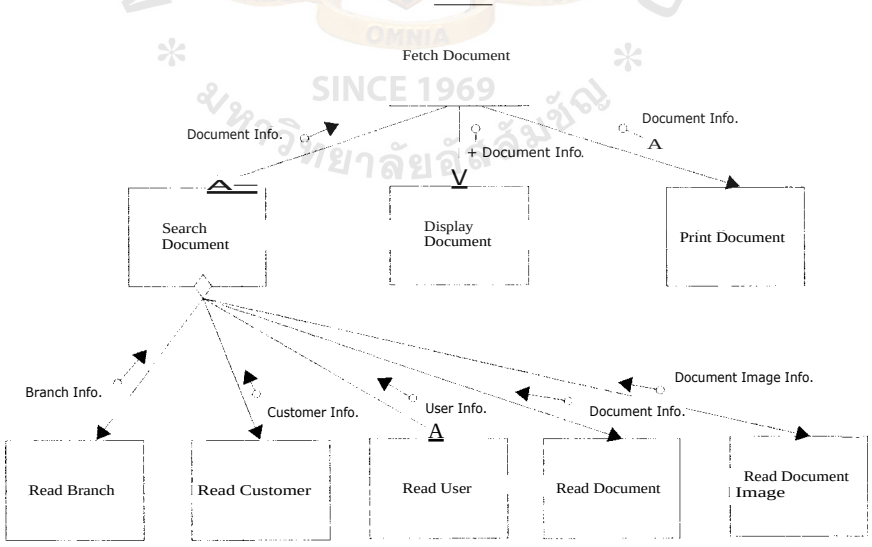

Figure 4.22. Structure Chart of Fetch Document Process.

4.5.4 Input Design

The Document Image System has been developed by using Visual Basic 6.0 which is run on Windows'98 and up. The input process will be designed with GUI for easy usage and understanding. Moreover, it should facilitate rapid data entry by minimizing key-stroke of user, and should provide the control of input by looking for the appropriate data type of each attribute.

Normally, input design emphasizes about what is the appropriate format and media for a computer input, how do you apply human factors to the design the computer inputs, and how do you select proper screen-based controls for input attributes that are to appear on a GUI input screen.

The prototype of input screens is presented in Figure 4.23. to Figure 4.38.

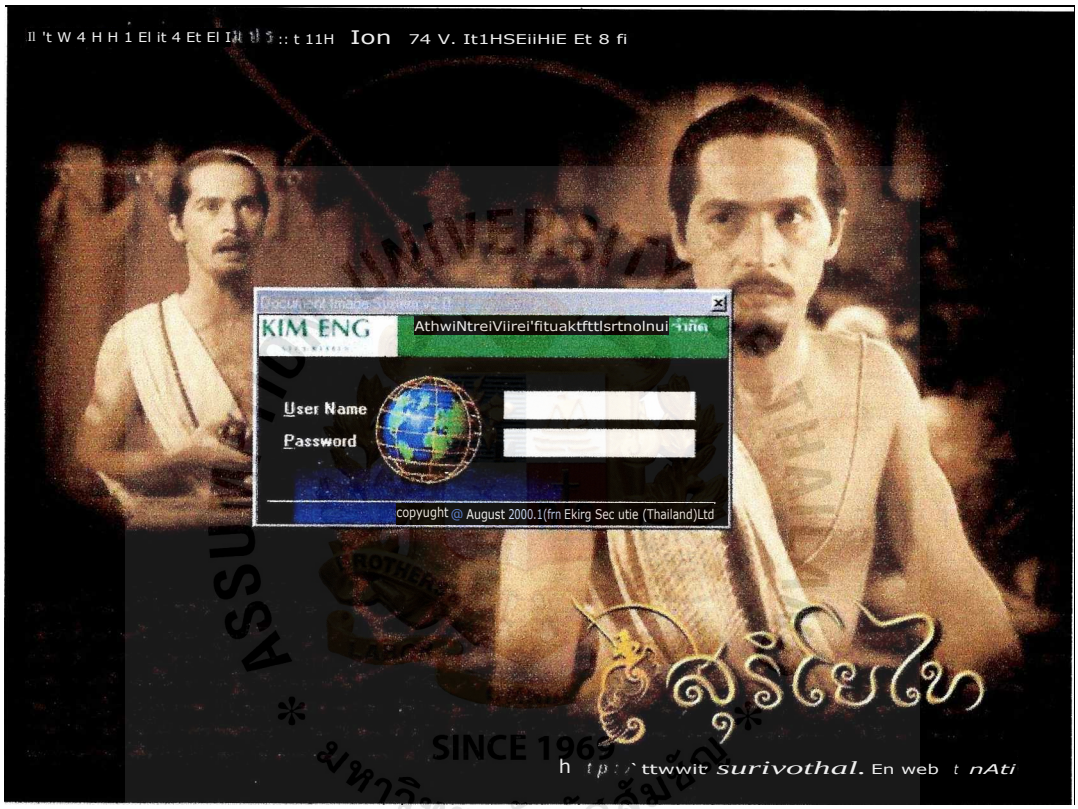

Figure 4.23. Logon Screen.

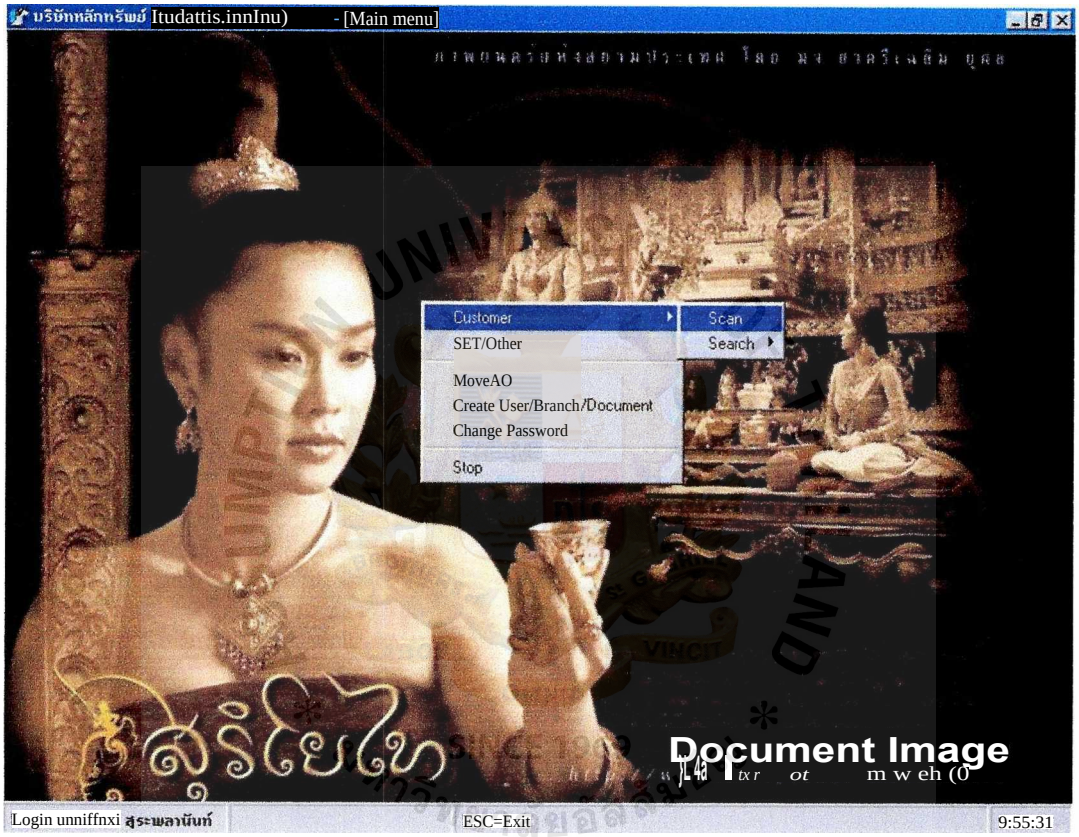

Figure 4.24. Main Menu.

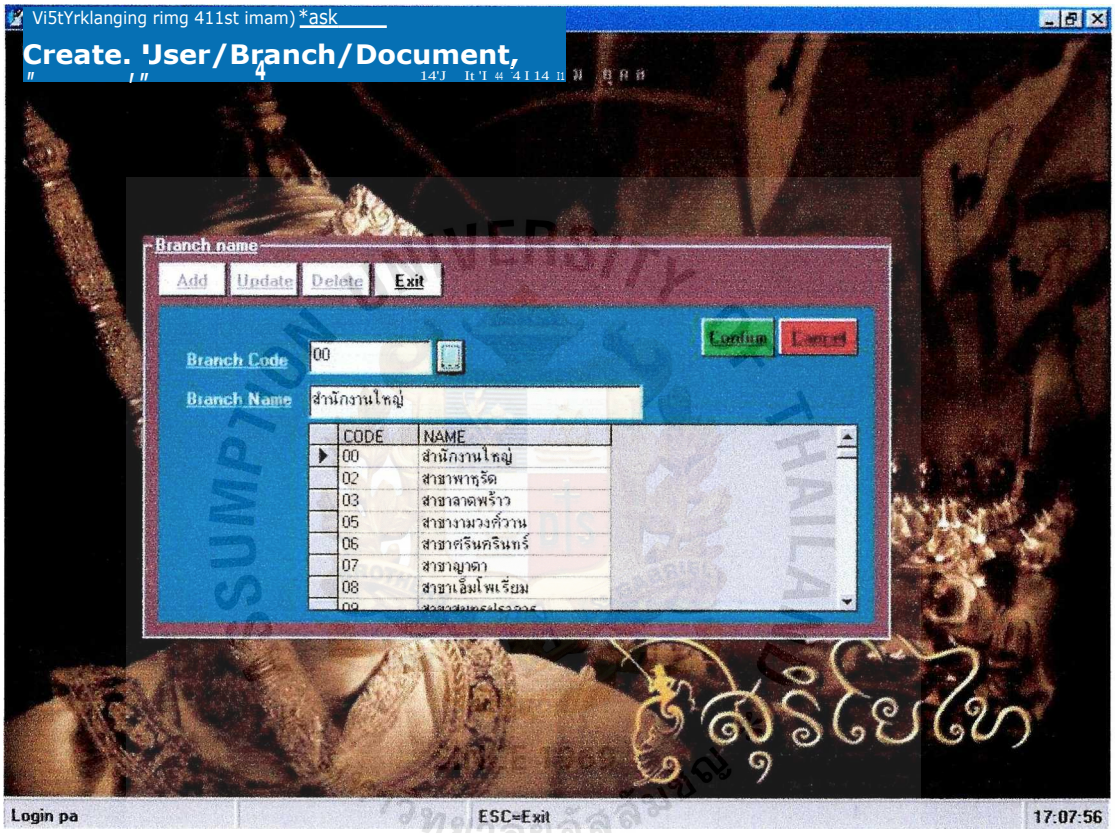

Figure 4.25. Create Branch.

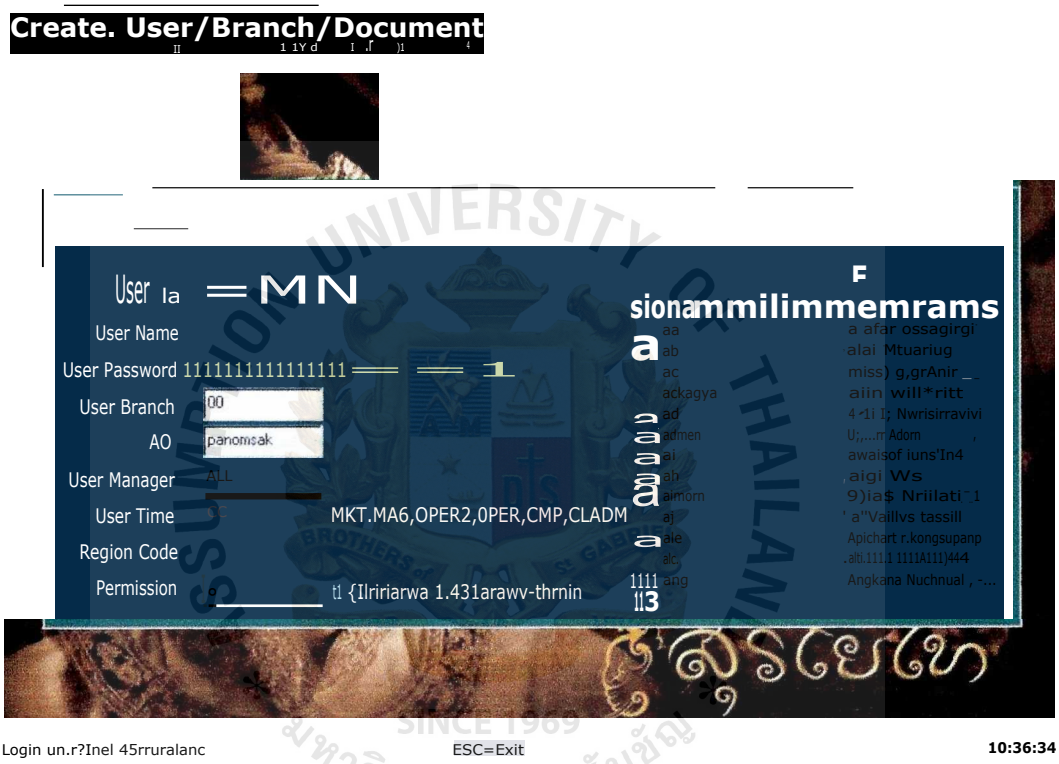

Figure 4.26. Create User.

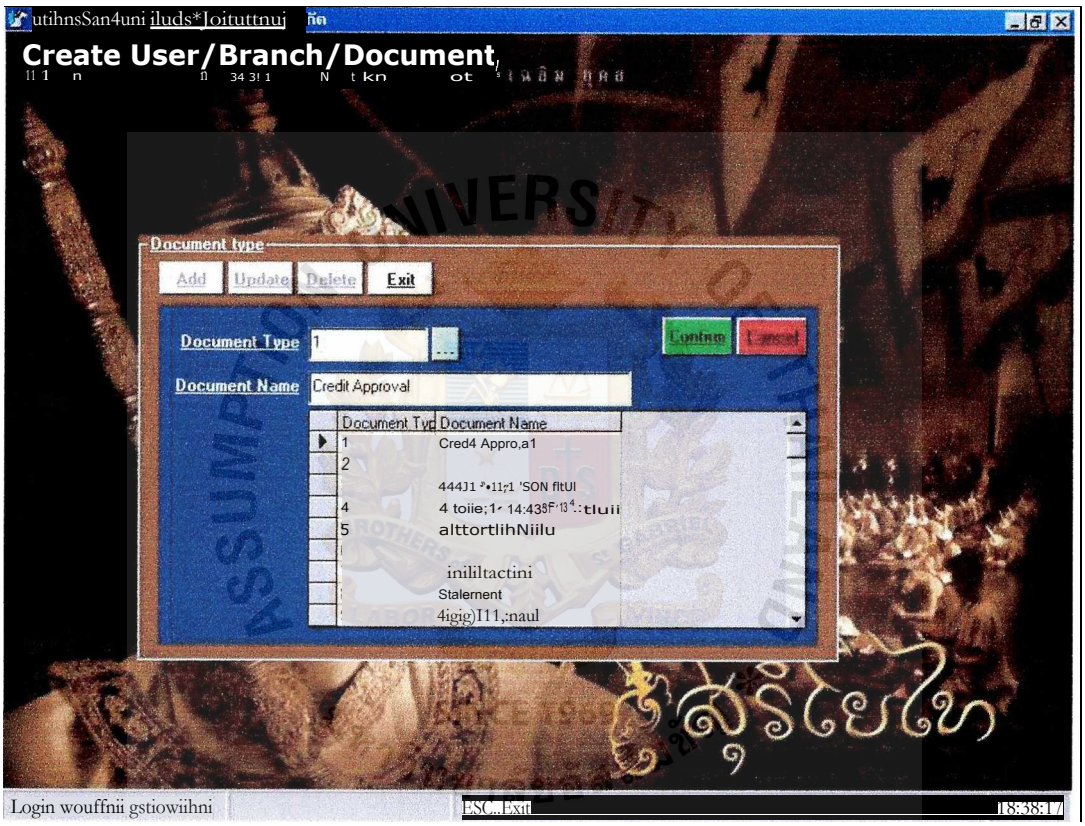

Figure 4.27. Create Document Type.

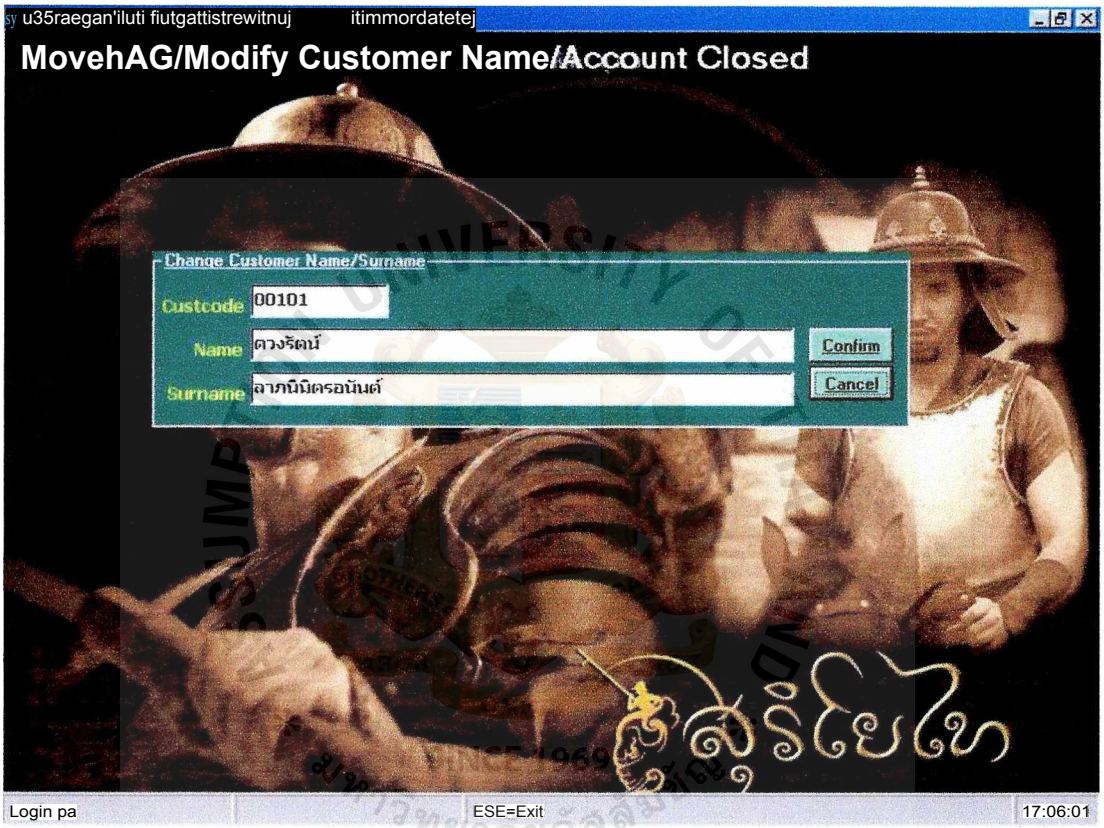

Figure 4.28. Modify Customer Information.

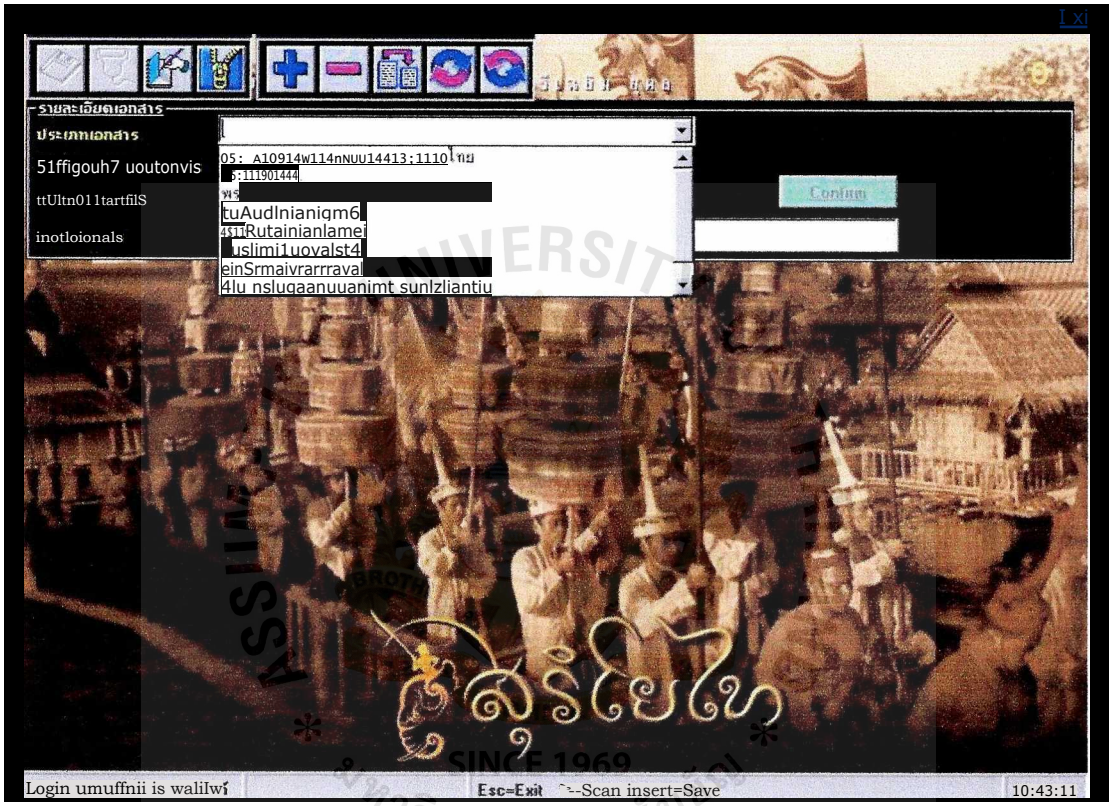

Figure 4.29. Scan Document.

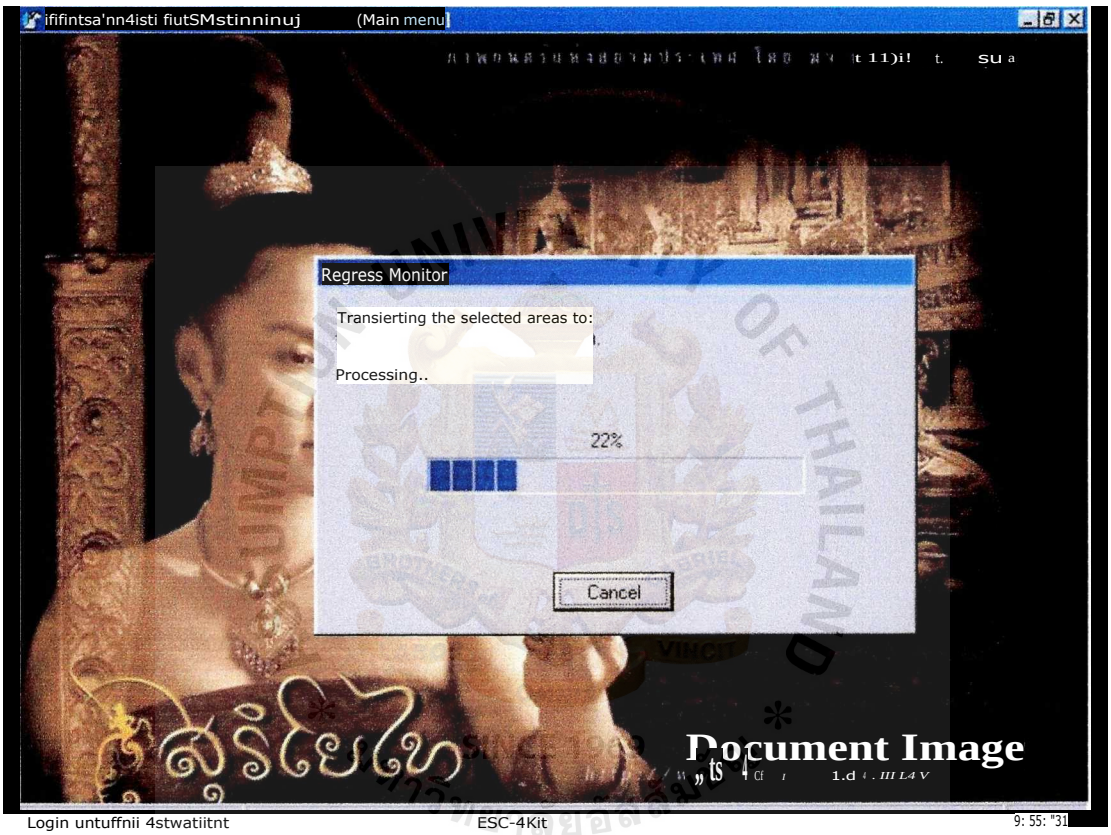

Figure 4.30. Scanning Document.

x

1510912001

The Assignor of Authority accepts all responsibilities for any and undertaken by the Attorney-In-Fact or Sub-Attorney so appointed by the At Fact in pursuance of this Deed which shall be binding and construed as if s has been undertaken personnally, in all aspects, by the Assignor of Authority

IN EVIDENCE THEREOF, this deed is signed in the presence of wit

(sign) _____ ASSIGNOR OF AUTHORITY

,Login ieuu*Mn4 astivaiiiuA* Esc=Ex* an Insert-Save **10:47:40**

Figure 4.31. Display Document (After Scan).

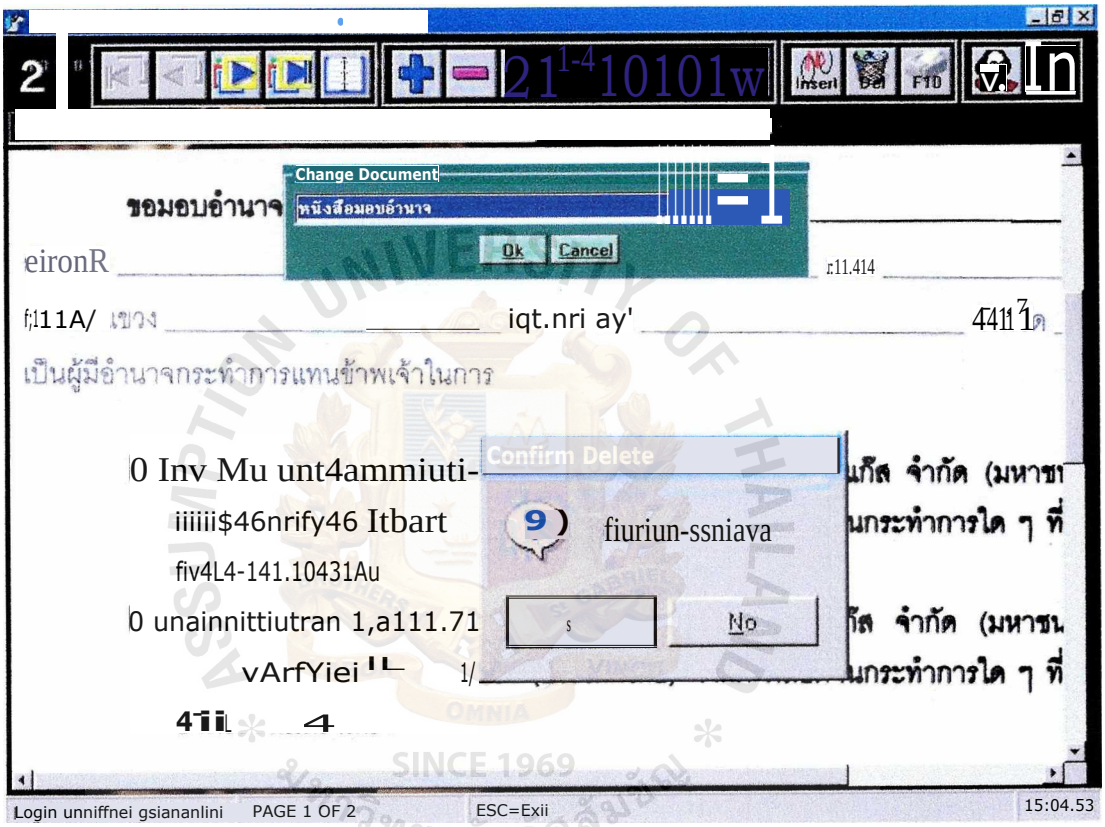

Figure 4.32. Change Document.

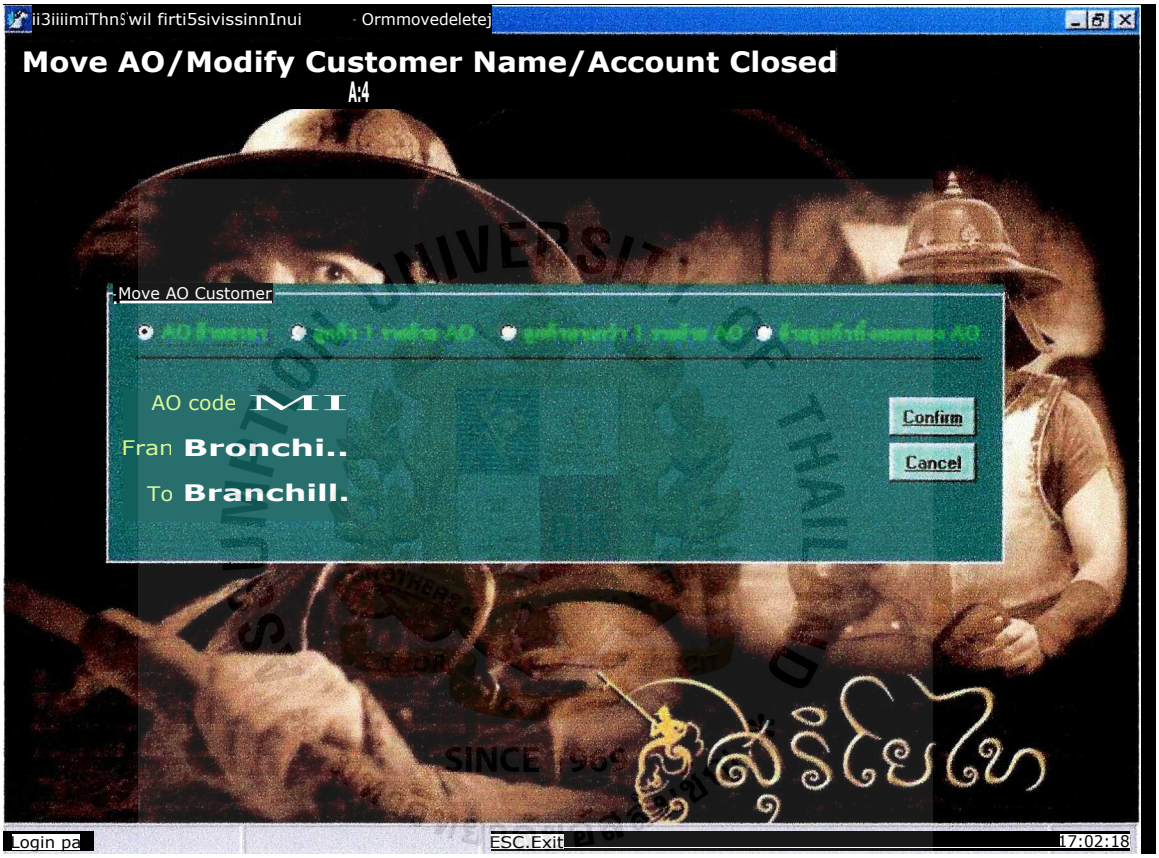

Figure 4.33. Move Account Officer (AO Change Branch).

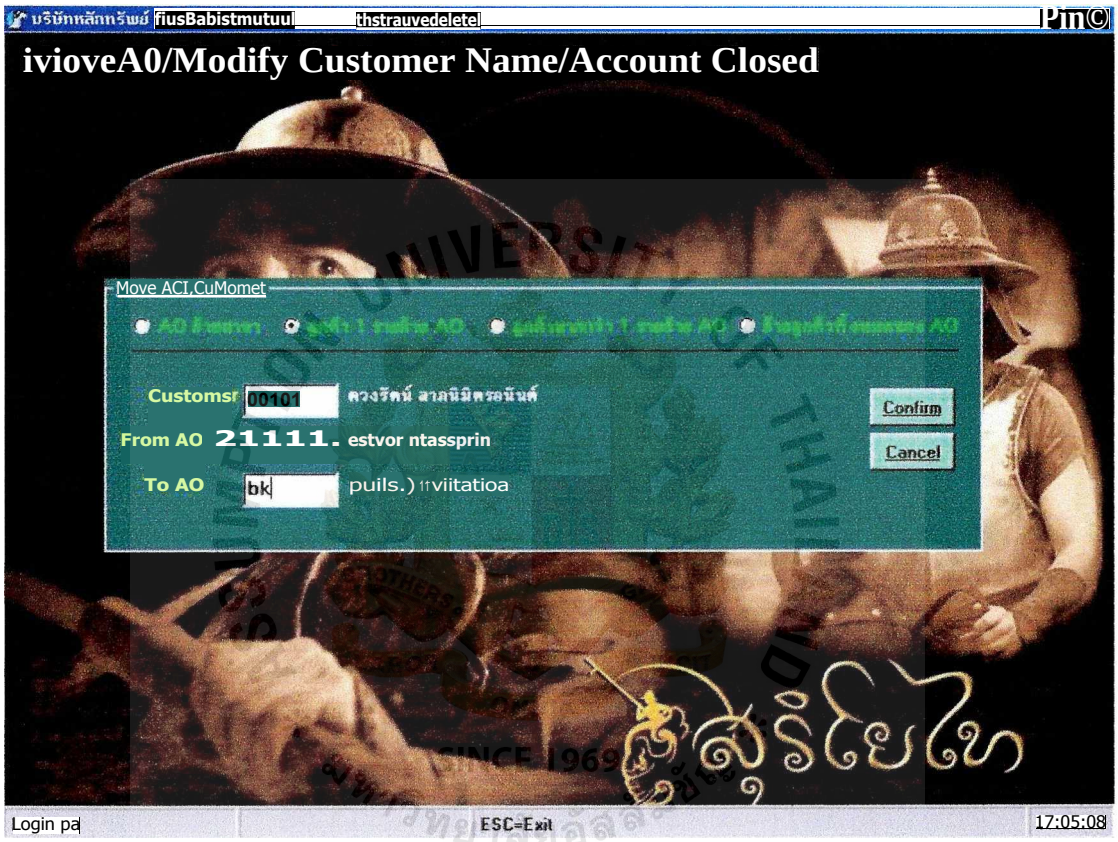

Figure 4.34. Move Customer (Customer Change AO).

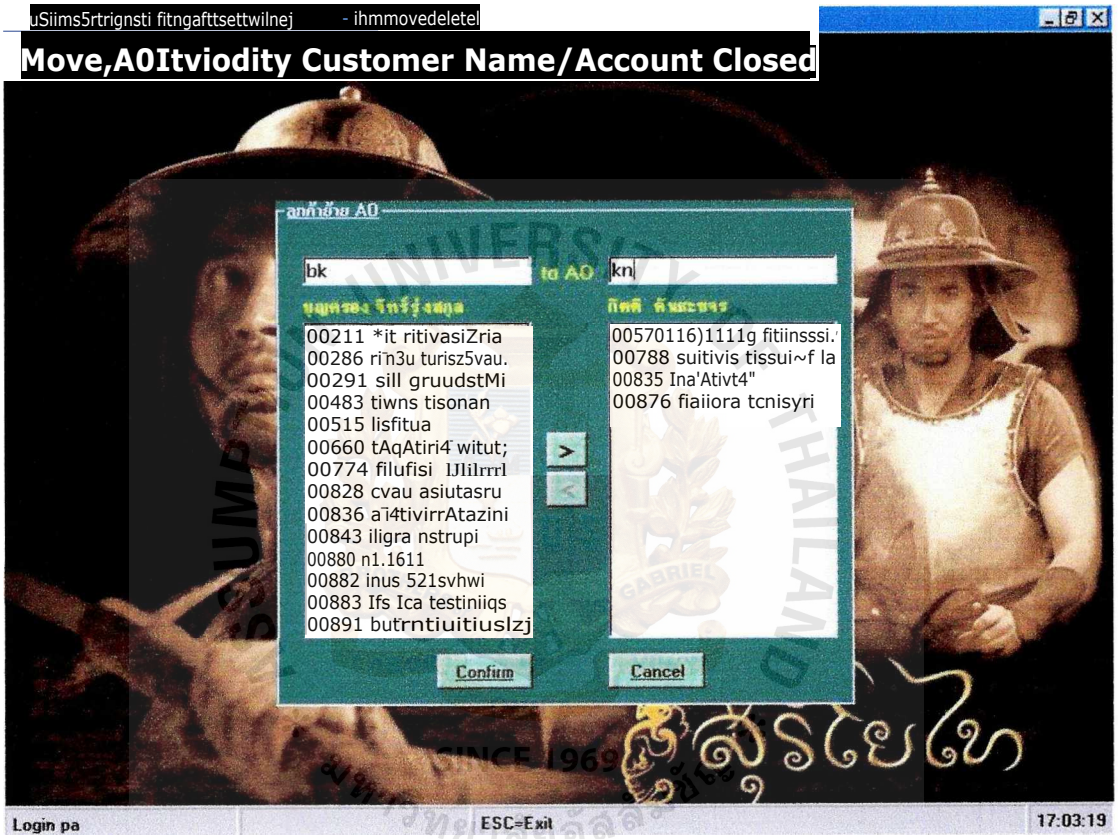

Figure 4.35. Move Customer (More than 1 Customer Change AO).

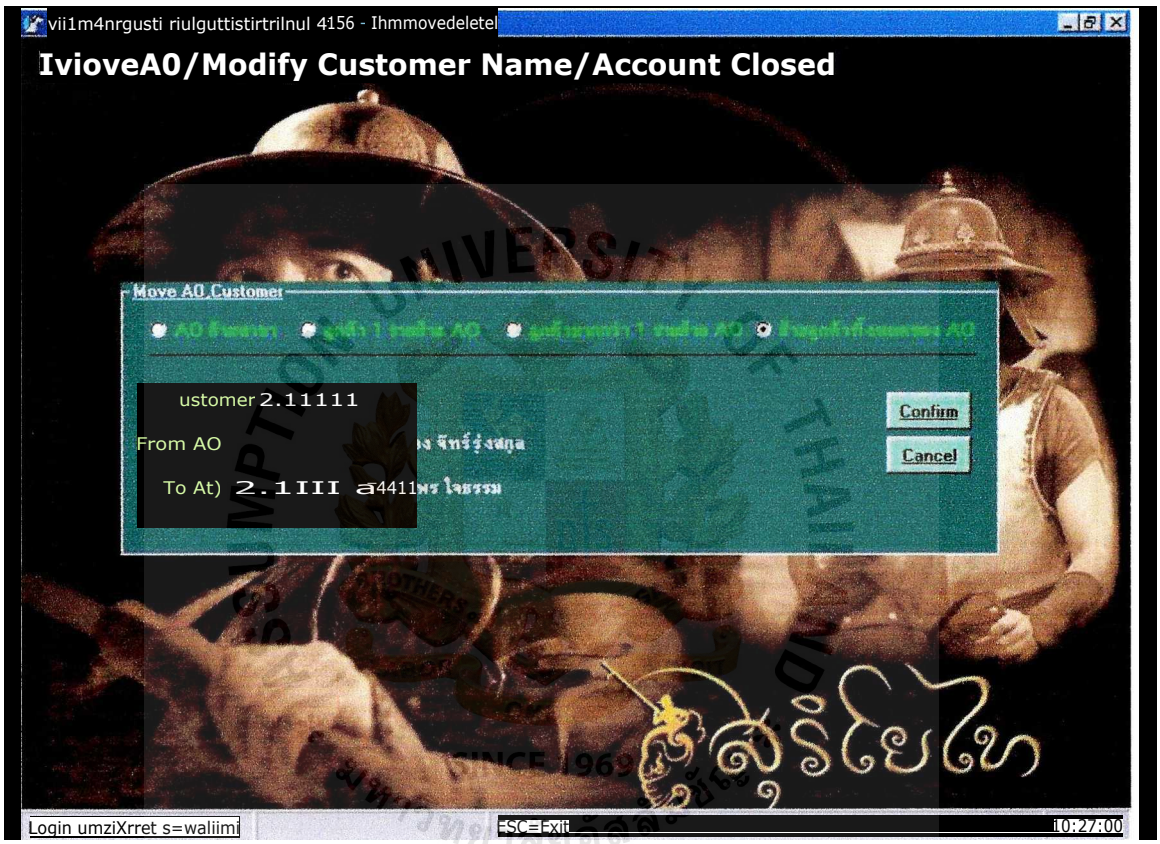

Figure 4.36. Move Customer (Change All Customer of AO).

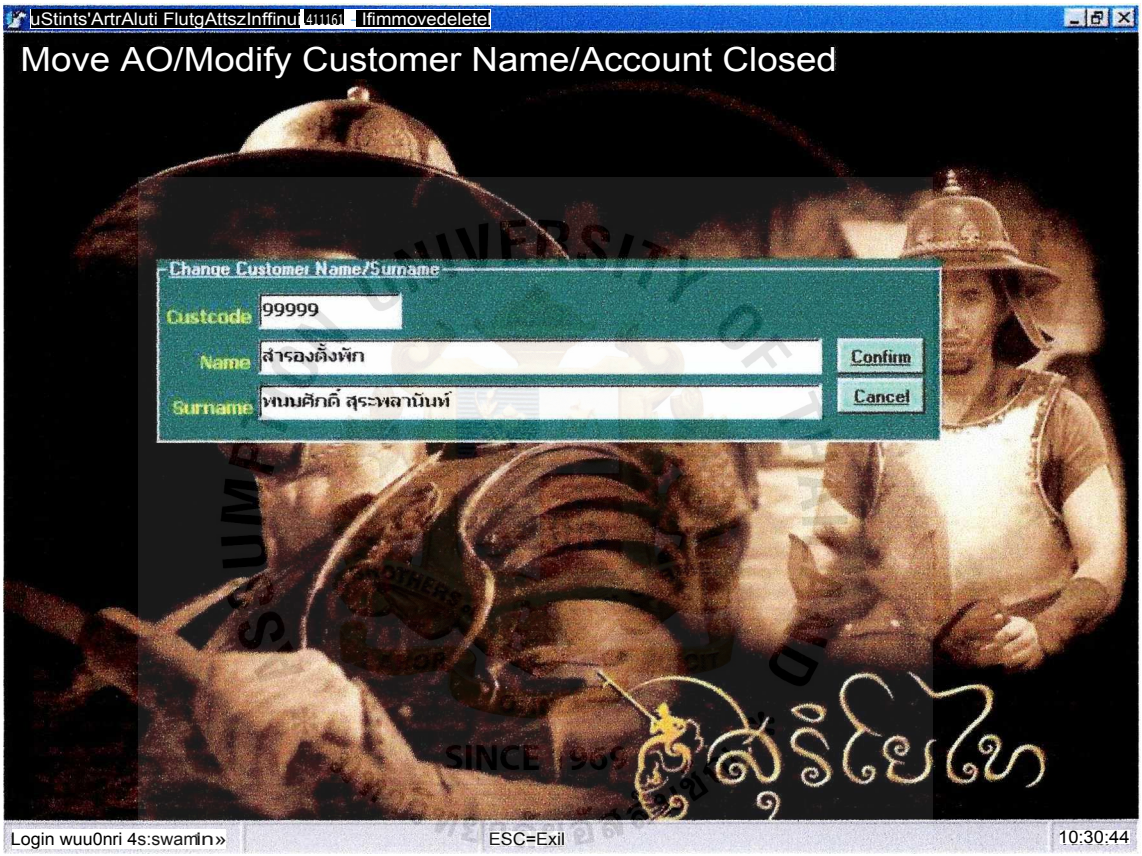

Figure 4.37. Account Closed.

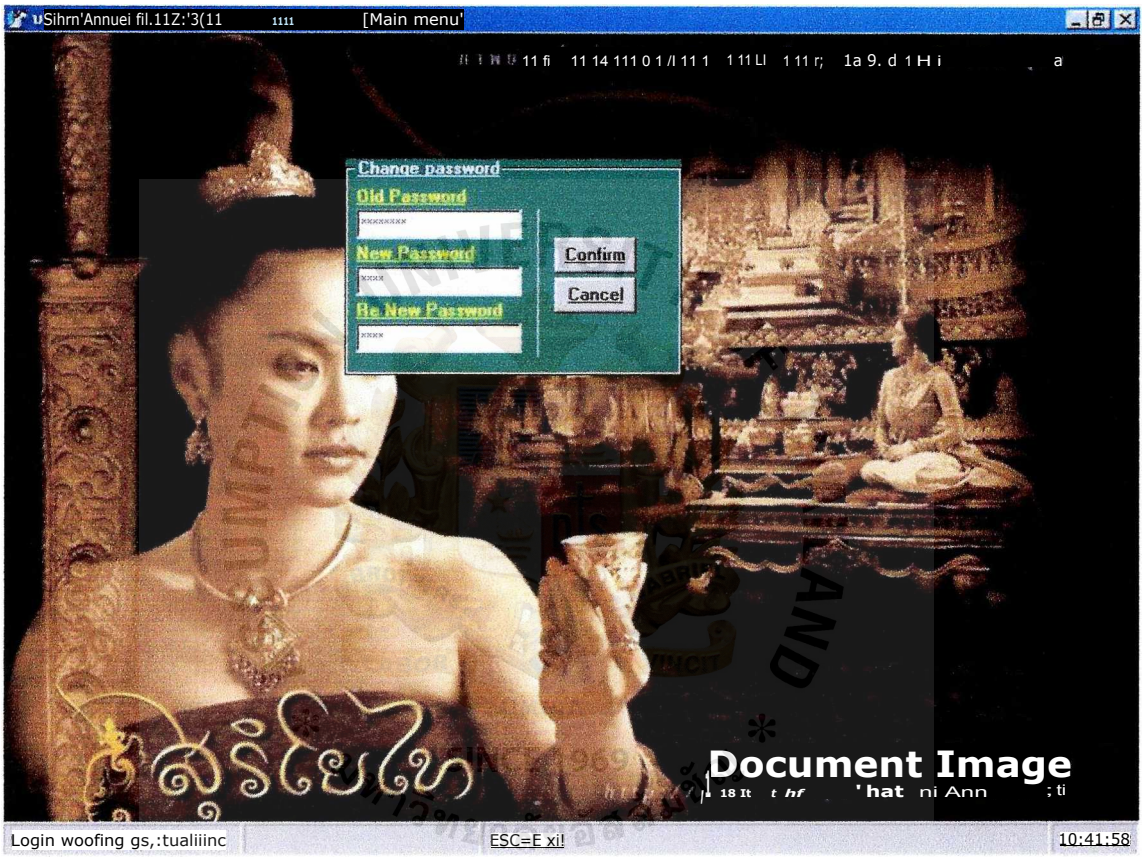

Figure 4.38. Change Password.

4.5.5 Output Design

System analysts must understand properly in what information that users needs to use. In order to design the appropriate format of output we used internal output, which used inside the company to support the system's users and other. The output can be either hard copy (printed document) or soft copy (displayed on screen). The prototype of outputs is presented in Figure 4.39. to Figure 4.45.

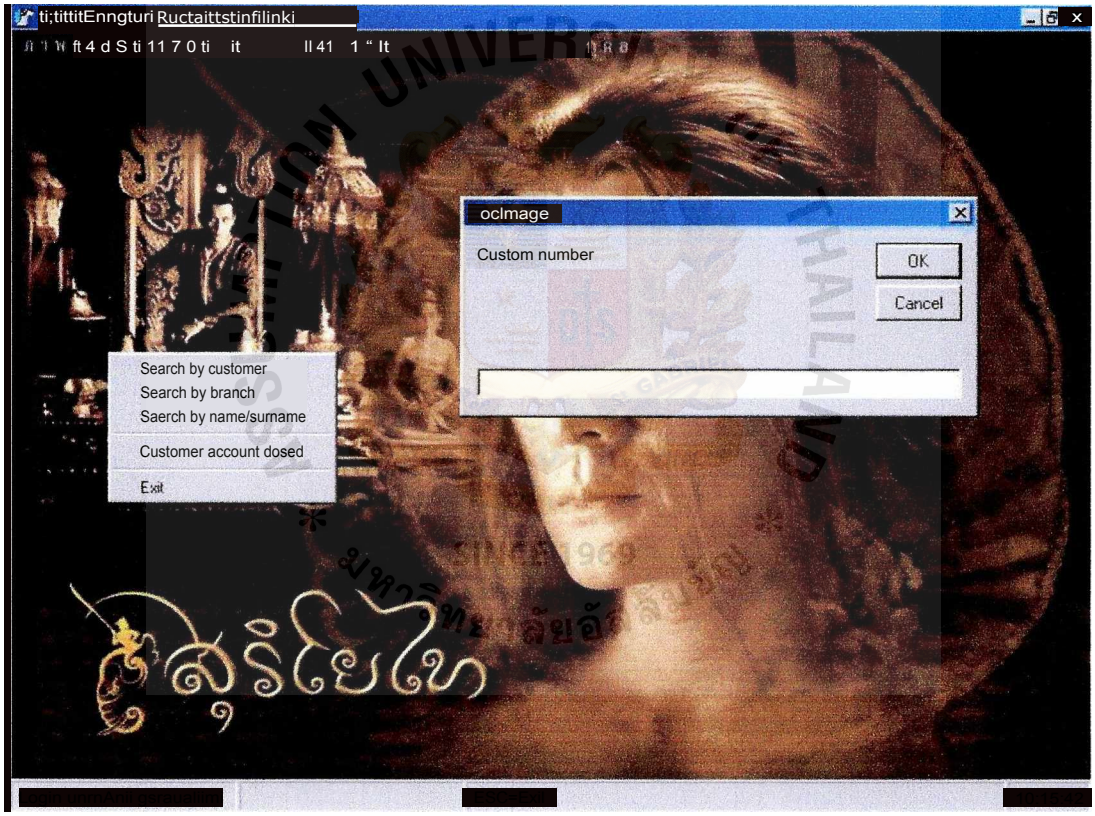

Figure 4.39. Search by Customer.

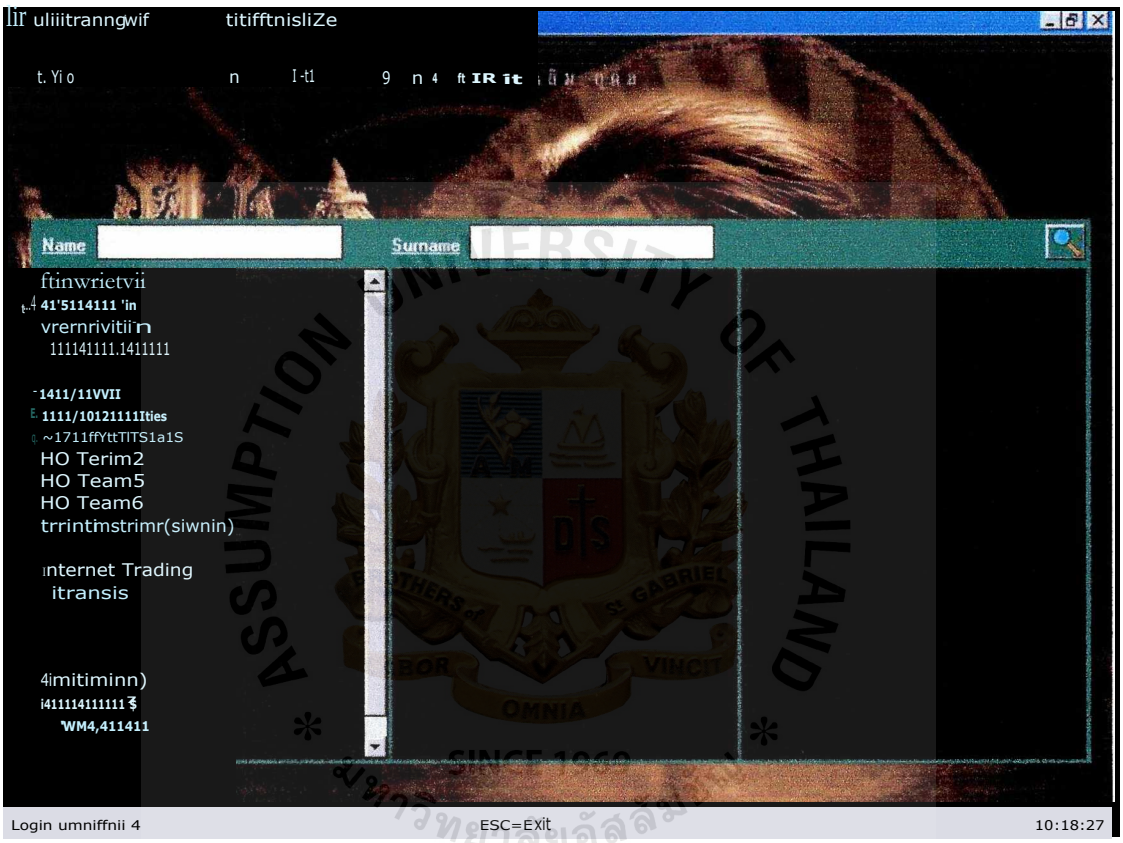

Figure 4.40. Search by Branch.

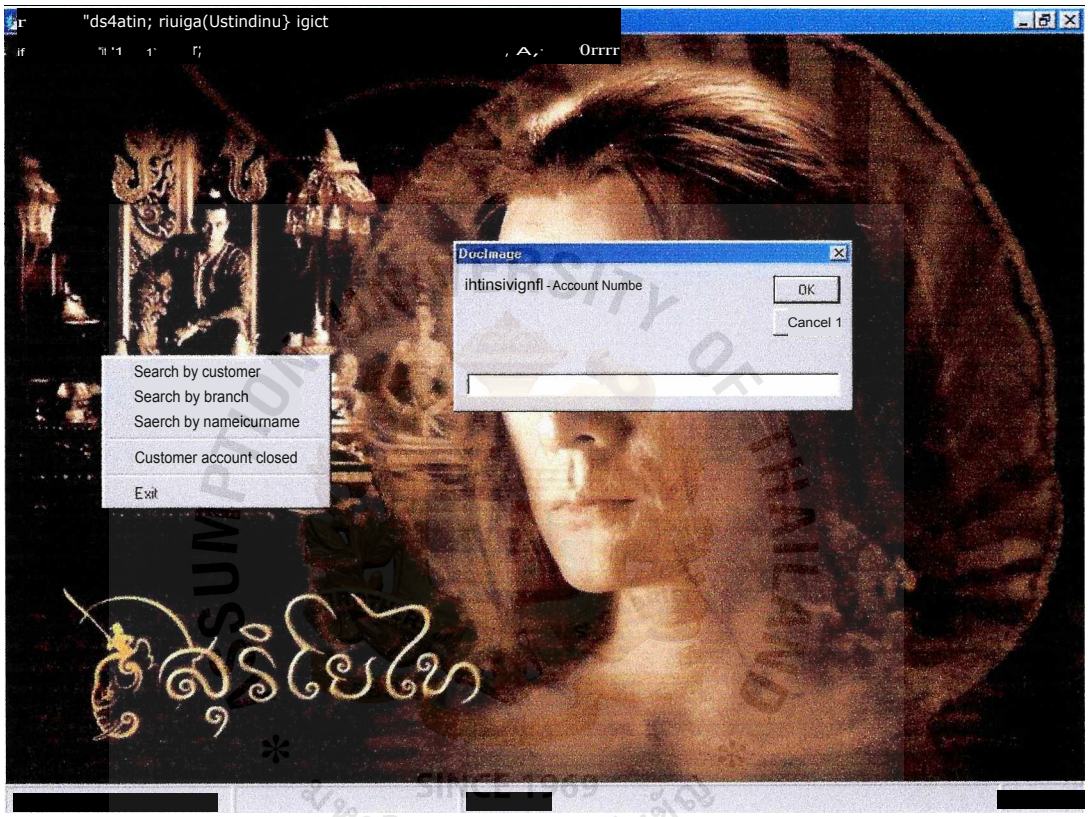

Figure 4.41. Search by Name/Surname.

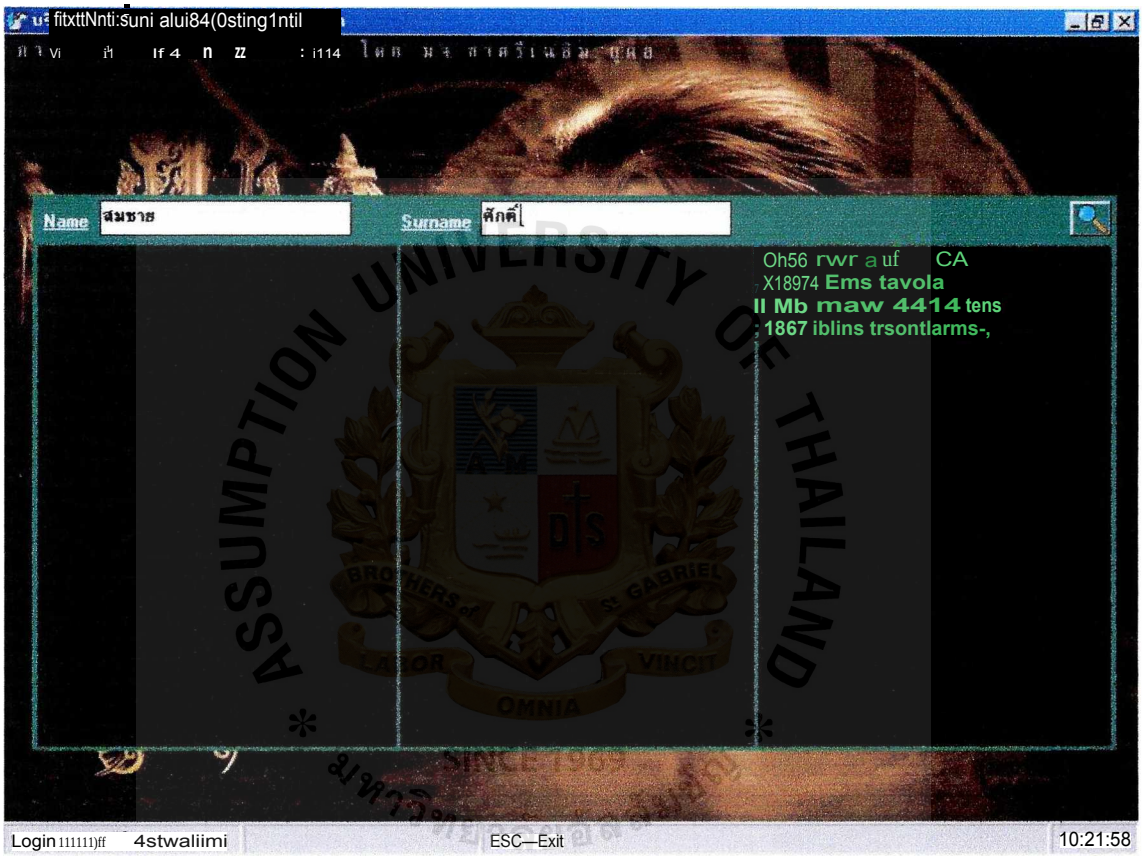

Figure 4.42. Search by Name/Surname.

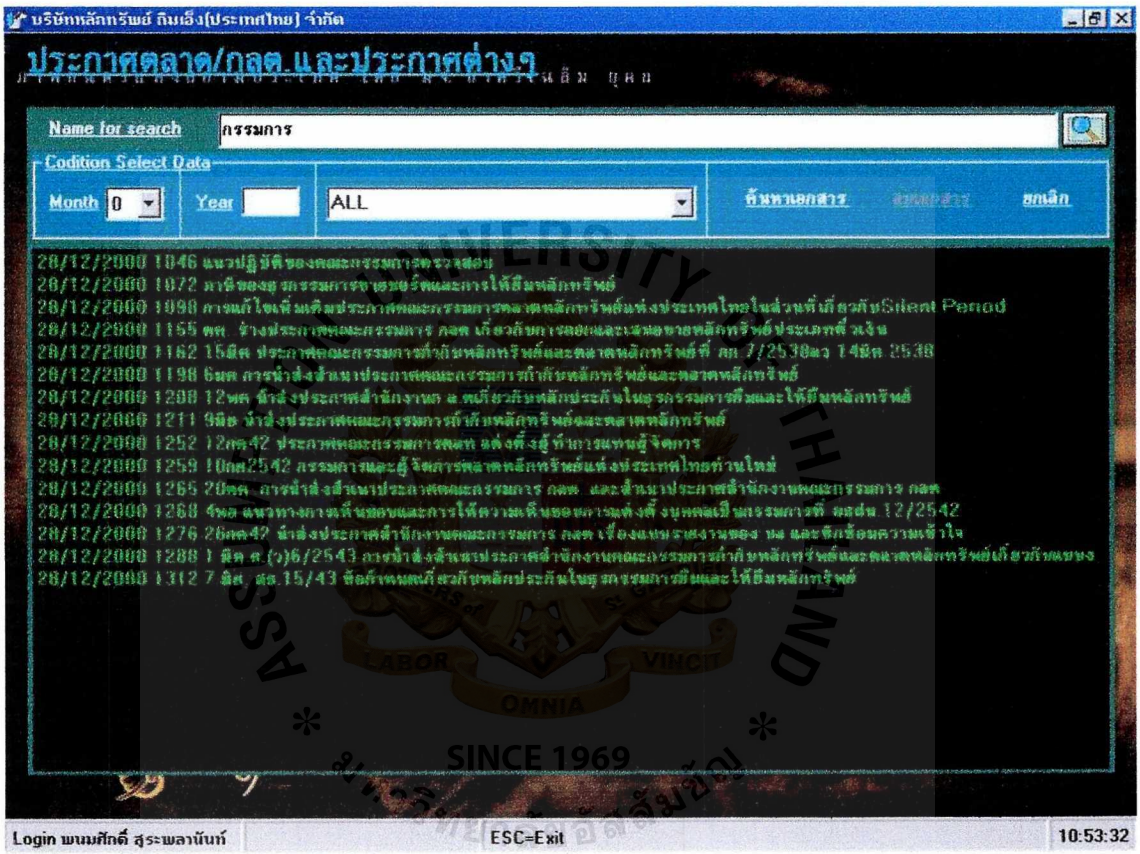

Figure 4.43. Search by Document.

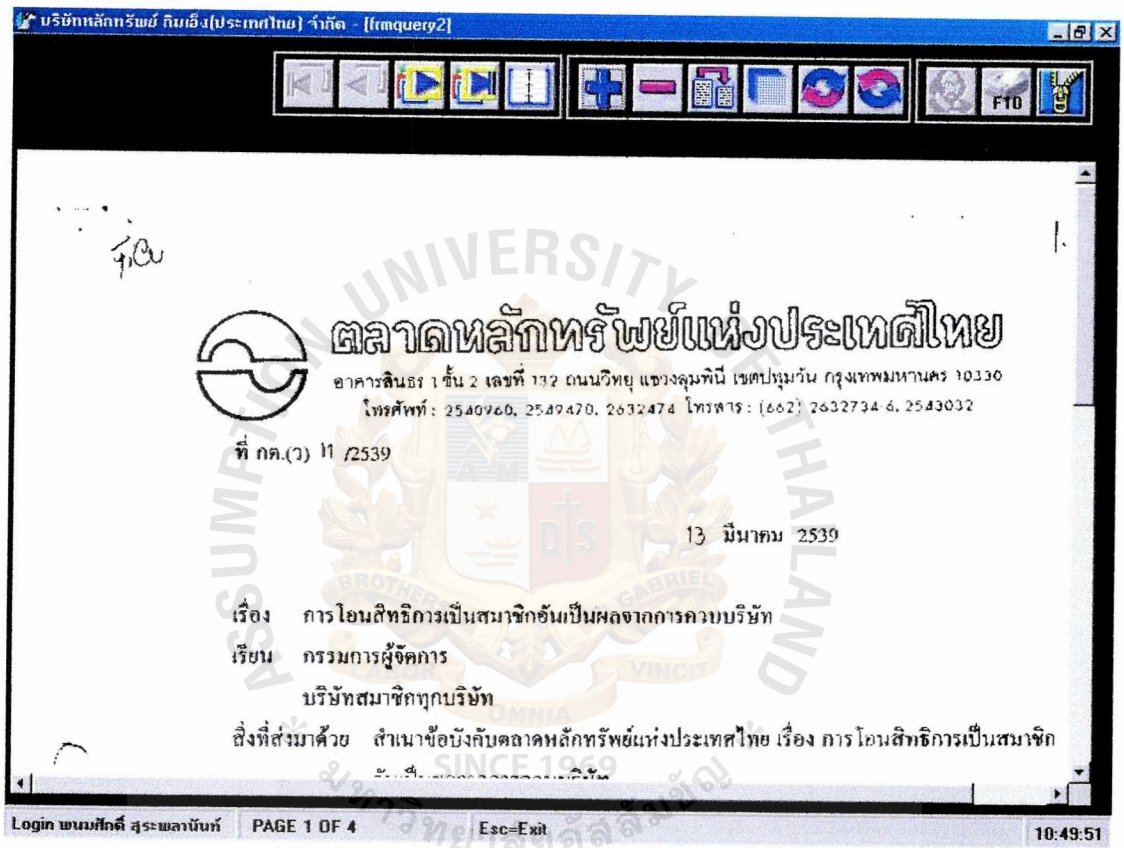

Figure 4.44. Display Document.

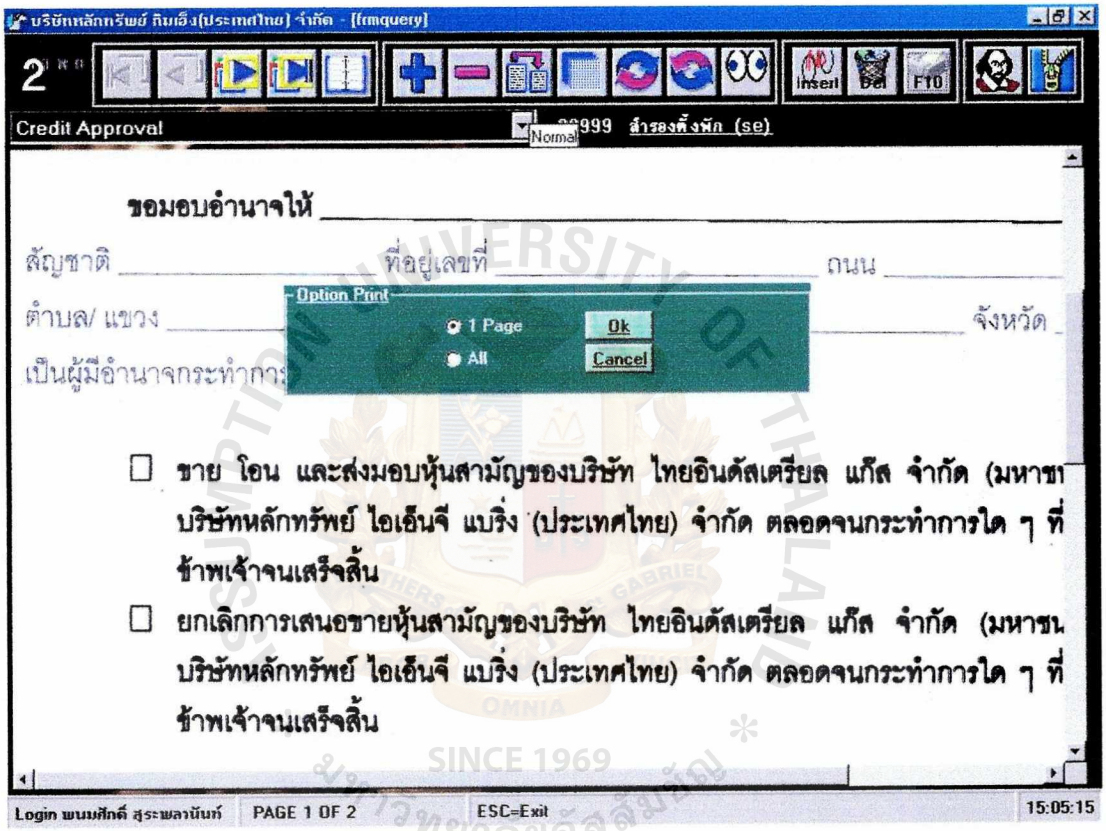

Figure 4.45. Print Document.

4.6 Hardware and Software Requirements

In the proposed system, all computers are based on 2-tiered Client/Server architecture. The main hardware are required 26 computer sets, peripherals, and communication equipments for supporting an interactive system. All computers are connected to LAN & WAN. A file server will be used to store Document Image application and to manage databases and shared printer among all clients. The rest of the 25 computer sets are used as clients.

The application will be designed based on GUI interface by using Visual Basic 6.0 and running on Microsoft Windows NT version 4.0 (for Server) and Windows'98 (for clients). The application will be worked on SQLServer 7.0 database installed on the server. In additions, the Document Image System provides multi tasking in order to access the database concurrently by multiple users with powerful concurrency database control.

4.6.1 Hardware Configuration

Server configuration is specified same existing system (refer to page 10) as follows:

Intel Pentium III 800 MHz COMPAQ PCs 1 Unit

(1) Intel Pentium III 800 MHz CPU

(2) 512 MB RAM

(3) 40 GB Hard disk

(4) 15" Monitor

(5) 40X CD-ROM

(6) 1.44" Floppy Disk Drive

(7) Keyboard & Mouse

(8) 3Com EtherLink 10/100 PCI LAN CARD

(9) Tape backup (DDS 3) 24 GB

Client configuration is specified same existing system (refer to page 10) as follows:

Intel Celeron 533 MHz COMPAQ PCs 25 Units

(1) Intel Celeron 533 MHz CPU

(2) 96 MB RAM

(3) 4.3 GB Hard disk

(4) 15" Monitor

(5) 1.44" Floppy Disk Drive

(6) Keyboard & Mouse

(7) 3Com EtherLink 10/100 PCI LAN CARD

Printer configuration is specified same existing system (refer to page 10) as follows:

(1) LaserJet 2100 TH Hewlett Packard 1 Unit

Scanner configuration is specified as follows:

(1) Scanner with paper feeder (optional) 16 Units

4.6.2 Software Configuration

Software configuration at server is specified as follows:

(1) Windows NT 4.0

(2) SQLServer 7.0 Enterprise RDBMS

(3) Visual Basic 6.0

Software configuration is specified as follows:

(1) Microsoft Window 98

(2) ODBC for SQLServer

(3) Client for Microsoft Networks

(4) TCP/IP

4.6.3 Network Configuration

Communication equipment configuration is specified as follows:

(1)	Router	16 Units
(2)	Hub & ports	1 Unit
(3)	Cables	
(4)	Leased Line 128 Kbps	16 Units

4.7 Security and Control

A Document Image System should run smoothly under normal circumstances. However, computers sometimes can run out of order and perform mulfunctions. Thus, the system control and security control are needed to ensure that the system will run as planned and the mistakes will be reduced. The inappropriate procedures should also be detected and corrected before the system is affected.

To establish the security and control of the proposed system, the following protection and control can be implemented.

4.7.1 To Protect against Unauthorized Access

The system should have both physical security and operation logging. The physical security is the security for physical level in order to secure the computer facility, equipment and software through physical means. The basic physical securities should be made by controlling the access to the system with keying user login and password, and granting the right privileges on access data in the table to each user such as some users can retrieve data only, some can scan or update but cannot delete and so on.

4.7.2 To Protect Against Loss

The program protection and data protection are involved in protection against loss. The system has to be kept in a copy every time after program changed. The data back up procedures must be set up in such a way that all data in the system are kept securely and can be recovered whenever system fails. The system should be protected from viruses by installation of the anti-virus program in all computers.

4.7.3 To Control Input and to Minimize Human Errors

The Validation of input should be embedded in the application in order to protect the invalid data occurring during daily operations.

4.7.4 To Control Process

The system should provide the control to ensure that all processes will be done in the right way.

4.8 System Cost Evaluation and Comparison

Evaluating the costs of existing system and proposed system is a must because of the high investment. The company has to invest in terms of developing, implementing, and maintenance. Moreover, the costs of hardware, software, and peopleware are considerable. As a result, the company has to make reasonable comparison and decision whether the project should be continued or not.

4.8.1 System Cost Analysis

System Cost is divided into two categories which are implementation cost and annual operation cost. The implementation cost is usually onetime cost which is quite high. After the project has been completed, the other cost is annual operation cost including salaries of system analysts, programmers, operators and other staffs as well as maintenance cost. Not only is the computer usage cost used for programming, testing and conversion data, but also cost of computer equipment and hardware depreciation is

grouped into maintenance cost. The depreciation of computer is calculated based on the estimated life years which is about 3 years and the scrap value 0 baht.

Total system cost of the existing system is presented as Table 4.16 and Table 4.18. Tables 4.19 and 4.21 are the description of the system cost of the proposed system.

Table 4.16. Estimated Annual Operation Cost of the Existing System.

Cost Items	Amount (Baht)
2. Staff Cost	
Credit Control Manager	240,000
Credit Control Supervisor	120,000
Credit Control Staff	60,000
Account Officers	900,000
Messengers	240,000
Service to Other Depaiintents	240,000
(The Detail of Amount for Staff Cost is described in Table 4.6.)	
Sub Total	1,800,000
2. Operation Cost	324,000
Paper ((20 ream * 100/ream = 2,000/ month) * 12 = 24,000)	
Copier ((Cost 0.50/Paper * 10,000 Papers/ month) * 12 = 60,000)	
Vehicle Expense & Mailing ((1,000/ Day * 20 Days) * 12 = 240,000)	
3. Utility Cost	100,000
Electric City Cost 90,000/per year	
Telephone Cost 10,000/per year	
4. Maintenance Cost	-
Grand Total	2,224,000

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Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.17. The Detail of Amount for Staff Cost of Existing System.

ManPower Item	Man	Usage (Per Month)	Man Day Cost	Man Day Amount Cost	Total Amount (Per Year)
Credit Control Manager	1	20	1,000	20,000	240,000
Credit Control Supervisor	1	20	500	10,000	120,000
Credit Control Staff	1	20	250	5,000	60,000
Account Officers	30	20	125	75,000	900,000
Messengers	10	20	100	20,000	240,000
Service to Other Depailments	20	10	100	20,000	240,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.18. Estimated Implementation Cost of the Existing System.

Cost items	Quantity	Unit Price (Baht)	Amount (Baht)
Hardware & Software			
(1) Server	1	70,000	70,000
(2) Clients	25	30,000	750,000
(3) Laser Printer	1	35,000	35,000
(4) Hub	1	3,000	3,000
(5) Cable and Network Interface	27	2,000	54,000
(6) Router	16	40,000	640,000
(7) Leased Line 128 Kbps	16	120,000	1,920,000
(8) Copier	1	380,000	380,000
Grand Total			3,852,000

Source of Data: Quotation of Hardware from PantipPrice.com, As of 08/2001.

Quotation of Copier from Thai Fuji Xerox Co., Ltd., As of 08/2001.

Quotation of Leased Line from Talecom Asia, As of 08/2001.

Table 4.19. Estimated Annual Operation Cost of the Proposed System.

Cost Items	Amount (Baht)
1. Staff Cost	
Credit Control Manager	84,000
Credit Control Supervisor	42,000
Credit Control Staff	30,000
Account Officers	180,000
Messengers	-
Service to Other Departments	48,000
(The Detail of Amount for Staff cost is described in Table 4.13.)	
Sub Total	384,000
2. Operation Cost	7,200
Paper ((1 ream * 100/ream = 100/ month) * 12 = 1,200)	
Printer ((Cost 1/Paper * 500 Papers/ month) * 12 = 6,000)	
3. Utility Cost	105,000
Electric City Cost 100,000/ year	
Telephone Cost 5,000/ year	
4. Maintenance Cost	12,000
Maintenance Software by Internal Staff 1 Man	
(Man Day @ 1,000 * 12 = 12,000)	
Grand Total	508,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.20. The Detail of Amount for Staff Cost of Proposed System.

ManPower Item	Man	Usage (Par Month)	Man Day Cost	Man Day A171═1 Cost	Total t¯131ˉat (Per Year)
Credit Control Manager	1	20	350	7,000	84,000
Ciciiii Conuoi Supei visoi	1	20	i 75	3,500	42,000
Credit Control Staff	l	20	125	2,500	30,000
Account Officers	30	20	25	15,000	180,000
Messengers	-	-	-	-	-
Service to Other Departments (average 1 person @1,000 per year)	20	10	20	4,000	48,000

Source of Data: Kim Eng Securities (Thailand) Co., Ltd., Accounting Department, As of 08/2001.

Table 4.21. Estimated Implementation Cost of the Proposed System.

Cost items	Quantity	Unit Price (Baht)	Amount (Baht)
I lardware & Software			
(1) Server	1	70,000	70,000
(2) Clients	25	30,000	750,000
(3) Laser Printer	1	35,000	35.000
(4) Scanner (Networking Flexibility)	16	10,000	160,000
(5) Hub	1	3,000	3,000
(6) Cable and Network Interface	27	2,000	54,000
(7) Router	16	40,000	640,000
(8) Leased Line 128 Kbps	16	120,000	1,920,000
le s ico) a1,e1_,IGIVG1 / A/ 1\11131V11.3	1	100,000	100,000
(9) Visual Basic 6.0	1	4nnrin	4PP(in
SO.'tota]			1777000
Development & Implementation	Man	Usage (Days)	
(1) System Analysis (Man Day @2,000/Day)	1	10	20,000
(2) System Design (Man Day @2,000/Day)	1	10	20,000
(3) Programming (Man Day @1,000/Day)	1	31	31,000
(4) Testing (Man Day @1,000/Day)	1	2	2,000
(5) Training & Documentation			5,000
(Duration 1 Days Course Fee 5,000)			
(6) Implementation (Man Day@1,000/Day)	1	2	2,000
Sub Total			80,000
Grand Total			3,852,000

Source of Data: Quotation of Hardware from PantipPrice.com, As of 08/2001.

Quotation of Leased Line from Talecom Asia, As of 08/2001.

Source of Data: Quotation of Software from Kim Eng Securities (Thailand) Co., Ltd., Information Technology Department, As of 08/2001.

4.8.2 Benefit Analysis

The anticipated benefits expected to come along with the new system are classfied as tangible and intangible.

Tangible benefits are benefits which can usually be measured in terms of profit to the firm; they are listed as follows:

(1) To reduce man day cost from 1,800,000 to 384,000 and reduce messenger from 10 persons to zero.

(2) To reduce expense for handing of papers cost from 24,000 to 1,200

(3) To reduce cost of making copy (eliminated copy machine, ink cost, machine maintenance cost and mailing copy cost) by 294,000

All of tangible benefits discussed above can be estimated in terms of monetary cost as in Table 4.22.

Table 4.22. Estimated Annual Tangible Benefit.

Benefit	Amount (B9111).
Saving on Man Day Cost	1,416,000
Saving on Handling Paper Works	22,800
[illegible]	[illegible]
Total	1,732,800

Intangible benefits are benefits which are believed to be difficult or impossible to quantify. The following list is ranked in priority from highest to lowest:

(1) To improve the quality of data available for better decision-making.

(2) To provide more efficient control document of customers and other documents.

(3) To provide users with more user-friendly and easy to use application.

(4) To be more competitive than our competitors.

4.8.3 Payback Period Analysis

The method of calculating for the investment is Payback Period which determines how much time will lapse before accrued benefits overtake accrued and continuing cost. It will compare the cost of the proposed system to the benefits in order to determine the time the new system takes to recover the initial investment. Calculation is shown in Table 4.23.

Table 4.23. Payback Period Matrix (Discounted Factor 12%), in Baht.

Cost Items	Years					
	0	1	2	3	4	5
Development cost	-3,852,000					
Operation maintain cost		-508,000	-558,800	-614,680	-676,148	-743,763
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Tim _adjusted costs adjusted to present value	-3,852,000	-453,644	-445,364	-437,652	-430,030	-421,714
Cumulative time-adjusted cost over lifetime	-3,852,000	-4,305,644	-4,751,008	-5,188,660	-5,618,690	-6,040,404
Benefits derived from operation of new system	0	1,732,800	1,906,080	2,096,688	2,306,357	2,536,992
Discount factors for 12%	1.0000	0.893	0.797	0.712	0.636	0.567
Time-adjusted benefits adjusted to present value	0	1,547,390	1,519,146	1,492,842	1,466,843	1,438,474
Cumulative time-adjusted benefits over lifetime	0	1,547,390	3,066,536	4,559,378	6,026,221	7,464,695
Cumulative lifetime time-adjusted — cost + benefits	-3,852,000	-2,758,254	-1,684,472	-629,282	407,531	1,424,291

Payback Period = Last year of negative + $\frac{\text{Cumulative difference last negative year}}{\text{Absolute value of cumulative difference}}$

$$= 3 + \frac{629,282}{(629,282 + 407,531)}$$

= 3.61 Years

Net Present Value = 1,424,291 Baht.

4.8.4 Return On investment (ROI) Analysis

The ROI compares the lifetime profitability of alternative solution. ROI is a percentage rate that measures the relationship between the amount the business gets back from an investment and the amount invested. The ROI for a potential solution is calculated as follows:

$$\text{Return On Investment (ROI)} = \frac{1}{\text{Payback}}$$

$$\frac{1}{3.61}$$

$$= 27.70\ \%$$

4.8.5 Breakeven Analysis

It is a must to analyze the cost between the proposed system and the existing system before starting to develop the new system. The purpose is to know when the investment of the proposed system will be recovered.

The descriptions of system operation and maintenance cost of the proposed system and the existing system are explained in Table 4.24.

Table 4.24. Cost Comparison between Existing System and Proposed System, Baht.

Cost Items	Years				
	1	2	3	-.	5
Existing System					
Hardware (3,852,000 / 3)	1,284,000	1,284,000	1,284,000		
Maintenance Cost	-	-	-	-	-
Operation Cost (324,000 + 10%)	324,000	356,400	392,040	431,244	474,368
Salary (1,800,000 + 10%)	1,800,000	1,980,000	2,178,000	2,395,800	2,635,380
Utility Cost (100,000 + 10%)	100,000	110,000	121,000	133,100	146,410
Total Existing System Cost	3,508,000	3,370,400	3,975,040	2,960,144	3,256,158
Cumulative Existing System Cost	3,508,000	7,238,400	11,213,440	14,173,584	17,429,742
Proposed System					
Development Cost	3,852,000				
Hardware (3,632,000 / 3)	1,210,667	1,210,667	1,210,666		
Software (140,000 / 3)	46,667	46,667	46,666		
Maintenance Cost (12,000+10%)	12,000	13,200	14,520	15,972	17,569
Operation Cost (7,200 + 10%)	7,200	7,920	8,712	9,583	10,542
Salary (384,000 + 10%)	384,000	422,400	464,640	511,104	562,214
Utility Cost (105,000 + 10%)	105,000	115,500	127,050	139,755	153,731
Total Proposed System Cost	5,617,534	1,816,354	1,872,254	676,414	744,056
Cumulative Proposed System Cost	5,617,534	7,433,888	9,306,142	9,982,556	10,726,612

Breakeven Point is shown as Figure 4.46.

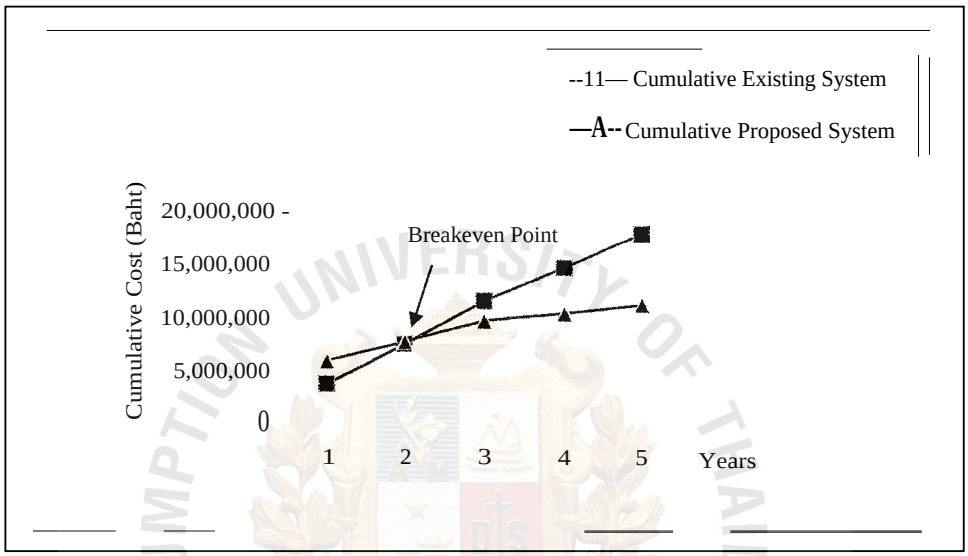


Figure 4.46. Breakeven Point.

V. PROJECT IMPLEMENTATION

5.1 Overview

Project implementation is the construction of the new system and the delivery of that system into production including testing, conversion, and training. The proposed system requires a new database. Therefore, the system needs to be tested in terms of the database and application program. Conversion, the process of changing form an old system to a new one, must also be carefully planned and executed. The conversion plan describes all the activities that must occur to implement the new system and put it into operation. It identifies the tasks and assigns the responsibilities for carrying them out. The conversion plan should also anticipate the most common problems, such as mission documents, incorrect data formats, lost data, and unanticipated system requirements, and provide ways for dealing with them when they occur.

After the system is implemented and the conversion is complete, a review should be conducted to determine whether the system is meeting expectations and where improvements are needed. System quality, user confidence, and operating statistics are assessed through such techniques as event logging, impact evaluation, and attitude surveys. The data collection methods used during analysis are equally effective during the post implementation review. The review not only assesses how well the current system is designed and implemented, but also is a valuable source of information the can be applied to the next systems project.

5.2 Testing

To make sure the new system can run properly, we have to test database and application programs. For database testing, the characteristics of the database are as follows:

(1) Minimum redundancy — The normalization of database is at least 3 NF

(2) Maximum integrity such as ....

(3) High degree of data security — The system must have 2 levels of login and password — Operation system level and DBMS level) and access permission — select, insert, delete, and update) for each user and group

For program testing, there are three levels of testing to be performed: stub testing, unit or program testing, and system testing:

(1) Stub testing is the test performed on individual modules, whether they be main program, subroutine, subprogram, block, or paragraph.

(2) Unit or program testing is a test whereby all the modules that have been coded and stub tested are tested as an integrated unit.

(3) Systems testing is a test that ensures that application programs written in isolation work properly when they are integrated into the total system.

Just because a single program works properly doesn't mean that is works properly with other programs. The integrated set of programs should be run through the systems test to make sure one program properly accepts, as input, the output of other programs.

5.3 Conversion

Once a successful proposed system has been set, we can make preparations to place the new system into operation. The system analyst will develop a detailed conversion plan. This plan will identify database to be installed, end-user training and documentation that needs to be developed, and a strategy for converting from the old system to the new system. For the proposed system, we will use parallel conversion. Under this approach, both the old and new systems are operated for a period of time. This is done to ensure that all major problems in the new system have been solved before the old system is discarded. The final cut-over may be either abrupt — usually at

the end of one business period) or gradual, as portions of the new system are deemed adequate. This strategy minimizes the risk of major flaw in the new system; however, it is also incurred.

5.4 Training

Converting to a new system necessitates that users be trained and provided with documentation (user manual) that guides them through using the new system. For the Document Image System, a training program is developed to cover the follow topics:

(1) Purpose and objectives of the system

(2) Difference between the existing and the proposed system

(3) Overview and use of the user manual

(4) Duties and responsibilities of the end users

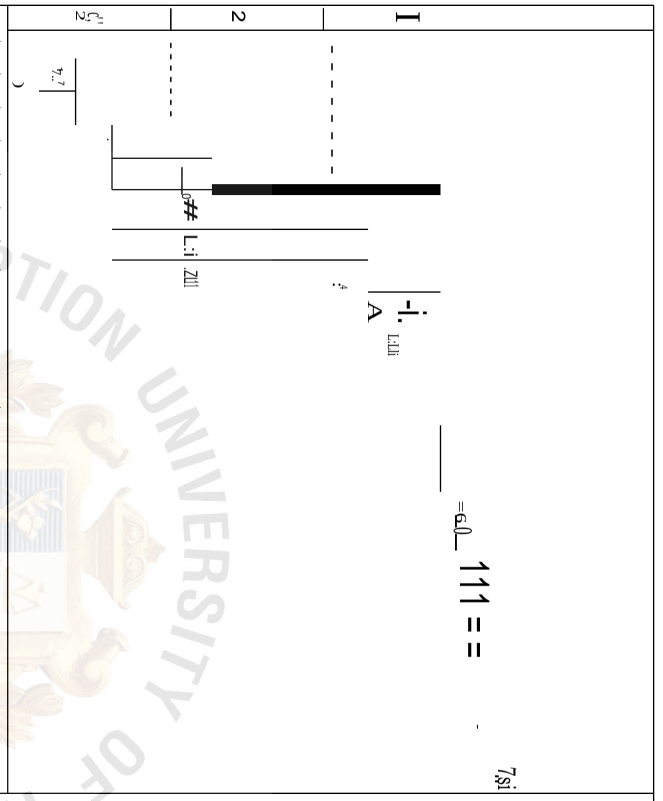
(5) Demonstration of the system

The user manual is the primary resource for the user-training program. Since the proposed system is designed with easiest program operation using GUI, the duration of training program will take only a few hours.

5.5 Project Implement Schedule

The details of project implement schedule of the Document Image System are shown in Figure 5.1.

	Task Name	Duration	Start	Finish
	Business Requirements	9 days	Tuc 1/5/01	Fri 11/5/01
	Collect business requirements	9 days	Tue 1/5/01	Fri 11/5/01
	Prepare business requirement documents	5 days	Mon 14/5/01	Fri 18/5/01
	Signoff by end users	I day	Fri 18/5/01	Fri 18/5/01
	System design	IS days	Mon 21/5/01	Fri 1/6/01
	System Development	31 slays	Mon 4/6/01	Mon 16/7/01
	- Create Input Screen & its validations	20 days	Mon 4/6/01	Sat 30/6/01
	- Create Output Screen	25 days	Mon 4/6/01	Fri 6/7/01
	- Create Users & Set Security	5days	Tuc 10/7/01	Mon 16/7/01
	System Tesing by IT	2 days	Fri 13/7/01	Mon 16/7/01
	User acceptance test	1 day	Tue 17/7/01	Tue 1 ⅞/01
	UAT Enviromnent preparation	2 days	Wed 18/7/01	Thu 19/7/01
	UAT Plan & Test script preparation	3 days	Wed 18/7/01	Fri 20/7/01
	Perform UAT	3 days	Mon 23/7/01	Wed 25/7/01
	UAT result signoff	1 day	Wed 25/7/01	Wed 25/7/01
	Training & Documentations	1 day	Thu 26/7/01	Thu 26/7/01
	Data Conversion	1 day	Fri 2 ⅞/01	Sun 29/7/01
	- Prepare formatted old data	1 day	Fri 27/7/01	Fri 27/7/01
	- Convert old data to the system	1 day	Fri 27/7/01	Sun 29/7/01
	Implementation	2 days	Mon 30/7/01	Tue 31/7/01
	Go Live	1 day	Wed 1/8/01	Wed 1/8/01
	Perfomt Post Go Live Support	I day	Wed 1/8/01	Wed 1/8/01
	Weekly problem & Solution meeting	4 days	Wed 1/8/01	Thu 9/8/01



Task Milestone Rolled
Split Summary Rolled
Progress Rolled Up Task Rolled

Project Implement Schedule.

After the implementation of the proposed system, the database information is automatically being shared, and it is more flexible and more efficient to access when need required. That would cause the company to save the operation cost and to minimize all human errors.

Table 5.1. Comparison on Time Saving Existing System V.S. Proposed System.

Process	Existing System	Proposed System
Maintain Customer Information	10 mins.	2 mins
Store Document (original)	15 mins.	25 mins.
Fetch Document Information	10 mins.	0.5 seconds.
Delivery Document	20 mins.	0 mins.
Store Document (Copy)	5 mins	0 mins.
Total	60 mins.	27.5 mins

The following explained each process from Table 5.1.

(1) Maintain Customer Information Process.

The proposed system key in customer information on system but the existing system has to manually keep on the customer book.

(2) Store Document Process.

The proposed system scan document into system before keeping the document on file but the existing system keeps the document on file.

(3) Fetch Document Information Process.

The proposed system directly access document from the system, existing system has to request document from credit control department and make copy then send the document to requestor.

(4) Delivery Document Process.

The proposed system can directly access document from the system there is no need to copy any documents, the existing system has to make copy document from credit control department and delivery to requestor.

(5) Store Document (Copy) Process.

There is no paper work on proposed system but existing system has to make a lot of copy documents and the requestor has to keep on his file.

As a result the proposed system could reduce a lot of copy documents and save a lot of unnecessary paper work.

VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

At present, the business world has the highest inclination in terms of competition in obtaining market shares, interests or benefits into their organizations. As the consumers have increasing varieties of options whilst the consumptive qualities have constantly expanded or reduced based on the deterioration of the global economics, this causes the manufacturers to do researches or marketing plans in investing businesses complying with the consumers' needs. The most important factor is a capital budget and a manufacturing period : the capital budget should be low and the manufacturing period should be short. The securities business in Thailand is classified as, of businesses requiring the above-mentioned procedure. Therefore, as Information Technology matter is extremely anticipated as the most important factor to motivate its organization onwards with the highest capacity.

The documentations pertaining to the securities business are too complicated and troublesome for organization and practical matters. Moreover, these paper resources have been utilized without strictly-controlled plans and a lot of times have been spent under operating management. This, in fact, cause an increase of capital budget and problems of worthlessness of workmanship.

To utilize a Document Imaging system instead of existing manual systems will solve these problems. However, the Document Imaging system available in the markets may not match with the user's requirement. Therefore, the criteria of analysis in the best candidate solution have been proceeded in order to obtain the most efficient system with saving and quick subjects. Which are 4 feasibilities concerned

(1) Technical feasibility

(2) Economic feasibility (cost to develop, payback period, net present value, ROI)

(3) Operational feasibility

(4) Schedule feasibility

These studies are based on information from Kim Eng Securities (Thailand) Co., Ltd. And suppliers relevant to this respect. The candidates are determined in accordance with systems the same as the user's requirements.

The final solution of the Document Imaging system is developed by Kim Eng's internal staffs that reaches the highest score from the feasibility analysis matrix. The extensions of the analysis after the implementation are evaluated in the same consequence which the summary of the operating times have been reduced in high ratio such as to maintain customer information, to store, to fetch and to deliver the documents.

6.2 Recommendations

In order to make the proposed system most beneficial in the future, we would like to recommend that:

(1) The company has to utilize an existing Hardware to reach the most productivity.

(2) The company has to arrange training course for users.

(3) The Document Image system is only the first phase being implemented in order to reduce problem in connection with waste materials such as paper, printer's ink. Moreover, the Document Image system has an intention to

lessen complicated operation which cause human errors and to reduce time consumption effecting workflows.

(4) The company should also utilize the system for collecting all government or public announcement and provide the information available to employee.

(5) The Company should sell the service of the system to other company in order to increase company revenue.

(6) According to the above-mentioned system, this is only the primary application in providing this technology to reach the most productivity in the organization. The goal of the company is to re-engineer the management visions by replacing paper works with this technology such as,

To implement online workflow systems regarding take-leave and other documents which relate to personnel department in order to be approved by the management and submitted to personnel department.

To implement online workflow systems in term of stationary order or internal used materials.

To online backup accounting reports for auditor from Revenue Department of Thailand.

To publish announcements or company's information via interne and intranet.

To implement online stock trading form.

(7) The company should constantly review and monitoring the system annually for improvement after implementation.

APPENDIX A

DATA DICTIONARY

ao Data Element
Description:
Account Officer Code
Data element attributes
Storage Type: Char
Length: 10
Null Type: Null
Location:
Entity --> Cl_'STONIER
Entity --> 1;SER(A0)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

branch Data Element
Values & Meanings:
Branch Code
Data element attributes
Storage Type: Char
Length: 2
Null Type: Null
Location:
Entity --> USERLAO)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

BRANCH Entity
Description:
Branch Information
Composition:
branchcodc : Char
branchnamc : Char

Column(s): branchcode ASC I
Location:
FRDI

Attached relationships on ERD1:
possesses MIN: 1 MAX: many
USER(AO).
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

branchcode Data Element
Description:
Branch Code
Data element attributes
Storage Type: Char
Length: 2
Null Type: Null
Location:
Entity --> BRANCI1
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

branchname Data Element
Description:
Branch Name
Data element attributes
Storage Type: Char
Length: 30
Null Type: Null
Location:
Entity --> BRANC11
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

custcode Data Element
Description:
Customer Code
Data element attributes
Storage Typc: Char
Length: 15
Null Type: NotNull
Location:
Entity --> CUSTOMER

Date Last Altered: 23/10/2001 Date Created: 2[3]/10/2001

---

custname Data Element

Description:
Customer Name
Data element attributes
Storage Type: Char
Length: 50
Null Type: Null
Location:
Entity --> CUSTOMER
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

CUSTOMER Entity

Description:
Customer Information
Composition:
custcode : Char
custname : Char
custsumame : Chay
ao : Char
Primary Key:
Index Name: Generated by VAW
Column(s): custcorie [ASC]
Foreign Key(s):
1.:SER(A0) 'Possesses'
On Delete Restrict
On Update Restrict
On Insert of Child Row Restrict
Location:
FRO I

Attached relationships on ERD I :
[Possesses] MIN: 1 MAX: 1
1:SERtA0)
h as MIN: 1 MAX: many
IMAGE
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

custsumame Data Element

Description:
Customer Surname
Data element attributes
Storage Type: Char
Length: 30
Null Type: Null
Location:
Entity --> CGS [OMER
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

doccode Data Element

Description:
Document Code
Values & Meanings:
(Customer Code)
Data element attributes
Storage Type: VarChar
Length: 15
Null Type: NotNull
Location:
Entity --> IMAGE
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

docname Data Element

Description:
Document Name
Data element attributes
Storage Type: Char
Length: 60
Null Type: NotNull
Location:
Entity --> DOC1 MENT
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

docpage Data Element

Description:
Document Page
Data element attributes
Storage Type: Undefined
Location:
Entity --> IMAGE
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

doctype Data Element
Description:
Document Type
Data element attributes
Storage Type: Undefined
Location:
Entity --> DOCUMENT
Entity --> IMAGE
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

DOCUMENT Entity
Description:
Document Information
Composition:
doctype : Undefined
docname : Char
Primary Key:
Index Name: Generated by VAW
Column(s): (1(x:type [ASC]
Foreign Key(s):
USER(A0) 'Scans and Fetch'
On Delete Restrict
On Update Restrict
On Insert of Child Row Restrict
Location:
ERDI

Attached relationships on ERDI:
[Scans and Fetch] MIN: 1 MAX: many

'SER00)
I las MIN: 0 MAX: many

IMAGE
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

Has Relationship
Attached Entities:
CUSTOMER
Has MIN: 1 MAX: many
ill AGE
[(Lit MIN: 1 MAX: many
Location:
ERDI
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

Has Relationship
Attached Entities:
DOCEMTN1'
Has MIN 0 MAX: many
[MACiE
[Has] MIN: 1 MAX: 1
Location:
ERDI
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

image Data Element [Domain]
Description:
Image Information
Location:
Entity --> IMAGE
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

IMAGE Entity
Description:
Document Image Information
Composition:
doccode : VarChar

doel\pe : Undefined
doepasi:e : Undefined
mace : imags'
Primary Key:
Index Name: Generated by YAW
Column(s): doccode [ASC]
Foreign Key(s):
CUSTOMER 'Has'
On Delete Restrict
On Update Restrict
On Insert of Child Row Restrict
DOCUMENT 'Has'
On Delete Restrict
On Update Restrict
On Insert of Child Row Restrict
Location:
FRDI
Attached relationships on ERD1:
[Has] MIN: 1 MAX: many
CUSTOMER
[Ilas] MIN: I MAX: 1
DOCU MEN)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

Int Data Element [Domain]
Data element attributes
Storage Type: Undefined
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

manager Data Element
Description:
Manager Code
Data element attributes
Storage Type: Char
Length: 10
Null Type: Null
Location:
Entity --> t!SER(/ Q).
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

password Data Element
Description:
Password
Data element attributes
Storage Type: Char
Length: 10
Null Type: Null
Location:
Entity --> US E ROO)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

permission Data Element
Description:
Permission
Data element attributes
Domain: Smalllnt
Storage Type: Smalllnteger 2
Length: 2
Null Type: NotNull
Location:
Entity --> USE/Z(AO)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

possesses Relationship
Attached Entities:
BRANCH
possesses MIN: 1 MAX: many
USIRIAG).
[ppssesses MIN: 1 MAX: 1
Location:
FRD1
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

Possesses — Relationship

Attached Entities:

ER(_AO)

Possesses — MIN: 0 MAX: many

USTOMLIZ

[Possesses] — MIN: 1 MAX: 1

Location:

l:1RD

Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

region — Data Element

Description:

Region

Data element attributes

Storage Type: Char

Length: 10

Null Type: Null

Location:

Entity --> l;SER(A0)

Date Last Altered: 23/10/2001 Date Created: 23/10/2001

Scans and Fetch — Relationship

Attached Entities:

t SER(AO)

Scans and Fetch — MIN: 0 MAX: many

DOCUMENT

[Scans and Fetch] — MIN: 1 MAX: many

Location:

[RD I

Date Last Altered: 23/10/2001 Date Created: 23/10/2001

SmallInt — Data Element [Domain]

Data element attributes

Storage Type: Smalllnteger 2

Length: 2

Null Type: NotNull

Location:

Data Element --> *pe*n fission

Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

status — Data Element

Description:

Status

Data element attributes

Storage Type: Char

Length: 1

Null Type: Null

Location:

Entity --> I_!sER(A0)

Date Last Altered: 23/10/2001 Date Created: 23/10/2001

USER(AO) — Entity

Description:

User Information

Composition:

userid : Char

password : Char

username : Char

branch : Char

ao : Char

manager : Char

usertvne : Char

region : Char

permission : Smallint

status : Char

Primary Key:

Index Name: Generated by VAW

Column(s): userid [ASC]

Foreign Key(s):

BRANCH 'possesses'

On Delete Restrict

On Update Restrict

On Insert of Child Row Restrict

Location:

ERD 1

Attached relationships on ERD1:
[possesses] MIN: 1 MAX: 1
BRANCH
Possesses MIN: 0 MAX: many
CUSTOMER
Scans and Fetch MIN: 0 MAX: many
DOC1 iMENT

Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

userid Data Element

Description:
User ID
Data element attributes
Storage Type: Char
Length: 20
Null Type: NotNull
Location:
Entity --> CSER001
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

username Data Element

Description:
User Name
Data element attributes
Storage Type: Char
Length: 50
Null Type: Null
Location:
Entity --> 511{OO)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

---

usertype Data Element

Description:
User Type
Data element attributes
Storage Type: Char
Length: 10
Null Type: Null
Location:
Entity --> ¹SER(A0)
Date Last Altered: 23/10/2001 Date Created: 23/10/2001

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