

**MEDICAL DIAGNOSTIC DECISION SUPPORT SYSTEM  
(MDSS): A CASE STUDY OF MAMMOGRAMS**

**SIRIPAN PANCHAROEN**

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Thesis  
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(MDSS): A CASE STUDY OF MAMMOGRAMS**

.....  
Ms Siripan Pancharoen  
Candidate

.....  
Lect.Songpol Ongwattanakul,  
Ph.D. (Computer Engineering)  
Major advisor

.....  
Asst. Prof. Warakorn Charoensuk,  
Ph.D. (Electrical Engineering)  
Co-advisor

.....  
Asst. Prof. Cholatip Wiratkapun,  
M.D. (Dip Thai Board of General  
Radiology)  
Co-advisor

.....  
Prof. Banchong Mahaisavariya,  
M.D., Dip Thai Board of Orthopedics  
Dean  
Faculty of Graduate Studies  
Mahidol University

.....  
Asst. Prof. Thanakorn Uan-on,  
D.Engr. (Water Resources)  
Acting Program Director  
Master of Science Program in  
Technology of Information System  
Faculty of Engineering  
Mahidol University

Thesis  
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was submitted to the Faculty of Graduate Studies, Mahidol University  
for the degree of Master of Science  
(Technology of Information System Management)

on  
September 20, 2010

.....  
Ms Siripan Pancharoen  
Candidate

.....  
Asst. Prof. Pisit Phokharatkul,  
D.Eng. (Electrical Engineering)  
Chair

.....  
Lect.Songpol Ongwattanakul,  
Ph.D. (Computer Engineering)  
Member

.....  
Asst. Prof. Warakorn Charoensuk,  
Ph.D. (Electrical Engineering)  
Member

.....  
Lect.Supaporn Kiattisin,  
Ph.D. (Electrical and Computer  
Engineering)  
Member

.....  
Asst. Prof. Cholatip Wiratkapun,  
M.D. (Dip Thai Board of General  
Radiology)  
Member

.....  
Prof. Banchong Mahaisavariya,  
M.D., Dip Thai Board of Orthopedics  
Dean  
Faculty of Graduate Studies  
Mahidol University

.....  
Asst. Prof. Thanadol Pritranan,  
M.Sc. (Computation)  
Acting Dean  
Faculty of Engineering  
Mahidol University

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Siripan Pancharoen

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**SIRIPAN PANCHAROEN 4837207 EGTI / M**

**M.Sc. (TECHNOLOGY OF INFORMATION SYSTEM MANAGEMENT)**

**THESIS ADVISORY COMMITTEE: SONGPOL ONGWATTANAKUL, Ph.D.,  
CHOLATIP WIRATKAPUN, M.D., WARAKORN CHAROENSUK, Ph.D.**

**ABSTRACT**

A Medical Diagnostic Decision Support System (MDSS) has been established so as to facilitate the search of all kinds of data such as mammograms. This system also facilitates fast and accurate diagnosis. Data collected from the Breast Diagnostic Center, the Faculty of Medicine Ramathibodi Hospital were used for developing the system. The tool that was used to develop the system was Adobe Flash CS4. The languages used were Action Script3 and PHP. The obtained data were stored in a MySQL database.

The MDSS is an application that works with several web-browsers, which makes it easier to search for and share data. As a result, physicians can spend less time on treating the disease and less time on comparing it to other cases. The MDSS enables physicians to search for the mammogram that is most similar to the example, data for diagnosing the disease, and a suggestion for disease diagnosis.

**KEY WORDS: MDSS / DSS/ DECISION SUPPORT SYSTEM**

83 pages

ต้นแบบระบบสารสนเทศที่ใช้ในการค้นคืนภาพ เพื่อการสนับสนุนการตัดสินใจในการวินิจฉัยทางการแพทย์ กรณีศึกษาสำหรับภาพแมมโมแกรม

MEDICAL DIAGNOSTIC DECISION SUPPORT SYSTEM (MDSS): A CASE STUDY OF MAMMOGRAMS

ศิริปาน ปานเจริญ 4837207 EGTI/M

วท.ม. (เทคโนโลยีการจัดการระบบสารสนเทศ)

คณะกรรมการที่ปรึกษาวิทยานิพนธ์ : ทรงพล องค์กรวัฒนกุล, Ph.D., ชลทิพย์ วิรัตน์พันธ์, M.D., วรากร เจริญสุข Ph.D.

#### บทคัดย่อ

ระบบสนับสนุนการตัดสินใจทางการแพทย์วินิจฉัยโรคมะเร็งเต้านม (MDSS) นี้จัดทำขึ้นเพื่ออำนวยความสะดวกในการสืบค้นข้อมูลในรูปแบบต่างๆ เช่น ภาพ Mammograms เป็นต้น โดยช่วยในการตัดสินใจรักษาโรคได้อย่างรวดเร็วและมีความถูกต้องสูง โดยการพัฒนาระบบขึ้นมาได้เก็บรวบรวมข้อมูลจากศูนย์วิจัยโรคมะเร็งโรงพยาบาลรามาธิบดี โดยเครื่องมือที่ใช้ในการพัฒนา คือ Adobe Flash CS4 ใช้ภาษา Action Script3 และ PHP ในการพัฒนาระบบ โดยข้อมูลเก็บไว้ในฐานข้อมูล MySQL

โดยระบบสนับสนุนการตัดสินใจทางการแพทย์วินิจฉัยโรคมะเร็งเต้านม (MDSS) นี้เป็นการทำงานของโปรแกรมประยุกต์ผ่านเว็บ Browser ซึ่งจะช่วยในการสืบค้นข้อมูลและการใช้ข้อมูลร่วมกันได้อย่างมีประสิทธิภาพมากยิ่งขึ้น ดังนั้นจึงช่วยลดเวลาในการวินิจฉัยโรคโดยไม่ต้องเสียเวลาในการค้นหาข้อมูลเก่าๆ ที่มีลักษณะคล้ายกัน โดยผลที่ได้จากระบบสนับสนุนการตัดสินใจทางการแพทย์วินิจฉัยโรคมะเร็งเต้านม (MDSS) นี้จะสามารถสืบค้นภาพ Mammograms ที่มีลักษณะใกล้เคียงกับภาพตัวอย่างมากที่สุดขึ้นมา ได้ข้อมูลการวินิจฉัยโรคในกรณีนั้นๆ รวมไปถึงคำแนะนำในการวินิจฉัยโรคอีกด้วย

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# CHAPTER I

## INTRODUCTION

### 1.1 Introduction and Background

In a global perspective, breast cancer is the most common type of cancer in woman (10.4% of all cancer incidence, both sexes counted) and the fifth most common cause of cancer death. In 2004, it caused 519,000 deaths around the world (with 7% of cancer deaths; almost 1% of all deaths). Moreover, breast cancer is about 100 times as frequent among women as among men, but survival rates are equal in both sexes.

Breast cancer is one of the most common types found in Thai women, ranking second after cervix cancer. There are also a few cases of breast cancer reported in men.

Breast cancer is caused by abnormal changes in breast cells developing to be cancerous. Generally, it begins at either the lactiferous duct or at the alveoli.

Mammography is a common screening method, since it is relatively fast and widely available in developed countries. Breast cancers detected by mammography are usually smaller than those detected by patients or doctors as a breast lump, and presumably treatment in an earlier stage will improve outcome. Nowadays, the Radiology units in many hospitals have RIS(Radiology information system)/PACS (PACS stands for Picture Archiving and Communication System, while RIS means Radiology Information System) to store imaging data.

A RIS PACS system is an electronic medical information system. Although it previously was only available to the largest hospitals due to the high cost, today RIS PACS is quite affordable for small and mid-sized medical facilities due to improved technology and reduced price of all electronics, especially computer systems.

In the beginning, PACS and RIS are two separate but related features. PACS has to do with digital medical imaging, and it is a software and hardware

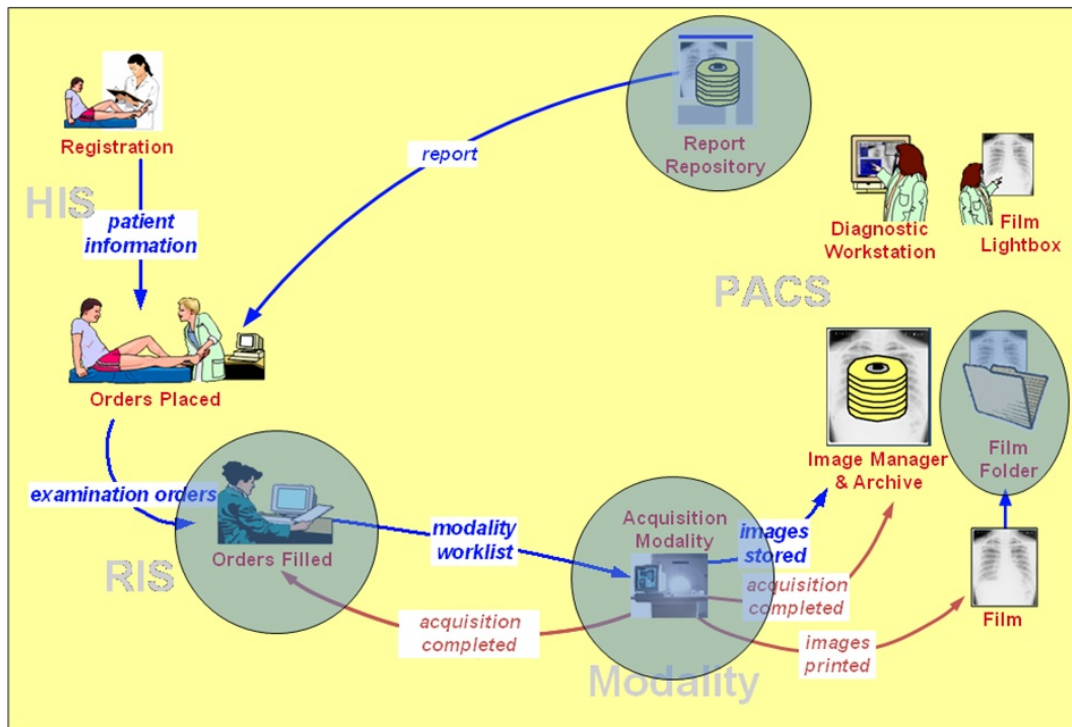
system that allows medical facilities to store, view, retrieve, send and receive digital medical images from a computer. RIS is a software database that enables radiology departments to archive and distribute both digital medical images as well as other types of data such as patient scheduling, tracking and reporting. When used together, they greatly improve the workflow for any radiology department in a small or large medical facility.

A pacs server allows medical personnel to obtain images from various modalities, such as mammographies, MRIs and CTs, and then take those digital images and view them on a workstation, store them in archives and transmit them via a secure network. PACS RIS also come as mini-pacs and web-based pacs. Mini-pacs are an extremely focused type of pacs system that allows you to use images taken from one type of modality, rather than multiple modalities as can be done on a full pacs system, and then manipulate them on a workstation. A web-based pacs is a system that allows you to send and receive digital medical images and other data over the Internet. They use secure transmissions over virtual private networks or secure socket layer. The web-based aspect of the pacs has changed how medical offices function, because now it is a simple matter to remotely work nearly anywhere in the world due to the use of the World Wide Web, and this also allows for improved consultations with physicians located down the hall or across the world from you.

A RIS PACS system helps keep a radiology department organized in terms of patient care. With this type of system, departments can track the registration and scheduling of their patients. It is easy to create test requests and results entries, reports and printouts automatically. The system can handle emailing clinical reports, and can be used to book patient appointments, to maintain your office workflow, and even to create customized reports. Many systems also take care of billing as well.

For the speed and ease of use brought about by this new technology, many medical offices are switching over to a pacs server.

A RIS PACS system is an electronic medical information system. Although it previously was only available to the largest hospitals due to the high cost, today RIS PACS is quite affordable for small and mid-sized medical facilities due to improved technology and reduced price of all electronics, especially computer systems.



**Figure 1.1** RIS/PACS Workflow

Information Retrieval (IR) is necessary for store digital mammography data. Because IR is the science of searching for documents, for information within documents, and for metadata about documents, as well as that of searching relational databases and the World Wide Web. There is overlap in the usage of the terms data retrieval, document retrieval, information retrieval, and text retrieval, but each also has its own body of literature, theory, praxis, and technologies. The making of information retrieval is limited to the fact that it is to query using simply text-based information.

## 1.2 Problem statement of existing system

Problems can be summarized as follows,

1.2.1 According to the limitation above, image-based information retrieval is an alternative by bringing a patient's diagnosis from the database as part of decision making

1.2.3 Accessibility of the previous Mammogram difficult to be compared with a new one

1.2.3 Timeliness

1.2.4 No compatible format for storage effective in storing the old Mammogram in use for future diagnostic comparison

1.2.5 No readiness/ easiness in using the data for analysis and summarization

1.2.6 No accessibility via the Internet

### **1.3 Objective**

The objective of this project is to build medical diagnostic decision support system (MDSS) for breast cancer which,

1.3.1 Is aimed at providing convenience to doctors who need to compare the previous similar Mammogram in terms of speed and efficiency.

1.3.2 Is to increase accuracy to increase survival rate in cancer patients in case of early diagnosis.

1.3.3 Is stimulated with a post decision support and direction among doctors who have similar cases

### **1.4 Scope of study**

The scope of project includes,

Developing MDSS for breast cancer composes of:

1.4.1 Collection and classification of previous data from the Mammogram, attached with the diagnosis in the same systematic storage

1.4.2 Web application for information delivery, connect to server

1.4.3 Report result can be easily accessed

Using data source from The Breast Diagnostic Center, The Faculty of Medicine, Ramathibodi Hospital, Mahidol University.

### **1.5 Expected Results**

The results are,

1.5.1 The radiologist can make a comparison with the use of the old Mammogram indicating breast cancer with similar patterns.

1.5.2 The radiologist can ask for advice from another radiologist with almost like case.

1.5.3 To increase diagnostic accuracy of breast cancer.

## **CHAPTER II**

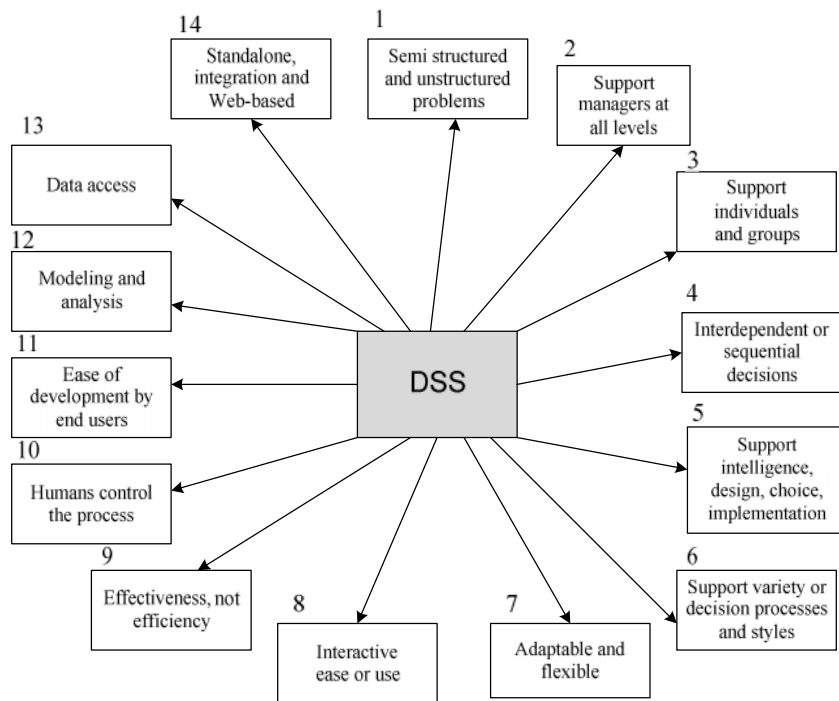
### **LITERATURE REVIEW**

#### **2.1 Definition (DSS Characteristics and Capabilities)**

Because there is no consensus on exactly what a DSS is, no agreement on the standard characteristics and capabilities of DSS is obvious. In Figure 2.1, the capabilities constitute an ideal set, some members of which are described in the definitions and illustrated in the opening vignette. The term BI is not quite synonymous with DSS. However, the two terms are often used interchangeable in practice. We differentiate the two in that DSS are generally built to solve a specific problem and include their own data, base (s), whereas BI applications focus on reporting and identifying problems by scanning data extracted from a data warehouse. Although BI systems with such tools are typically called business analytics systems, both systems generally include analytical tools. Both DSS and BI applications have become tightly aligned with Web implementations in terms of data and model access from servers and browsers as clients to run the system.

Business analytics (BA) implies the use of models and data to improve an organization's performance or competitive posture. The focus, in business analytics, is on the use of models, even if they are deeply buried inside the system. Although advanced models are extremely effective, they are not often used in BI. (Humana Corp. in the opening vignette does so, though.) This is because few managers and even analysts truly understand how and when to apply appropriate models to describe and analyze a particular situation. Data mining and OLAP systems have models embedded in them. However, practically, they are still not well understood. Web analytics is an approach to using business analytics tools on real-time Web information to assist in decision making. Most of these applications are in relation to electronic commerce (e-commerce). This is especially true in CRM. Some have been initiated in product development and supply-chain management (SCM). The term predictive analytics eventually describes the business analytics method of predicting problems and

opportunities rather than simply reporting them as they occur. Predictive analytics employs advanced forecasting and simulation models. Having developed some fairly sophisticated analysis tools that are currently described as predictive analytics tools. Humana Corp. and the Oklahoma Heart Hospital are as described in the opening vignette.



**Figure 2.1** Key characteristics and Capabilities of DSS

The key characteristics and capabilities of DSS (as shown in Figure 2.1) are

1. Supporting for decision makers, mainly in semi-structured and unstructured situations, by bringing together human judgment and computerized information. Such problems cannot be solved (or cannot be solved conveniently) by other computerized systems or through use of standard quantitative methods or tools. Generally, these problems gain structure as the DSS is developed. Even some structured problems have been solved by DSS.

2. Assisting all managerial levels, ranging from top executives to line managers.

3. Aiding individuals as well as groups. Less-structured problems often require the involvement to individuals from different departments and organizational levels or even from different organizations. DSS support virtual teams through collaborative Web tools. DSS have been developed to support individual and group work, as well as to support individual decision making and groups of decision makers working somewhat independently.

4. Backing interdependent and/or sequential decisions. The decisions may be made once, several times, or repeatedly.

5. Assisting in all phases of the decision-making processes: intelligence, design, choice, and implementation.

6. Supporting for a variety of decision-making processes and styles.

7. Indicating that the decision maker should be reactive, able to confront changing conditions quickly, and able to adapt the DSS to meet these changes. DSS are flexible, so users, can add, delete, combine, change, or rearrange basic elements. They are also flexible in that they can be readily modified to solve other, similar problems.

8. of User-friendliness, strong graphical capabilities, and a natural language interactive human-machine interface can greatly increases the effectiveness of DSS. Most new DSS applications use Web-based interfaces.

9. for the Improvement of the effectiveness of decision making (e.g., accuracy, timeliness, quality) rather than its efficiency (e.g., the cost of making decisions). When DSS are deployed, decision making often takes longer, but the decisions are better.

10. for The decision maker who has complete control over all steps of the decision-making process in solving a problem. A DSS specifically aims to support. It is not to replace the decision maker.

11. for end users who are able to develop and modify simple systems by themselves while larger systems can be built with assistance from information system (IS) specialists. In developing simpler systems, spreadsheet packages have been utilized. Online analytical processing (OLAP) and data mining software, allow users to build fairly large, complex DSS, combined with data warehouses.

12. for models which are generally utilized to analyze decision-making situations. The modeling capability enables experimentation with different strategies under different configurations. In fact, the models make a DSS different from most MIS.

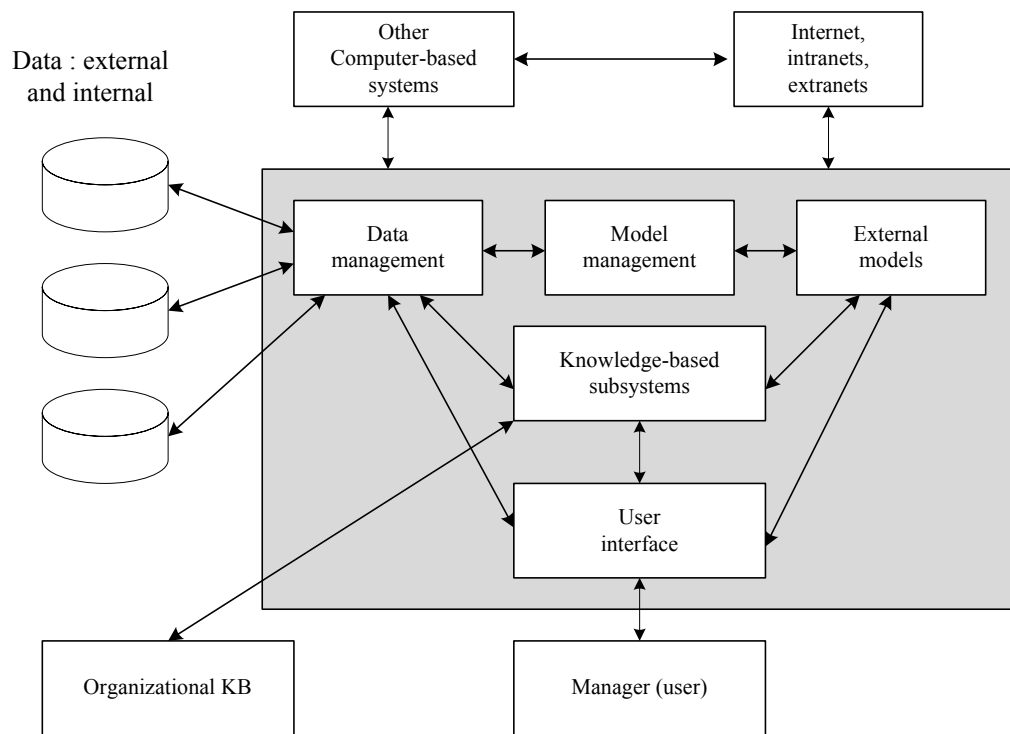
13. as access is provided to a variety of data sources, formats, and types, including GIS, multimedia, and object oriented.

14. to be employed as a standalone tool to be utilized by an individual decision maker in one location or distributed throughout an organization and in several organizations along the supply chain. With the use of networking and Web technologies, it can be integrated with other DSS and/or applications, as well as being circulated internally and externally.

These key DSS characteristics and capabilities allow decision makers to make better, more consistent decisions in a timely manner, and they are provided by the major DSS components, with we describe next.

## **2.2 Components of DSS**

A DSS application can be composed of the data management subsystem, the model management subsystem, the user interface subsystem, and a knowledge-based management subsystem. We show these in Figure 2.2



**Figure 2.2** A Schematic View of DSS

### THE DATA MANAGEMENT SUBSYSTEM

The data management subsystem includes a database containing relevant data for the situation. It is managed by software called the database management system (DBMS).<sup>1</sup> The subsystem can be interconnected with the corporate data warehouse, which is a repository for corporate relevant decision-making data. The data are usually stored or accessed using a database Web server.

### THE MODEL MANAGEMENT SUBSYSTEM

The model management subsystem is a software package. It includes financial, statistical, management science, or quantitative models that provide the system's analytical capabilities and appropriate software management. The subsystem also includes modeling languages for building custom models. This software is often called a model base management system (MBMS). This component can be connected to corporate or external storage of models. Model solution methods and management systems are implemented in Web development systems (such as Java) to run on application servers.

**THE USER INTERFACE SUBSYSTEM**

Through the user interface subsystem, the user communicates with and commands the DSS and is considered part of the system. According to researchers, it was asserted that some of the unique contributions of DSS are derived from the intensive interaction between the computer and the decision maker. The Web browser provides a familiar, consistent graphical user interface (GUI) structure for most DSS.

**THE KNOWLEDGE-BASED MANAGEMENT SUBSYSTEM**

The knowledge-based management subsystem can back up any of the other subsystems or as an independent component. It provides intelligence to intensify the decision maker’s own. It can be interconnected with the organization’s knowledge repository (part of a knowledge management system [KMS]). This is sometimes called the organizational knowledge base in which knowledge may be provided via.

**Table 2.1** Summary of DSS Component Capabilities

**Overall Capabilities**

Create a variety of DSS applications (specific DSS) quickly and easily

Facilitate iterative design process

**General Capabilities**

<b>User Interface</b>	<b>Data</b>	<b>Models</b>	<b>Knowledge</b>
Easy to use For routine use and modification and construction of DSS	Access to a variety of data sources, types, and formats for a variety problems and contexts	Access to a variety of analysis capabilities with some suggestion or guidance available	Access to a variety of artificial intelligence tools to provide intelligence to the other three components and to provide mechanisms for problem solving directly

**Component Capabilities**

<b>User Interface</b>	<b>Data</b>	<b>Models</b>	<b>Knowledge</b>
<p>1. A consistent GUI, usually via a Web client</p> <p>2. Variety of user input devices</p> <p>3. Variety of output Formats and devices</p> <p>4. Variety of flexible Dialog styles</p> <p>5. Support communication among users and with developer</p> <p>6. Support knowledge of users (documentation)</p> <p>7. Capture, store, analyze (and track) dialogs</p> <p>8. Flexible and adaptive dialog support</p> <p>9. Provides integration of DSS components</p>	<p>1. Variety of data Forms and types</p> <p>2. Extraction, capture, and integration, especially into local, multidimensional data cubes</p> <p>3. Data access function:</p> <p>    a. Retrieval/query</p> <p>    b. Report/display</p> <p>    c. User/efficient data handling</p> <p>4. Database management function on both clients and servers</p> <p>5. Variety of logical data views available</p> <p>6. Data documentation</p> <p>7. Tracking of data usage</p> <p>8. Flexible and adaptive data support</p>	<p>1. Library of models to constitute a model base :</p> <p>    a. Many types</p> <p>    b. Maintain, catalog integrate</p> <p>    c. Canned (preprogrammed) library</p> <p>2. Model building facility</p> <p>3. Model manipulation and use facility</p> <p>4. Model base management functions</p> <p>5. Model documentation</p> <p>6. Tracking of model usage</p> <p>7. Flexible and adaptive model support</p>	<p>1. Library of artificial intelligence techniques to assist users in :</p> <p>    a. The user interface</p> <p>    b. The database</p> <p>    c. The model base</p> <p>2. Assistance directly in decision making</p> <p>3. Enables automated decision making</p> <p>4. Symbolic reasoning capabilities directly for decision making</p> <p>5. Improved decision making through more accurate tools, such as expert systems (ES) and artificial neural networks</p>

**Table 2.2** DSS Components and Web Impacts

DSS Component	Web Impacts	Impacts on the Web
<p>Database management System (DBMS)</p>	<p>Database servers provide data directly Consistent, friendly graphical user I interface (GUI)</p> <p>Provides for a direct mechanism to query databases</p> <p>Provides a consistent communication channel for data, information, and knowledge</p> <p>Connections to data via portable devices (PDA, cell phones, etc.)</p> <p>Connections to data warehouses</p> <p>Connections to internal and external data sources</p> <p>Data access through mobile-commerce(m-commerce) and universal commerce (u-commerce, also known as ultimate-commerce and ubiquitous-commerce)devices</p> <p>Direct assess by customers</p> <p>Intranets and extranets</p> <p>Web-based development tools</p> <p>New programming languages</p>	<p>A means to conduct e-commerce , m-commerce, and u-commerce (transactions must be stored and acted upon)</p> <p>Customer tracking and use implies cross-selling, up-selling, and help system access, which impact Web traffic</p> <p>Database Web servers store data about the Web for analysis, suing models to determine effectiveness and efficiency (via Web intelligence and Web analytics)</p>

	<p>and systems</p> <p>Proliferation of database use throughout organizations , which made enterprise-wide systems feasible</p> <p>Access to information about databases</p>	
<p>Model base management system (MBMS)</p>	<p>Access to models and solution methods implemented as Java applets and other Web development systems</p> <p>Use of models by untrained managers (and analysis) because they are easy to use</p> <p>Access to Web-based artificial intelligence tools to suggest models and solution methods in DSS</p> <p>Access to information about models</p>	<p>Improved infrastructure design and updates</p> <p>Models and solutions of Web infrastructure issues</p> <p>Models of Web message routing improve performance</p> <p>Forecasting models predict viability of hardware and software choices</p>
<p>User interface dialog system</p>	<p>Web browsers provide a flexible, consistent, and familiar DSS GUI</p> <p>Access to information about user Interfaces</p> <p>Experimental user interfaces are tested, distributed, and used via the Web</p> <p>New interfaces are readily available</p> <p>Artificial intelligence-based</p>	<p>Initial GUIs and the computer Mouse helped define how Web Browsers work</p> <p>Users have an expectation of how</p> <p>They will access data, information, models, etc.</p> <p>Speech recognition and generation</p> <p>Are deployed over the Web</p> <p>New graphical-oriented display</p>

	tools communicate directly with users via Web-based interface tools	mechanisms are deployed over the Web
Knowledge-based management system (KBMS)	<p>Access to artificial intelligence methods</p> <p>Access to information about artificial intelligence methods</p> <p>Access to knowledge</p> <p>Web-based artificial intelligence readily run and provide access to customers directly (help desks, newscasts, etc.)</p>	<p>Artificial intelligence methods readily handle network design issues and message routing</p> <p>ES diagnose problems and workarounds for failures in internet communication, hardware and software in servers and clients</p> <p>ES and intelligent agents diagnose hardware problems and recommend specific repairs</p> <p>Intelligent search engines learn user patterns</p> <p>Intelligent agents readily monitor</p> <p>Internet performance and alert IT staff when problems arise or are predicted to arise</p> <p>The proliferation of the Web and access has increased commercial development via and on the Web</p>
User	User attitudes and expectations are strongly influenced by Web tools and access. Users expect ready vaccess and 100% reliability of information, other sources, and other users	The proliferation of the Web and access has increased commercial development via and on the Web E-commerce proliferation led to the need for fast servers, clients, and communication channels

Web servers. Many artificial intelligence methods have been implemented in Web development systems such as Java. They are easy to integrate into the other DSS components.

A DSS must include the three major components; DBMS, MBMS, and user interface. The knowledge-based management subsystem is optional. However, it can provide many benefits by providing intelligence in and to the three major components. The user may be considered a component of DSS, as in any other MIS.

### **2.3 Systems, information Quality, and Models**

A decision support system is a system. More specifically, it is an information system.

A system is a group of interacting components with a purpose. In addition to its components and its purpose, every system has a boundary that separates the components of the system from the world outside the system. A system may integrate. Feedback can occur within the system or outside it.

An information system is a system with the function of storing, Communicating, and processing information. In business today, most large information systems incorporate computers. However, many important information systems do not. Therefore, it is important to consider noncomputerized information-processing methods as solutions to business problems.

Data flow diagrams are a convenient and widely accepted way to record and communicate (1) the processes and data stores comprising a system and (2) the information flows among them and between them and the outside world. However, data flow diagrams do not show the timing relationships among system activities, the conditions under which certain activities occur, or the reasons why they occur. For this reason, they must be augmented by other system description methods.

As information systems, decision support systems, use data stores that are created and updated by other systems. They communicate their results to human decision makers, not to other information systems.

Information is whatever reduces our uncertainty about something we didn't know or were unsure of. The more the information reduces our uncertainty, the more information we have. Derived from data by comparing two data elements,

information performs computations on several data elements, or by these elements combined.

Information is the basis for nearly every organizational decision. High quality information causes these decisions to be made correctly. Low quality information can cause them to be made incorrectly. It can harm the organization. The ability of information to contribute to the goals of the organization depends on the quality of that information. It can be described in terms of 11 factors:

*Relevance* - the degree to which it applies to the task being performed. Computers can provide so much information to their user. The relevance of the information is thus reduced.

*Correctness* - whether or not the information matches reality. Computers can produce correct information only if their inputs are correct and the processing of those inputs has been specified correctly.

*Accuracy* - a measure of the difference, if any, between an information item and the reality it represents. Computers can introduce inaccuracy through computational processes. Reduced accuracy may be acceptable if it permits improving information quality in other respects.

*Precision* - the potential accuracy conducted by internal or external data representations. Computers allow high precision. However, the underlying accuracy of the data does not always justify it.

*Completeness* - All relevant data are inclusive in arriving at information. As computers do not generally affect completeness directly, they may hide its absence.

*Timeliness* - includes two aspects: the availability of information in time for its intended use, and the currency of the information as of the time of that use. Computers can improve the timeliness of information. However, the cost of their doing so must be measured against the value.

*Usability* - the ease of using the information for its intended purpose. Computers can increase information usability by formatting it appropriately. But this can be overdone.

*Accessibility* - the degree to which information is available to users when and where needed. Computers generally improve accessibility, but poor performance, a poor user interface, or obtrusive security procedures may impair it.

*Conformity to expectations* - measures how closely the creation of an information item matches the expectations of the person or people who will use it. Ensuring that computer-derived information conforms to expectations raises concerns that do not arise with manually developed information.

*Consistency* - an information item based on data elements that refer to the same time frame, organizational entity, and assumptions. The impact of computers on consistency depends on the degree to which system designers took this factor into account.

*Cost of information* - refers to both the costs of the computers, networks, and more, that are used to obtain that information, and the cost of the time users spend working with that information. Cost can usually be traded off against other information quality factors.

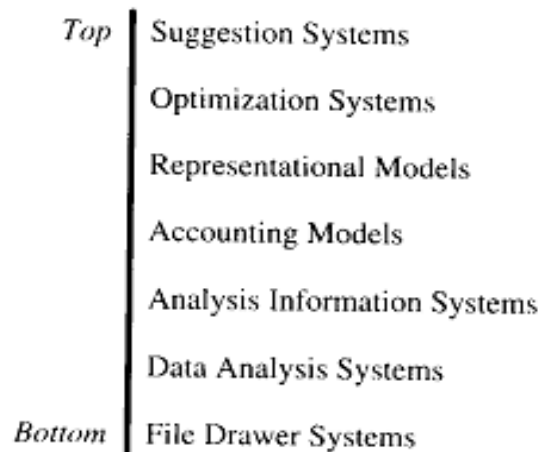
A model is a simplified representation of a real system or object. In decision support systems, models are used because (1) they are easier to operate than the real systems whose behavior are to be investigated, (2) it is easier to extract data from them, and (3) they generate results more quickly. For a model to be useful we must be sure not to simplify the description of the real system so far that the usefulness of the model is lost.

## 2.4 The DSS hierarchy and Type of DSS

The Categorization of decision support systems were made into the seven levels shown in Figure 2.3 This hierarchy is originally from [ALTE80]. It is based on what a DSS Does, not how it's built. Because there has not significant changing in the past 20 years, it still fits well though the technologies underneath DSS have changed dramatically. While the categories don't fit every system that exists, and while there are gray areas between some adjoining categories, they are an excellent place to start.

From the bottom to the top, the seven DSS types and Alter's original definitions are

- **File drawer systems** permit immediate access to data items.
- **Data analysis systems** allow the manipulation of data by means of operators, who are tailored to the task and settings or operators of a general nature.



**Figure 2.3** DSS Hierarchy from (ALTE80)

- Analysis information systems provide access to a series of databases and small Models.
- Accounting models calculate the consequences of planned actions on the basis of accounting definitions.
- Representational models estimate the consequences of actions on the basis of models that are partially non-definitional.
- Optimization systems provide guidelines for action by generating the optimal solution consistent with a set of constraints.
- Suggestion systems perform mechanical work leading to a specific suggested decision for a fairly structured task.

### **The Seven DSS Types**

In this section we'll look at the seven DSS types in a bit more detail. We'll cover them in the order given above. However, even though they are in a sequence, don't think of the higher levels as being somehow "better" than the lower ones. They are more complex and carry out more of the decision-making process on their own but they may not match a given decision situation as well as a simpler type of DSS would.

The first categories - the lower ones - are generally better suited to less structured problems. The latter ones are better for more structured decisions. Or, they

are for decisions recurring often enough for people to have developed good ways to deal with them.

**File Drawer Systems** These are the simplest DSS. However, they can often be of Value. Retrieving a desired piece of information can help reach decisions. When an ATM prints your account balance, when a travel agent or a Web-based reservation system informs you that there are no seats left on a flight about which you inquired, when an order entry operator tells you that your credit card's limit will not cover the goods you're trying to order, they are all using file drawer systems. In each case, you are then in a position to make a decision and to take suitable action. The actions could be to move funds from one account to another, to choose an earlier or later flight, to reduce your order or use a different method of payment.

Business decisions are also often based on a single data item. The case in point is when a supplier refuses to deliver your purchased and a purchasing agent comes to intervene by dealing with the supplier of the order or with finding another supplier.

The statement that business decisions are often based on a single data item is not in conflict with what you read in the last chapter: that decisions are based on data that has been processed, via calculations and comparisons, into information. In this case, the calculations and comparisons are done intuitively by the decision maker based on his or her business knowledge and experience. The purchasing agent responds by agreeing to the delay in receiving ordered electric motors is based on the agent's comparing the date on which the motors are needed with the available date-a week from Tuesday. The decision is also based on knowing how motors of different sizes would or would not fit the company's product.

**Data Analysis systems** It is rare that data management system today that cannot also complete operations such as conditional retrieval of records and elementary arithmetic summaries of selected data. In the early 2000s pure file drawer systems (that is, file drawer systems that can't do more if the need arises) are found only in dedicated end-user applications such as checking a bank balance at an ATM or the inventory status of a product at a supplier's Web site. Almost all software packages and systems are used as file drawer systems. They also have some data

analysis capability. Any SQL-based relational database management system can find the sum and average of the data it retrieves. These operations are built into the lowest level of the SQL standard. The airline reservation system that displays “no more seats on that flight” can also display a list of alternate nights to the same destination at about the same time. If one is working with such tools, then, rather than with a finished application, one is not likely to encounter file drawer systems.

Combining a spreadsheet with data management capability, integrated software packages create useful data analysis systems for desktop microcomputers. However, spreadsheet programs have modeling and analysis capabilities beyond what this category of DSS requires. Their data management capabilities do not serve. Most spreadsheet packages can import files from other data or database management software. Setting up the transfer may require some technical skills. This is true if the files in question reside on another system connected to the user’s computer via a network. A person with the requisite skills has set up the connection. The importing procedure, which imports the latest data for local analysis, does not tax the typical end user.

**Analysis Information Systems** Alter’s name for this category could be confusing. If the second category is called “data analysis systems,” shouldn’t this one be “information analysis systems?” However, the emphasis in this category name is on the “analysis.” The last two words are to be taken as a single phrase, “information systems.”, meaning that an information system follows through the analysis.

The key distinguishing feature between the preceding DSS category and this one is that we are now combining information from several files. That means we have what is in effect a true database, though we might not use what a computer scientist would consider database technology. A user should be enabled to compare the sales growth trend, with the use of an analysis information system. Calculation could be done from its internal sales data with industry wide data from an external source.

Since the mid1990s, analysis information systems have become increasingly popular since. However, few of their users would realize that name. Instead, data warehouse is the current term<sup>4</sup> which you’ve heard before. This is far from the first time that a concept has been “reinvented,” with a new name and

employing new technologies in the information systems field-often to succeed in its new incarnation far beyond its acceptance the first time around. Chapters 12 through 15 of this book are about them<sup>8</sup> because of the critical role that data warehouses play in<sup>8</sup>decision support today.

**Accounting Models** The term accounting model refers to a model with no uncertainty, in which the calculations in each time period depend only on other data from that time period. Such models arise frequently in accounting. Balance sheets and income statements are accounting models, with certain calculations being performed to yield the correct results. Double-entry bookkeeping is an accounting model allowing the owners of a business to know how much the business is worth. The owners can finish the task without checking its bank balances, outstanding invoices, inventories, and so on.

The most common tool used to represent accounting models is the spreadsheet Program. It was invented by two business school students. The Program is for automate accounting calculations for their case analyses. Other tools can also be used, especially if the accounting model is a small part of a larger DSS.

A material Requirements Planning (MRP) system is a basic component of most manufacturing software. Its integration includes accounting models. The bill of materials (OBM) for a product indicates types of components, and amount of each, go into that Product. If the BOM of a desk calls for 4 legs, precisely 4 legs are needed; not 3, not 3.5, not a statistical distribution with a mean of 4 and standard deviation of 0.3. No uncertainty in the calculations is to be performed with this number. If the MRP system is used to help make production planning or shipment scheduling decisions, it would be part of an accounting model DDS.

An accounting model itself cannot incorporate any uncertainty. Moreover, its inputs may not be known precisely. For instance, [ALTE80] discusses a model used by a shipping firm to calculate its costs<sup>4</sup> in order to decide on the prices it will offer to people who want to charter its ocean freighters. There are two factors in this calculation, which are fuel consumption and the unit cost of fuel at the time of the voyage. Both of them under the influence of uncertainty, though historical data for a given ship allow the firm to estimate its fuel consumption closely. Fuel price forecasts are available from several petroleum industry sources. When the firm has estimated

those, the model itself behaves as if the figures were known precisely and does not take their uncertainty into account. Therefore, the model in this DSS is an accounting model. Similarly, a budget forecast uses an estimated future inflation rate. It also estimates of future revenues and expenses, or any such model, is an accounting model in the context of these seven DSS categories.

**Representational Models** Representational models reflect uncertainty, often in individual or collective human behavior, or represent the dynamic behavior of systems over time-where what a system in the model does at one instant depends on what happened before.

Representational models are widely used to forecast the future effect of a decision. They are, for example, the productivity of one factory setup versus another, the stockout frequency of one ordering policy versus another, the response time of one computer system configuration versus another. By representing how we expect a real-world system to respond to certain inputs, we can consider different decisions (system inputs) and choose among them on the basis of their predicted results (system outputs).

**Optimization Systems** We can estimate the effect of various decision alternatives with a suitable model. A program can select the one that yields the best results if the alternatives can be enumerated or laid out along mathematical axes. The best mathematical forecast is not always the only basis for decision making-using. However, it alone corresponds to the “rational manager” concept of Chapter 2-it often helps a decision maker to have this information. A system that selects the best of several alternatives on a numerical basis is called an optimization system.

**Suggestion Systems** It is often a short step from determining an optimal decision to suggesting that the decision maker should make that decision. It may be practical for a DSS to make such a suggestion. Such DSS are called, appropriately, suggestion systems when decisions are highly structured.

Another type of suggestion system codifies the decision-making process into a number of rules. These rules can imitate the decision-making process that a human expert would use. They provide a descriptive model of the decision-making process. Alternatively, they can describe the right way to make a decision when this can be defined as a normative model. The system then suggests either way that the user make the same decision that these rules would yield. This approach works well

where human expertise or the desired decision-making process can be codified into a reasonable number of rules. The technology of expert systems is often used to build this type of suggestion system.

## **2.5 DSS Cures for Health care**

DSS can provide benefits; such as, increased effectiveness and efficiency in health systems. Here are several examples in which hospitals and agencies in the health care industry have implemented successful DSS initiative.

### **2.5.1 DSS Assists Directly in Providing Patient Care at Riverside Health System**

Riverside Health System (Newport News, VA) developed a system called Soarian. It is a fully integrated, workflow-driven hospital information system (HIS) from Siemens Medical Solutions Health Services Corp. The enterprise-wide, Web-based system is at the core of Riverside's information technology (IT) program. All necessary patient information and documentation are relevant. Models and internal rules automatically generate alerts as care conflicts occur.

### **2.5.2 DSS Monitors and Improves Oklahoma Heart Hospital's IT Performance**

Oklahoma Heart Hospital constructed a new facility. It also developed a new electronic medical records system and digitized all hospital records. This enterprise information management system monitors events and generates alarms (i.e., exceptions) The BMC Patrol Analytics tool (from Intuitive, Inc.) finds out which alarms are real and which are not. Access and reporting occur via Web interface, no paper required, with a bedside computer in every room. Patient charts and other information are available instantly everywhere.

Dynamically, Patrol Analytics predicts problems in the information system and alerts IT staff to take corrective measures. It also determines situations such as resource underutilization. By automating trouble detection, the IT staff can focus on helping people, leading ultimately to higher-quality patient care. It is indicated that at Oklahoma Heart Hospital, patient satisfaction is in the top 1 percent in the nation.

### **2.5.3 DSS Improve Health Care Options Effectively**

DSS that consists of analytical tools helps employers, insurance companies, and health care providers in providing the best care for employees, in the most efficient and effective manner. In large firms, between 2000 and 2005, health care costs rise by more than 80 percent. One approach to health care is to analyze where expenses go by using analytical tools to analyze data from a database and then propose effective treatment. For example, detailed analysis indicated that Navistar's International Truck and Engine Corp. employees were nearly twice as likely as the general population to suffer from diabetes. This condition alone accounted for some 24 percent of the firm's health care spending. Artificial intelligence and statistical methods were used to examine claims to search for combinations of factors that would be likely to lead to large medical claims. At Pitney Bowes, diabetes and asthma occurred frequently. Pitney Bowes managers decided to cut co-payments on drugs for diabetics and asthmatics. It was aimed at workers completing with their treatments. This immediately decreased the average annual care cost by 6 and 15 percent for diabetics and asthmatics, respectively. In some cases, employers have increased health care insurance premiums for employees who would follow through with their treatments. In the same respect, the state of Georgia has sharply increased premiums for smokers. Managers at some firms have added wellness care for employee health segments (analogous to customer segments utilized in marketing)

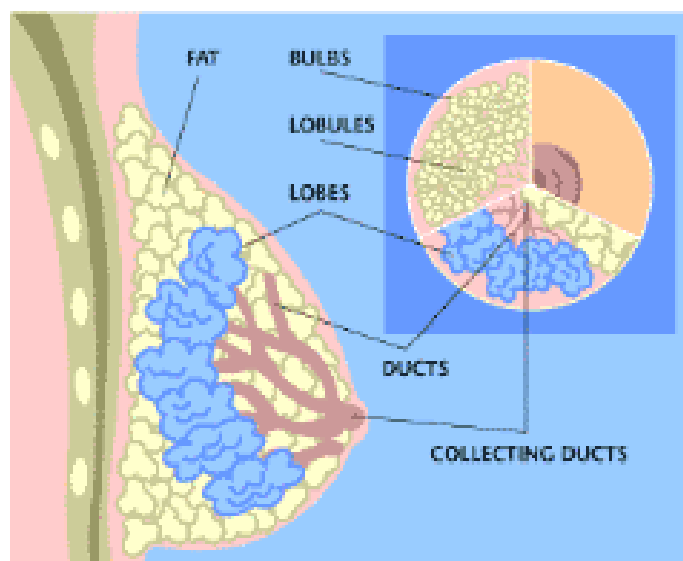
The Humana, Inc., Center for Health Metrics DSS generates clinical profiles that look like geographical information system (GIS) displays using color in indicating different risk segments. Humana is effectively developing advanced analytical models to control costs, improve service, and identify business opportunities. These models comprise statistical methods, pattern recognition, complexity theory, agent-based modeling, genetic programming, Markov models, and Bayesian learning networks. Simulation models run scenarios combining previous results. By early 2004, 8 to 10 people supported the modeling effort, with the \$1 million investment.

Based on health care need characteristics, employees are able to be segmented effectively. These benefit segments can be determined not only by using cluster analysis but also by class analysis, among other methodologies embedded in a

DSS. Financial analyses can reveal appropriate types of medical benefits that are beneficial to each segment and to the organization in which they work (identical to customer relationship management [CRM] customer segmentation). The aim is to be fair with employees in terms of the right benefits package in the right format at the right time at the right price. Simulation tools are used to determine the impacts of existing and new products/packages for each segment. DSS Research reported that with the segmentation of employees, market share increased providers and social services agencies can utilize DSS tools and methods similarly. GHS LLC has developed a short, accurate survey instrument. It is called Predicted Insurance Expenditures (PIE) to quickly stratify clients with an accurate prediction of future expenses.

## 2.6 Breast cancer

### 2.6.1 The structure of the breast



**Figure 2.4** Structure of the breast

Breast contains mammary approximately 15-20 internal lobe contains lobules and bag bulbs attached water, milk, which will open the nipple. (See figure

1.1) Within breast, there are also lymphatic drainage to the axillaries lymph nodes. The most common cancer occurred in the mammary ducts, called ductal carcinoma. When cancer spreads, it usually involves the axillary lymph node.

### **2.6.2 Causes of Breast cancer**

The primary risk factors that have been identified are sex, age, childbearing, hormones, a high-fat diet, alcohol intake, obesity, and environmental factors such as tobacco use, radiation, endocrine disruptors and shift work. Well established risk factors account for 47% of cases while 5% are attributable to hereditary syndromes. In particular, carriers of the breast cancer susceptibility genes, namely BRCA1 and

BRCA2, are at a 30-40% increased risk for breast and ovarian cancer. They depend on in which portion of the protein the mutation occurs.

- Personal history of breast cancer: A woman who had breast cancer in one breast has an increased risk of getting cancer in her other breast.
- Family history: A woman who had other member of her family, particularly mother, sister, or daughter, diagnosed with breast cancer, is at risk of the cancer as well, especially if the member got the cancer before the age 40. The same risk is there if the women has relatives with breast cancer (in either her mother's or father's family)
- Certain breast changes: Some women have cells in the breast that look abnormal under a microscope. Having certain types of abnormal cells (atypical hyperplasia (ADH) and lobular carcinoma in situ [LCIS]) increases the risk of breast cancer.
- Race: Breast cancer is diagnosed more often in Caucasian women than Latina, Asian, or African American women.
- No physical activity: Women who are physically inactive throughout life may have an increased risk of breast cancer. Being active may help decrease risk.

Abortion has not been found to be a risk factor for breast cancer. The breast cancer abortion hypothesis however continues to be promoted by some pro-life

groups. Bras and tight fitting clothing has not been found to be related to breast cancer.

### 2.6.3 Pathophysiology

Breast cancer, like other forms of cancer, is the outcome of multiple environmental and hereditary factors. Some of these factors include:

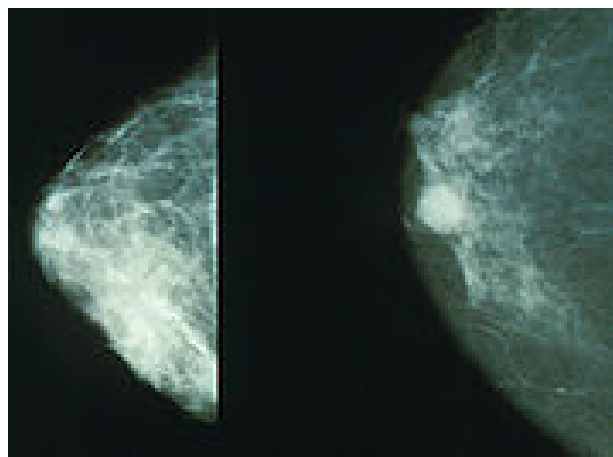
1. Lesions to DNA such as genetic mutations. Mutations that can lead to breast cancer have been experimentally linked to estrogen exposure.

Failure of immune surveillance, a theory in which the immune system removes malignant cells throughout one's life.

2. Abnormal growth factor signaling in the interaction between stromal cells and epithelial cells can facilitate malignant cell growth.

3. Inherited defects in DNA repair genes, such as *BRCA1*, *BRCA2* and *TP53*. People in less-developed countries report lower incidence rates than in developed countries.

### 2.6.4 Screening



**Figure 2.5** Structure of the breast Mammograms showing a normal breast (left) and a breast cancer (right).

Breast cancer screening refers to testing otherwise-healthy women for breast cancer. It is an attempt to achieve an earlier diagnosis, assumed that early

detection will improve outcomes. A number of screening tests includes clinical and breast-self examination, mammography, genetic screening, ultrasound, and magnetic resonance imaging.

A clinical or breast-self examination involves feeling the breast for lumps or other abnormalities. However, evidence does not support its use. Mammographic screening for breast cancer is also controversial. It uses x-rays to examine the breast to detect abnormalities such as masses or calcifications. The Cochrane collaboration in 2009 concluded that it is unclear whether screening does more good than harm. However, many national organizations suggest it. If mammography is decided upon it should only be done every two years in women between the ages of 50 and 74. In women at high risk, especially those who have relatives diagnosed with cancer, additional testing may include genetic screening and/or magnetic resonance imaging. Specifically, genetic screening involves testing for mutations in the BRCA genes.

### **2.6.5 Mammography**

In present, mammogram is accepted to be the imaging modality of choice for breast cancer screening, since it is relatively fast and widely available. Moreover, mammogram has relatively high sensitivity, specificity and accuracy. Breast cancers detected by mammography are usually smaller (in an earlier stage) than those detected by patients or doctors as a breast lump, method of treatment in the earlier stage is not as complicated as later stage of breast cancer.

Whether mammography is effective is controversial. A 1993 review estimated that it reduced breast cancer-related mortality by 20-30%. A 2005 Cochrane review estimated that the relative risk reduction was 15%, the absolute reduction of risk was 0.05%. Moreover, it also indicates that mammography may do more harm than good, such as the patient was sent to biopsy for benign lesion.

There is a debate over whether mammography screening should start at age 50 or earlier, and how frequently women should be screened. Routine mammography of women 40 or older is a screening method to diagnose early breast cancer. It has demonstrated a protective effect in multiple clinical trials. Recommendations on age vary around the world. Women are invited for screening once every three years beginning at age 50. Women with one or more first-degree

relatives (mother, sister, and daughter) with premenopausal breast cancer should begin screening at an earlier age. It is usually suggested to begin at an age 10 years younger than the age when the relative was diagnosed with breast cancer.

For women less than 50 years old, mammography is not as an effective screening technique. Interpretation mammogram in younger women is due to breast density. Radio graphically, a dense breast has a preponderance of glandular tissue, and younger age or estrogen hormone replacement therapy contributes to mammographic breast density. The breast glandular tissue gradually is replaced by fatty tissue after menopause. It makes mammographic interpretation much more accurate, as well as high sensitivity. Some authors speculate that estrogen hormone replacement therapy contributes to breast cancer mortality arising from the issue of increased mammographic breast density.

#### **2.6.6 Mammograms effective are in detecting breast cancer**

American Cancer Society indicates that only 1 or 2 of every 1,000 mammograms lead to a cancer diagnosis. To clarify or confirm the findings of the first mammogram, about 10% of women tested by mammography will need to have an additional mammogram. Of these women who require a second mammogram for clarification/confirmation, only 8% to 10% will need to have a biopsy. Approximately 80% of the results of these biopsies will be conditions other than breast cancer.

In order to standard mammographic interpretation, the American College of Radiology purposed the interpretation system called Breast imaging Reporting and data system (BI-RADS)

This system categorizes assessment of mammogram in to 7 categories, which are Category 0, 1, 2, 3, 4 (which subcategorized to 4A 4B and 4C), 5 and 6

A Category 0 mammogram means that the assessment is not complete. Additional imaging is required. By itself, a Category 0 result means that the radiologist may not have been able to see an abnormality completely. It also means the abnormality was not completely defined. Additional imaging, which includes the use of spot compression, magnification, ultrasound, and special mammographic views, may be used to help make a more complete evaluation.

In the process of Mammographic assessment, which is in complete category 0, it needs the further checking of Mammography or using old Mammogram for comparison. After a further checking to complete the diagnosis, the result will be put into the completely assessed category. Previously, the comparison of the Mammogram for diagnosing abnormalities, not just a benign finding. The doctor, who is involved, has duty to determine if there is a necessity for using the old Mammogram for comparison or not.

It was discovered that the treatment of breast cancer needs multidisciplinary approaches. Treatment of breast cancer requires the operation, radiotherapy, chemotherapy, or hormonal therapy, it is essential for a strong teamwork of a radiologist surgeon, pathologist, medical oncologist as well as radiation oncologist. Accompanied by accurate diagnosis, this can provide different chances of survival rate among breast cancer patients who are undergone treatment in their different stages of the cancer.

**Table 2.3** Showing different stages and rates of survival in breast cancer patients

Stage	5- Year survival (%)	10-Year survival (%)
I	70-95	60-80
II	50-80	40-60
III	10-50	0-30
IV	0-10	0-5

### **2.6.7 A review of content-based image retrieval systems in medical applications—clinical benefits and future directions**

Content-based visual information retrieval (CBVIR) or content-based image retrieval (CBIR) has been one on the most vivid research areas in the field of computer vision over the last 10 years. The availability of large and steadily growing amounts of visual and multimedia data, and the development of the Internet underline the need to create thematic access methods that offer more than simple text-based queries or requests based on matching exact database fields. Many programs and tools

have been developed to formulate and execute queries based on the visual or audio content and to help browsing large multimedia repositories. Still, no general breakthrough has been achieved with respect to large varied databases with documents of differing sorts and with varying characteristics. Answers to many questions with respect to speed, semantic descriptors or objective image interpretations are still unanswered. In the medical field, images, and especially digital images, are produced in ever-increasing quantities and used for diagnostics and therapy. The Radiology Department of the University Hospital of Geneva alone produced more than 12,000 images a day in 2002. The cardiology is currently the second largest producer of digital images, especially with videos of cardiac catheterization (~1800 exams per year containing almost 2000 images each). The total amount of cardiologic image data produced in the Geneva University Hospital was around 1 TB in 2002. Endoscopic videos can equally produce enormous amounts of data.

With digital imaging and communications in medicine (DICOM), a standard for image communication has been set and patient information can be stored with the actual image(s), although still a few problems prevail with respect to the standardization. In several articles, content-based access to medical images for supporting clinical decision-making has been proposed that would ease the management of clinical data and scenarios for the integration of content-based access methods into picture archiving and communication systems (PACS) have been created. Techniques used in medical image retrieval, this describes the various techniques that are currently-used or that have been proposed for the use in medical image retrieval applications. Many of the techniques are similar to those used for general content-based retrieval but also techniques that have not yet been used in medical applications are identified. A special focus is put on the datasets that are used to evaluate the image retrieval systems and on the measurements used for evaluation. Unfortunately, the performance evaluation of systems is currently strongly neglected. Machine learning in medical applications also gets increasingly more important and it is essential to research the various possibilities. Specialized workshops exist for this area.

## **CHAPTER III**

### **RESEARCH METHODOLOGY**

#### **3.1 Gather requirement and data analysis**

The preparation of data is based on the information available at Ramathibodi Hospital's Cancer Research Center.

#### **3.2 Designs for DSS**

Query system design for patient data imaging.

#### **3.3 DSS Development**

##### **The program development.**

- Adobe Flash CS4

##### **Language used in the system.**

- Action Script 3.0
- PHP ( PHP Hypertext Preprocessor)

##### **The database system development.**

- My SQL

#### **3.4 Implementation and Testing**

- The results of Mammograms were brought for matching ones with highest similarity.
- It is important that specialists be invited for checking accuracy and reliability of the system.
- Statistical conclusion of accuracy and speed in image searching.

### 3.5 Research schedule

Time (month) Tasks and Activities	1		2		3		4		5		6	
	1. Gather requirement and data analysis	←	→									
2. Design for DSS		←	→									
3. DSS Development			←	→								
4. Implementation and Testing						←	→					
5. Conclusion and Document									←	→		

## **CHAPTER IV**

### **RESULT**

In this chapter, the details of all the steps carried out in this research will be discussed. The researcher developed the Medical Diagnostic Decision Support System (MDSS) for breast cancer so as to facilitate physicians who want to have fast access to updated information on the case similar to theirs, which can be applied to their case in an effective manner. The steps in the study are as the follow:

- 4.1 Knowledge gleaning;
- 4.2 Planning;
- 4.3 System determination;
- 4.4 System design;
- 4.5 System development; and
- 4.6 System test.

#### **4.1 Research Procedure and Steps**

In order to develop the Medical Diagnostic Decision Support System (MDSS) for breast cancer, the researcher studied and gleaned knowledge and information from various sources such as many web-sites and several documents. The documents from which the researcher gleaned information are Decision Support and Data Warehouse Systems International edition 2000 Efrem G Mallach (Author) , Decision Support Systems and Intelligent Systems 6th edition EFRAIM TURBAN and JAY E. ARONSON (Author). Some information was retrieved from various online sources such as [http://en.wikipedia.org/wiki/Breast\\_cancer](http://en.wikipedia.org/wiki/Breast_cancer). Initially, the researcher had divided the study into three main parts, namely, statements of problems and system analysis, system development and the study on development tools.

4.1.1 In the first part, i.e., the statement of problems and system analysis, the researcher focused on current problems such as the incidents that the existing system is incapable of facilitating physicians to compare different cases at the same

time. For example, using the existing system, a physician can compare the conditions in the first treatment with those in the second, third and fourth ones; however, if the physician wants to compare this case to another similar case, the physician has to sign out off the current database and sign in to the other database. In addition, the existing system does not allow physicians to obtain both the information on the patient's conditions and the photos of the patient at the same time. Furthermore, the existing system does not allow the share of databases via internet networks. In this study, the data were obtained from the Breast Diagnostic Center, the Faculty of Medicine Ramathibodi Hospital. In addition to the data available from the center, the researcher collected information on users' needs. It has been found that patients' profiles, the profiles of physicians who diagnose or treat the disease, mammographs and other details should be filed in the database so as to be used whenever there is a case similar to them. This was supposed to enable physicians to work with high levels of hastiness and accuracy, with none or few errata.

4.1.2 The system development part was divided into three steps, i.e., system design, system development and system test.

4.1.2.1 System Design: The researcher had to understand the operation of the programme; thus, the system was designed to be comprehensible, less complicated and covering all needs of users.

1. Filing the information on patients who have already received treatments;
2. Filing the Mammograph;
3. Managing all kinds of information on patents such as patients' profiles and mammographs;
4. Reporting the results in three types of bar charts, namely,
  - 4.1. Calcifications Type is the graph that shows the relation between the number and the symptoms;
  - 4.2. Statistics of the patient is the graph that shows the relation between the number and the gender of the patients; and
  - 4.3. Age average is the graph that shows the relation between the age and the gender; and

5. Allowing users to browse for information or mammographs on the similar case.

4.1.2.2 System Development: The researcher used the following tools to develop the system:

1. Adobe Flash CS4;
2. Action Script3 language;
3. PHP language;
4. Image processing; and
5. MySQL database and Apache web server.

Developing the MDSS for breast cancer, the researcher emphasized on the information share through internet, which allowed the diagnosis with the comparison of symptoms or the comparison of the mammographs of similar cases, which would enable the fast and convenient diagnosis.

4.1.2.3 System Test: The researcher tested the MDSS for breast cancer by inputting the keywords and mammographs into the system so as to search for information and compare the mammographs. The results showed that the system could search for the desired information or mammographs accordingly to the input keywords. In addition, the results were plotted in bar charts and verified by experts who confirm that the reliability of the results reported in the bar chart were reliable in an acceptable degree. Furthermore, the research also added new information on new cases into the system. The mammographs and pictures could be uploaded via the internet only; thus, the system will not work at all without the internet.

## **4.2 Initial Study**

The researcher studied on the theorems concerning the use of the MDSS. In addition, the researcher also learnt about the display design, colours and picture adjustments. The knowledge obtained from the initial study concerns the following respects:

### **4.2.1 Planning**

The plan would determine the form and characteristics of the programme to be developed, which was planned to be easy to use and effective in clearly display the searched data in an accurate and reliable manner. In addition, the researcher had to

decide which information was to be filed in the database and how the data could be searched, such as via the picture or via the keyword.

#### **4.2.2 Data Selection**

After the planning phase, the researcher had to select the data and manage such selected data so as to obtain the predetermined objectives. The researcher had collected all the pictures and files that were related to the MDSS, as planned, by selecting the data from the database of the Breast Diagnostic Center, the Faculty of Medicine Ramathibodi Hospital, as well as collecting patients' profiles, the profiles of the doctors in charge if the case, the treatment, the way to cure the disease, and the four types of mammographs, such as R CC (R) , L CC (L) , L MLO (H) , and R MLO (H). In addition, data selection also included the selection for other respects such as font colours and logos on the display.

#### **4.2.3 Process**

Having all the desired data, the researcher added such data to the programme by creating the logos or adjusting the displayed pictures via the selected data so as to make the MDSS work in a way that the researcher wanted it to do. This step is important to the system development because it requires expertise and experience in the use of the programme. In addition, the knowledge concerning the use of the programme could enable the researcher to set the MDSS.

In selecting the pictures or files, the researcher had to consider how to arrange the display so as that the user would understand the system and could browse for the data in an easy manner. Importantly, the display must be clear and precise; the database should support the pictures; and the search technique should be accurate. The texts shown on the display had to be written clearly lest the users, required to fill the form, would misunderstand the statements and became confused.

#### **4.2.4 Fine-Tuning**

This step was similar to the determination for the display of the MDSS. However, this step emphasized on the linkage between one page to another such as when a user selects a type of information from a patient's page, the user will de

redirected to the data correction page or the data display page. In this step, the researcher had to consider the appropriateness of the display such as the appropriate size of the display, the size of the display of the mammograph. Furthermore, the researcher had to consider the picture adjustment, the position of the found picture, the position of the text, font colours, the agreement of the font colour to the background colour, so as that the display would be clear and precise as possible. In other words, after inputting all the selected data into the programme, the researcher had to consider the overview of the programme so as to see whether everything is in the order and agreeable to other respects or not. If not, the researcher had to adjust them. In this step, the researcher had asked many experienced experts and many users to consider the appropriateness of the programme. Furthermore, the linkage between one page to another had to be considered and made appropriate lest the user would become confused.

#### **4.2.5 Organization**

In this step, the researcher assembled all the sub-systems of the programme. For example, to write the programme of MDSS for breast cancer, the researcher had written sub-functions of the system before assembling all the written sub-functions into the complete system; or the researcher had to input the available data from the database of the Breast Diagnostic Center, the Faculty of Medicine Ramathibodi Hospital into the database of the system. Assembling the programme, the researcher had to set the links or the menu to be easy to use lest the user would be confused in using the sub-functions of the programme. Therefore, before assembling the programme, the researcher had to learn about the application of the following programmes and techniques such as:

4.2.5.1 Phototshop programme: This programme was used for adjusting the picture, resizing the picture (enlarging-downsizing) so as to fit the use in the MDSS, adjusting the colour, and creating the logos of other systems.

4.2.5.2 The MDSS for other diseases: The researcher had to learn from other existing systems which had been used by leading hospitals. The researcher took such existing systems as the guideline for designing and developing the MDSS for breast cancer.

4.2.5.3 **ActionScript3:** It is widely known that ActionScript language is used with Flash CS programme. Presently (in 2010), this script has been developed to version 3: ActionScript 3.0. Major APIs of the script can be applied to other programmes such as Adobe Flash and Adobe Flex, or other opened source tools such as Swftools or haXe. Like the writing of other script programmes, the writing of ActionScript consists of the encoding, compiling, testing and correcting. Many users who have used Flash CS programme might have learnt that a code should be written on each Keyframe of the original code the file type of which is ‘.fla’. Likewise, those who have used Flex might have been accustomed to writing the ActionScript into CDATA tag, the type of which is ‘.mxml’.

ActionScript could work faster in responding to situations; thus, the interactive activity could be better carried out, or the programme could support more OOPs by creating the class for itself to use before recording the class in the file type of ‘.as’. This class could be applied to other Flash Applications. Therefore, the programme became more convenient and flexible. As a result, the development of the MDSS for breast cancer became more interesting.

### **4.3 System Determination**

In the step of the system determination, the researcher had to analyze what respects that the MDSS for breast cancer needed and what the reasons to create this MDSS were so as to determine the system. The results from the analysis revealed that the respects that the system needed and the reasons for creating this system were:

4.3.1 To collect patients’ profiles which included genders, dates of birth and other categories of patients’ personal information;

4.3.2 To collect patients’ medical profiles which included received treatments, dates of treatments, symptoms to be treated, and physicians in charge of the treatments or diagnoses, as well as the four types of mammographs- R CC (R) , L CC (L) , L MLO (H) and R MLO (H);

4.3.3 To use the same database that e the Breast Diagnostic Center, the Faculty of Medicine Ramathibodi Hospital;

4.3.4 To be the application that operated through web browsers that connected to the internet;

4.3.5 To use the Adobe flash cs4 programme to adjust the picture, the Action Script3 and PHP languages by storing the information in the MySQL database;

4.3.6 To make the summary report that physicians could refer to, so as to compare the information in a more precise manner, in the following formats:

1. Calcifications Type is the graph that shows the relation between the number and the symptoms;
2. Statistics of the patient is the graph that shows the relation between the number and the gender of the patients; and
3. Age average is the graph that shows the relation between the age and the gender;

4.3.7 To have the function that users could manage the data such as to add, to change or to delete all kinds of data, both texts and pictures; and

4.3.8 To be able to find the data in the database through keywords, key phrases and pictures so as to find the texts or pictures that most fit the users' queries.

## **4.4 System Design**

The researcher had gleaned the data from the Breast Diagnostic Center, the Faculty of Medicine Ramathibodi Hospital and the information on users' needs, and used the obtained information to design the system, the displays, the database for the available data, the bar chart presentation, and the pages on which users had to provide their information. The researcher emphasized on the convenience, the hastiness and the accuracy of the operation, which enabled users to obtain the data and information that they needed for diagnosing the disease. Designing this MDSS for breast cancer, the researcher gathered information and data from other existing databases similar to this MDSS, together with the knowledge from documents and websites. Afterwards, the researcher had to draft the design for the display and had the prospect users criticize the design. In addition, the researcher had to ask some experts or experienced programmers to make suggestions on the design and the alignment of the compositions of the display

## 4.5 System Development

After the researcher had drafted the designs of the system and the display, which had been considered and criticized, the researcher applied the designs to the development of the MDSS for breast cancer. As a result, the developed system consisted of the following compositions.

4.5.1 On the first page of MDSS for breast cancer application, the users could see the list of all patients who had received the treatments. If the user would like to adjust the data or see the mammographs in details, the user could double click on the selected row. Then, the system would show the data and automatically change to the Viewer page.

Patient ID	Name	Gender	Date of birth	Mammographic findings	Accession no.	study time	study date	Medicines	Description
2381031	Example name 1	F	23/01/1954	Normal Calcifications Pt Breast, Punctate Calcification	0000710002003032	130740	2008-05-21 00	-	Mammography (Screening)
2781003	Example name 2	F	28/01/1945	Popcorn calcifications UOO RL	0004030002003028	004105	2009-01-08 00	-	Mammography (Screening)
3148133	Example name 3	I	30/01/1949	Calcifications 18 Breast, Punctate nod inner	0018230002003025	123483	2008-10-23 00	-	Mammography (Screening)
4260040	Example name 4	F	13/01/1955	Calcifications at BS	0019760002003026	165771	2008-11-26 00	-	Mammography (Screening)
3469092	Example name 5	F	18/01/1960	Normal Calcifications Both	0004250002003050	102131	2009-05-25 00	-	Mammography (Screening)
2490089	Example name 6	I	29/02/1941	Popcorn Calcification	0018140002003042	112951	2008-10-04 00	-	Mammography (Screening)
2420028	Example name 7	F	18/07/1957	Normal Calcification 14 Upper, ML	0018070002003054	160303	2008-10-02 00	-	Mammography (Screening)
3251077	Example name 8	F	22/02/1961	Punctate Calcification RU Upper	0004910002003058	102617	2009-01-01 00	-	Mammography (Screening)
1638012	Example name 9	I	16/01/1959	Calcification Both Breast	0019120002003020	094801	2008-11-12 00	-	Mammography (Screening)
3068333	Example name 10	F	07/07/1957	Benign Calcification Pt Breast	00181810002003020	091430	2008-10-11 00	-	Mammography (Screening)
1177310	Example name 11	F	15/01/1940	Fine pleomorphic calcifications	0002200002003008	103683	2008-02-20 00	-	Mammography (Routing Bel
2929010	Example name 12	I	06/03/1954	Calcification Both Breast	0009230002003055	103911	2008-05-22 00	-	Mammography (Screening)
3447425	Example name 13	F	16/07/1941	Calcification upper Pt Breast	0018060002003066	101550	2008-10-06 00	-	Mammography (Screening)
3097487	Example name 11	F	20/01/1962	Calcification	0004260002003041	132781	2008-09-26 00	-	Spot BreastRU, (RTT 7 7 7
4077010	Example name 15	I	23/01/1962	Punctate, Round Calcification Both Breast	0004200002003012	003741	2008-04-20 00	-	Mammography (Screening)
3406066	Example name 16	F	26/07/1957	Calcification at 10G	0007720002003038	137441	2008-07-22 00	-	Mammography (Routing Bel
2570767	Example name 17	F	04/03/1963	Punctate, Round Calcification Both Breast	0004230002003047	103651	2009-05-22 00	-	Mammography (Screening)
2680924	Example name 10	I	25/01/1961	Benign Lt Breast	0008200002003020	102120	2008-05-20 00	-	Mammography (Screening)
4175032	Example name 18	F	23/01/1964	Fine pleomorphic calcifications at 10G of Lt Bre	0009600002003010	003203	2008-01-16 00	-	Mammography (Routing Bel
2893267	Example name 20	F	24/01/1942	Calcification Both Breast	0018230002003048	111117	2008-10-28 00	-	Mammography (Screening)
3180302	Example name 21	I	18/01/1954	Punctate Calcification UO	0004800002003040	144220	2008-04-10 00	-	Mammography (Screening)
4154865	Example name 22	F	23/01/1957	Punctate Calcification Pt Breast	0018700002003011	090741	2008-10-20 00	-	Mammography (Screening)

**Figure 4.1: The page showing the list of patients who have received the treatments**

4.5.2 The user having double-clicked on the selected patient, the next page would be shown. On the second page, the user could select the type of picture from the four types- R CC (R) , L CC (L) , L MLO (H) and R MLO (H) by clicking on the menu at the top of the page. Then, the selected type of picture would be shown.

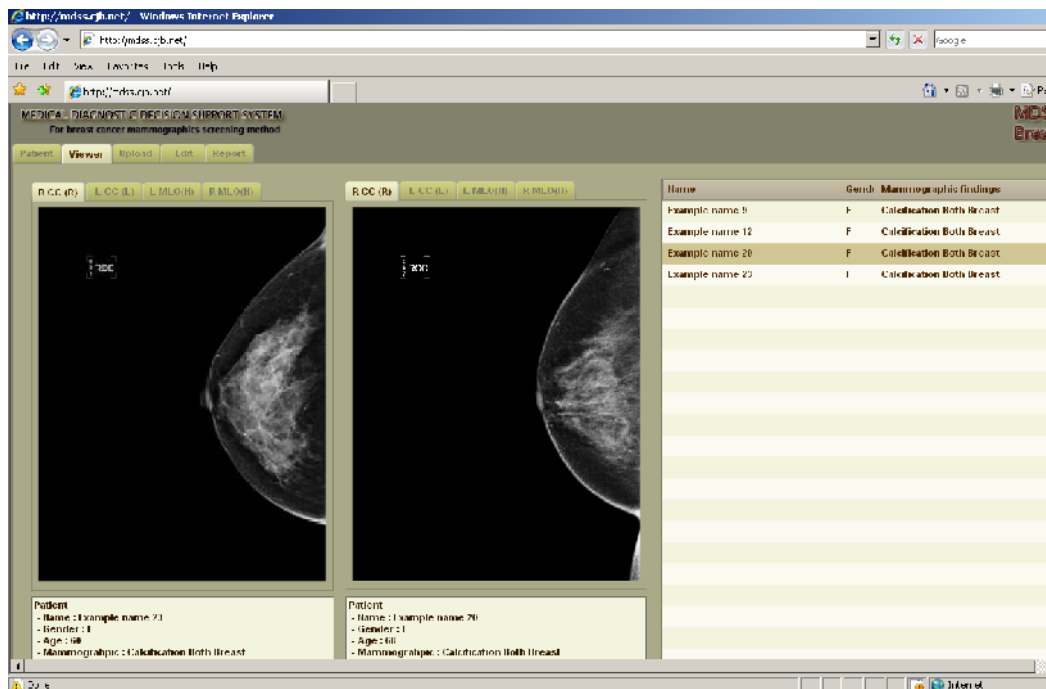
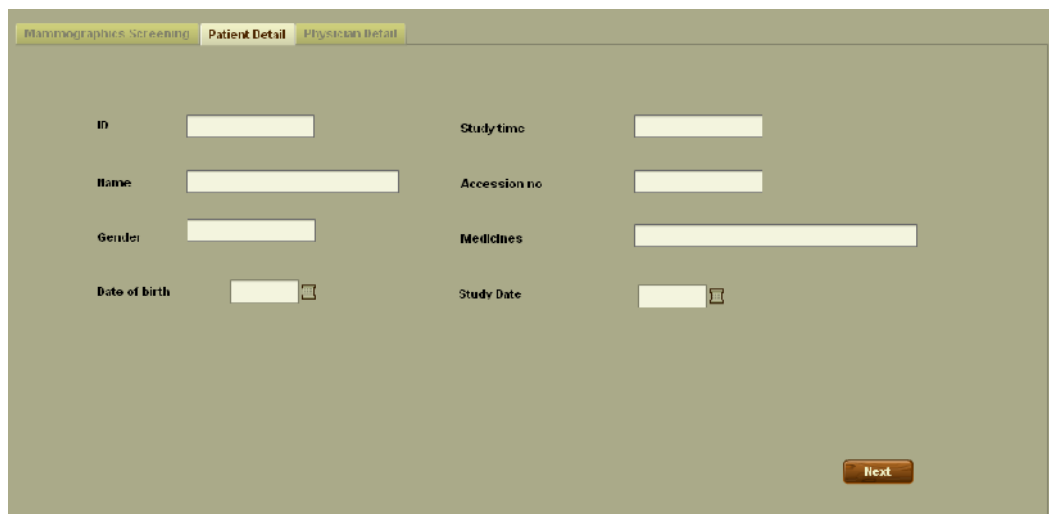


Figure 4.2: The page showing a patient’s profile in the Viewer menu

4.5.3 On the next page, the user could add some data provided that the user had to add the data on all the three pages in the order, from page one to page three.



Image 4.3: The page for adding the mammography

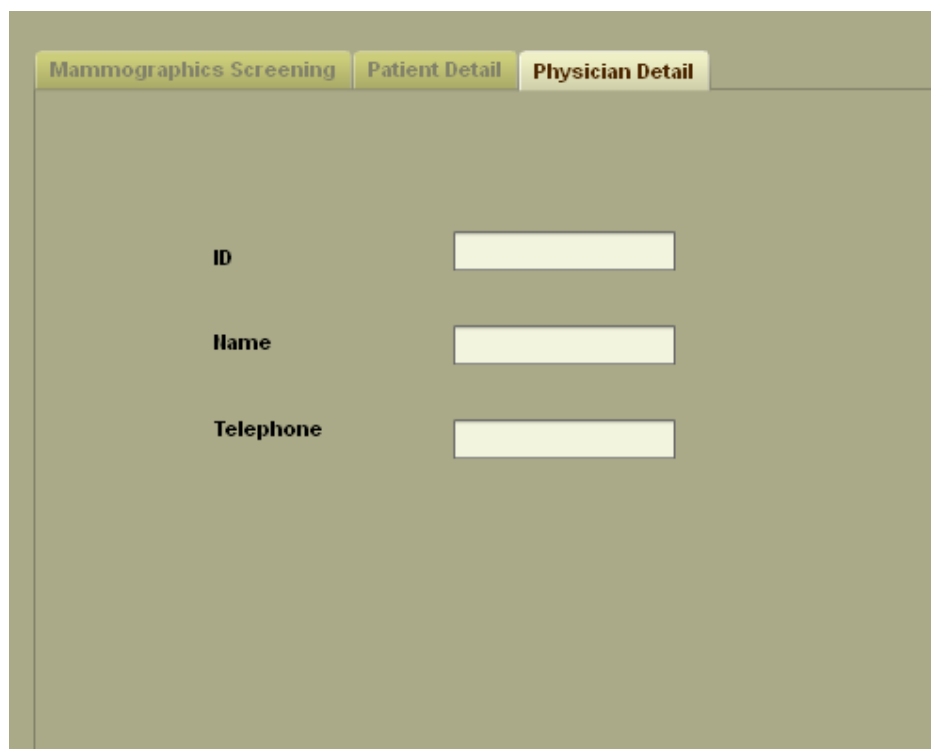


The screenshot shows a web-based form titled "Patient Detail" within a navigation menu that includes "Mammographics Screening", "Patient Detail", and "Physician Detail". The form contains several input fields for patient information:

ID	<input type="text"/>	Study time	<input type="text"/>
Name	<input type="text"/>	Accession no	<input type="text"/>
Gender	<input type="text"/>	Medicines	<input type="text"/>
Date of birth	<input type="text"/>	Study Date	<input type="text"/>

A "Next" button is located at the bottom right of the form area.

**Image 4.4: The page for adding the patient's information**

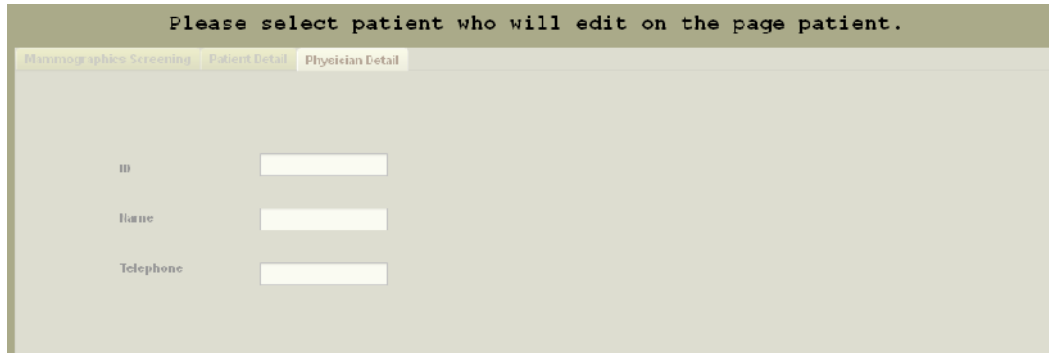


The screenshot shows a web-based form titled "Physician Detail" within a navigation menu that includes "Mammographics Screening", "Patient Detail", and "Physician Detail". The form contains three input fields for physician information:

ID	<input type="text"/>
Name	<input type="text"/>
Telephone	<input type="text"/>

**Image 4.5: The page for adding the information on the physician in charge**

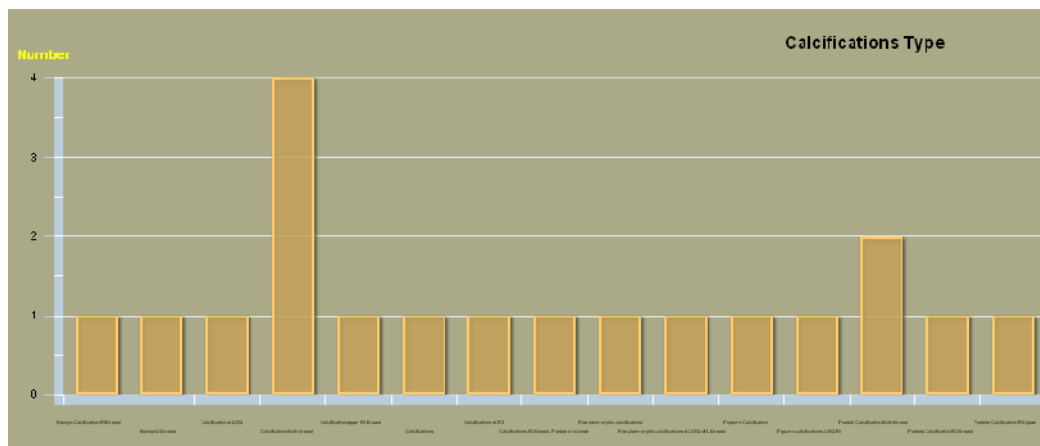
4.5.4 Working on the patient’s profile on the ‘Patient Detail’ page, the user had to select the patient’s profile from the page shown in image 4.1.



**Image 4.6: The page for changing the patient’s profile**

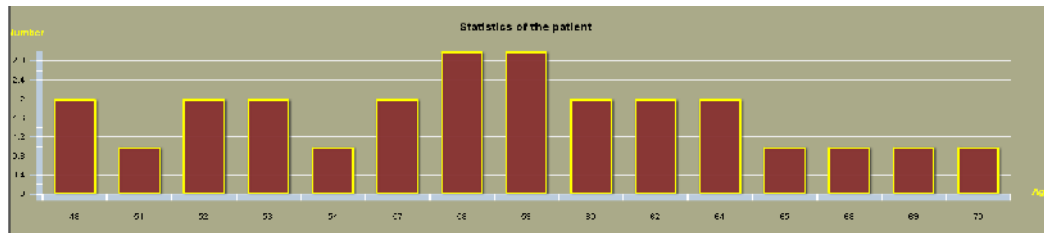
4.5.5 As for the bar chart report, the results would be shown on only one page, which included three parts as follow.

4.5.51. Calcifications Type is the graph that shows the relation between the number and the symptoms.



**Image 4.7: The page of the Calcifications - bar chart report**

4.5.5.2. Statistics of the patient is the graph that shows the relation between the number and the age of the patients.



**Image 4.8: The page of the Statistics of the patient- bar chart report**

## 4.6 System Test

The researcher tested both the utilization and the system in the following steps.

4.6.1 The researcher tried searching some texts and pictures from the developed application. The results from the test indicated that the system could offer the results that were most similar to the input texts and pictures.

4.6.2 The researcher tried accessing the application via web browsers. The results showed that the application could be accessed par web browsers.

4.6.3 The researcher examined the outcomes shown in the forms of the three types of bar charts. The results from the examination showed that the data shown in all the bar charts agreed to the information and data that the researcher had already had, and when compared with the bar charts shown in the existing documents, the bar charts in the application were exactly the same as those shown in the documents.

4.6.4 Concerning the display of patients' profiles and information on the diagnoses, the system could show the accurate text and pictures that were the same as those recorded upon the patients' admission.

## **CHAPTER V**

### **DISCUSSION**

#### **5.1 Discussion**

This research work is the project to develop the Medical Diagnostic Decision Support System (MDSS), the main objectives of which are:

5.1.1. To facilitate physicians who need to compare the diseases that they are diagnosing with the case taking place afore. This system helps physicians to analyze and make decision by booting the speed of historical information search, and the effectiveness of the treatment;

5.1.2. To increase the survival rate of breast cancer patients because the disease can be found in the initial stages;

5.1.3. To enable new physicians to accurately diagnose the disease without spending much time on the decision making and diagnosis; and

5.1.4. To enable physicians to consult other physicians in change of similar cases so as to encourage physicians to have mutual discussion, which will lead to the KM in giving treatment to patients.

The MDSS is a system whereby a prototype is stored and used for comparing with those to be searched for. The outcomes from the analysis reveal that the data search via the MDSS is less time-consuming than the data search via the traditional routine. This research work leads to the development of the appropriate routine of data search and filing, and the accurate access to stored data. The research work reduces unnecessary tasks of physicians and nurses. The data used in this research work are derived from the available data and information from the Cancer Research Institute of Ramathibodi Hospital. The obtained data are analyzed and stored in the database. The researcher will apply the knowledge obtained from this research work to the development the MDSS to be the web application for receiving-transferring information among servers. The MDSS is found to be easily accessible

and applicable. This MDSS uses the database of the Cancer Research Institute, Ramathibodi Hospital, and is developed to match the Mammography to the specimen from the database that is most similar to the case. This MDSS has been and examined for its accuracy and reliability. Finally, the accuracy and speed of the information and data search will be concluded via the statistical methodology.

## **CHAPTER VI**

### **CONCLUSION**

#### **6.1 Conclusion**

From the study on the Medical Diagnostic Decision Support System (MDSS): A Case Study for Breast Cancer Mammographic-screening Method, it can be concluded that:

6.1.1 The implication of the MDSS in the breast cancer mammographic-screening enables the physicians to browse for the information on the disease that has occurred before from mammography or from keywords or key phrases, which are kept in the database of the Cancer Research Center of Ramathobodi Hospital.

6.1.2 This MDSS for breast cancer mammographic-screening is the application that operates through web browsers, using Adobe flash cs4 as the tool, Action Script3 as the used language, and PHP in developing the system. The information and data are stored in the MySQL database which operates through the internet system. Physicians or users can hastily access the data without wasting time on installing the programme. Thus, this system helps users reduce resources and materials used in installing a programme to a specific computer.

6.1.3 This MDSS for breast cancer can search for the mammograph that most similar to a specific example, which will be used in diagnosing that case and giving suggestions for the diagnosis of other cases.

6.1.4 This MDSS has been developed to collect patients' profiles and mammographs, namely, R CC (R) , L CC (L) , L MLO (H) and R MLO (H). When diagnosing a case, the physician can search for the data via keywords and mammographs. The system will show the mammography or information that is most similar to the example, which can be used in the diagnosis.

6.1.5 This developed MDSS for breast cancer is reported with three bar graphs as follow:

1. Calcifications Type is the graph that shows the relation between the number and the symptoms;
2. Statistics of the patient is the graph that shows the relation between the number and the gender of the patients; and
3. Age average is the graph that shows the relation between the age and the gender.

## **6.2 Recommendation**

This program is very interesting because the program is very easy to use, the sizes of the fonts match the data and the colors of the fonts do not obstruct the reading of data. This program receives rather good satisfaction. However, some parts of it needs improvement and development to get full performance.

6.2.1 The sizes of mammograms are not appropriate. Their display should be designed full-screen and be able to zoom in and out to let viewers get better details of lesion.

6.2.2 The resolution of mammograms is very appropriate. Better resolution is needed.

6.2.3 The program is unable to store patients' complete data. Some parts are missing. There should be more BI-RADS category and recommendation added from the report.

6.2.4 The mammograms of patients can be compared better after using the program.

6.2.5 The program able to enhance communication among doctors who share similar cases.

6.2.6 Another suggestion includes the need to have an online network among mammogram centers so that they could exchange knowledge about cases of patients, such as similar findings, BI-RADS system, and recommendations.

6.2.7 This Medical Diagnostic Decision Support System (MDSS) for breast cancer should consist of the log-in function lest unauthorized users would access the system. This log-in function will require users and involving people to verify their given usernames and passwords.

6.2.8 This MDSS for breast cancer should have more searching options by increasing the lists or channels so as to show more information that might be obtained in the future. Even though the results from a search are alphabetically shown or are shown by the names of diseases, it can be difficult for users in the future since there tend to be more information which will lead to the difficulties in the searching. In order to solve this problem, this listing scheme will facilitate a search.

6.2.9 As for report of the system, presented as two bar graphs, the Calcifications Type should be reported separately by the nature of the disease. This should be reported either monthly or annually, accordingly to the users' implication purposed.

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## **APPENDICES**

## APPENDIX A

### QUESTIONNAIRE ON THE MDSS PROGRAM

#### แบบสอบถาม สำหรับโปรแกรม MDSS

**คำชี้แจง :** จิตเครื่องหมายถูก ลงใน  หน้าข้อที่ท่านต้องการจะตอบ และหากมีข้อเสนอแนะที่ควรปรับปรุง ท่านสามารถเขียนข้อเสนอแนะดังกล่าวเพิ่มเติมลงไปในพื้นที่ข้อเสนอนะที่จัดไว้ให้

**1. สีที่ใช้ในโปรแกรมเหมาะสมหรือไม่**

- สีเหมาะสมดี
- สีไม่ค่อยเหมาะสม ไม่เข้ากับโปรแกรม
- สีไม่สวยเลย ควรปรับปรุง

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**2. ขนาดตัวอักษรพอดีกับข้อมูลหรือไม่**

- ตัวอักษรมีขนาดพอดี
- ตัวอักษรมีขนาดที่ไม่เหมาะสมกับข้อมูลเลย

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**3. สีของตัวอักษรเป็นอุปสรรคในการอ่านข้อมูลหรือไม่**

- สีของตัวอักษร ไม่เป็นอุปสรรคเลย
- สีตัวอักษรเป็นอุปสรรค ทำให้อ่านยากขึ้น

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**4. ขนาดของภาพ mammograms มีความเหมาะสมหรือไม่**

- ขนาดของภาพ mammograms เหมาะสมดีแล้ว
- ขนาดของภาพ mammograms ไม่ค่อยเหมาะสมเลย

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**5. ความละเอียดของรูปภาพมีความเหมาะสมหรือไม่**

- ความละเอียดของภาพ mammograms เหมาะสมดีแล้ว
- ความละเอียดของภาพ mammograms ไม่ค่อยเหมาะสมเลย

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**6. โปรแกรมสามารถเก็บรวบรวมข้อมูลที่สำคัญของคนไข้ไว้ได้อย่างครบถ้วนหรือไม่**

- สามารถเก็บรวบรวมข้อมูลที่สำคัญของคนไข้ไว้ได้อย่างครบถ้วน
- การเก็บรวบรวมข้อมูลที่สำคัญของคนไข้ยังขาดในบางประเด็น

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**7. ก่อนและหลังใช้โปรแกรมท่านเข้าใจท่านสามารถเปรียบเทียบภาพ mammograms ของคนไข้ได้สะดวกขึ้นหรือไม่**

- สามารถเปรียบเทียบภาพ mammograms ของคนไข้ได้สะดวกขึ้นมากขึ้น
- สามารถเปรียบเทียบภาพ mammograms ของคนไข้ได้สะดวกขึ้นเหมือนเดิม

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**8. โปรแกรมนี้สามารถกระตุ้นให้เกิดการติดต่อสื่อสารระหว่างกันของแพทย์ผู้รักษาที่มีคนไข้ในลักษณะคล้ายกันมากขึ้นหรือไม่**

- โปรแกรมสามารถช่วยให้เกิดการติดต่อสื่อสารระหว่างกันมากขึ้น
- โปรแกรมช่วยให้เกิดการติดต่อสื่อสารระหว่างกันค่อนข้างน้อย

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**9. โปรแกรมนี้ใช้งานง่ายหรือไม่**

- โปรแกรมใช้งานง่ายมาก
- โปรแกรมใช้งานค่อนข้างยาก
- โปรแกรมใช้งานยากเกินไป

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**10. ท่านสามารถเข้า – ออกโปรแกรมง่ายหรือไม่**

- การเข้า-ออกของโปรแกรมง่ายมาก
- การเข้า-ออกของโปรแกรมค่อนข้างยาก
- การเข้า-ออกของโปรแกรมยากมากควรทำให้การเข้า-ออกของโปรแกรมง่ายกว่านี้

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**11. ความพึงพอใจเกี่ยวกับโปรแกรม**

- โปรแกรมนี้ดีมาก
- โปรแกรมนี้ควรมีการปรับปรุงปรับปรุงบางส่วน
- โปรแกรมนี้ควรมีการวางแผนให้มากกว่านี้

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**12. โปรแกรมนี้มีความน่าสนใจมากน้อยเพียงใด**

- โปรแกรมนี้มีความน่าสนใจมาก
- โปรแกรมนี้ไม่มีความน่าสนใจเลย

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**13. ท่านคิดว่าโปรแกรมนี้ควรปรับปรุงมากหรือน้อยเพียงใด**

- โปรแกรมนี้ควรมีการปรับปรุงมาก
- โปรแกรมนี้ควรมีการปรับปรุงเพียงบ้างช่วง
- โปรแกรมนี้ไม่ควรมีการปรับปรุงเลย

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**14. ข้อเสนอแนะ อื่นๆ .....**

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## APPENDIX B

### ACTION SCRIPT 3.0 CODE

```

<?xml version="1.0" encoding="utf-8"?>
<s:Application xmlns:fx="http://ns.adobe.com/mxml/2009"
               xmlns:s="library://ns.adobe.com/flex/spark"
               xmlns:mx="library://ns.adobe.com/flex/mx"
minWidth="1360" minHeight="600" pageTitle="MDSS Breast Cancer"
width="1360" height="724" creationComplete="initApp()"
initialize="init();">
  <fx:Style source="Dicom.css"/>
  <fx:Script>
    <![CDATA[
      import flash.events.*;
      import flash.net.*;

      import mx.collections.ArrayCollection;
      import mx.collections.IList;
      import mx.containers.TitleWindow;
      import mx.controls.*;
      import mx.events.*;
      import mx.events.CloseEvent;
      import mx.events.ListEvent;
      import mx.managers.*;
      import mx.managers.PopUpManager;
      import mx.states.*;
      private var titleWindow:TitleWindow;

      private const _strUploadScript:String =
"php/upload.php";

      private var _arrUploadFiles:Array;
      private var _numCurrentUpload:Number = 1;
      private var _refAddFiles1:FileReferenceList;
      private var _refAddFiles2:FileReferenceList;
      private var _refAddFiles3:FileReferenceList;
      private var _refAddFiles4:FileReferenceList;
      private var _refUdateFile:FileReferenceList;
      private var _refUploadFile:FileReference;

      private var _objFile1:FileReference;
      private var _objFile2:FileReference;
      private var _objFile3:FileReference;
      private var _objFile4:FileReference;

      private var _winProgress:winProgress;

      protected var _gblUploadNumber:String = "";

      protected var _gblID:String = "";
    ]]>
  </fx:Script>
</s:Application>

```

```

protected var _gblPic1:String = "";
protected var _gblPic2:String = "";
protected var _gblPic3:String = "";
protected var _gblPic4:String = "";
protected var _gblName:String = "";
protected var _gblGender:String = "";
protected var _gblMammo:String = "";
protected var _gblDescription:String = "";
protected var _gblPhyID:String = "";
protected var _gblPhyName:String = "";
protected var _gblPhyTel:String = "";
protected var _gblAge:String = "";

protected var _xmlMainb:XML;

[Bindable]
protected var _xmlChart1:XML;
protected var _xmlChart2:XML;
[Bindable]
protected var _xmlChart3:XML;

protected var _Time:Timer;
protected var _TimeCount:int = 0;

private function initApp():void {
    Security.allowDomain("*");
    _arrUploadFiles = new Array();

    titleWindow = new TitleWindow();
    titleWindow.title = "Custom title";
    titleWindow.showCloseButton = true;
    titleWindow.width = 240;
    titleWindow.height = 180;
    titleWindow.visible = false;
    //titleWindow.

    //titleWindow.addEventListener(CloseEvent.CLOSE,
    titleWindow_close);

    //titleWindow.addChild(labelXXX);

    PopUpManager.addPopUp(titleWindow, this,
true);

    PopUpManager.centerPopUp(titleWindow);

    loadData();
    loadChart1();
    loadChart2();
    loadChart3();

    dgPatient.addEventListener(ListEvent.ITEM_DOUBLE_CLICK,click_pa
tient);

```

```

Timer(100);
goTimerStart );
}

_Time = new
_Time.addListener(TimerEvent.TIMER ,
_Time.start());

protected function goTimerStart(e:TimerEvent):void{

    if(_TimeCount == 0){
        tabNavMain.selectedIndex = 1;
    }else if( _TimeCount == 1){
        tabPicLeft.selectedIndex = 0;
        tabPicRight.selectedIndex = 0;
    }else if( _TimeCount == 2){
        tabPicLeft.selectedIndex = 1;
        tabPicRight.selectedIndex = 1;
    }else if( _TimeCount == 3){
        tabPicLeft.selectedIndex = 2;
        tabPicRight.selectedIndex = 2;
    }else if( _TimeCount == 4){
        tabPicLeft.selectedIndex = 3;
        tabPicRight.selectedIndex = 3;
    }else if( _TimeCount == 5){
        tabNavMain.selectedIndex = 3;
    }else if( _TimeCount == 6){
        navRegContentEdit.selectedIndex = 0;
    }else if( _TimeCount == 7){
        navRegContentEdit.selectedIndex = 1;
    }else if( _TimeCount == 8){
        navRegContentEdit.selectedIndex = 2;
    }else if( _TimeCount == 9){
        navRegContentEdit.enabled = false;
        tabNavMain.selectedIndex = 0;
        _Time.stop();

        _Time.removeListener(TimerEvent.TIMER , goTimerStart );
        PopUpManager.removePopUp(titleWindow);

    }

    _TimeCount++;
}

private function init():void{

}

protected function
click_patient(event>ListEvent):void {

```

```

        if(navRegContentEdit.enabled==false) {navRegContentEdit.enabled
= true;}
                _gblID =
event.currentTarget.selectedItem.id.toString();
                _gblPic1 =
event.currentTarget.selectedItem.rccr.toString();
                _gblPic2 =
event.currentTarget.selectedItem.lccl.toString();
                _gblPic3 =
event.currentTarget.selectedItem.lmloh.toString();
                _gblPic4 =
event.currentTarget.selectedItem.rmloh.toString();
                _gblName =
event.currentTarget.selectedItem.name.toString();
                _gblGender =
event.currentTarget.selectedItem.gender.toString();
                _gblMammo =
event.currentTarget.selectedItem.mammo.toString();
                _gblDescription =
event.currentTarget.selectedItem.description.toString();
                _gblPhyID =
event.currentTarget.selectedItem.phy_id.toString();
                _gblPhyName =
event.currentTarget.selectedItem.phy_name.toString();
                _gblPhyTel =
event.currentTarget.selectedItem.phy_tel.toString();
                _gblAge =
event.currentTarget.selectedItem.age.toString();
                //Alert.show("id : " + _gblID);
                //Alert.show("pic1 : " + _gblPic1);
                //Alert.show("pic2 : " + _gblPic2);
                //Alert.show("pic3 : " + _gblPic3);
                //Alert.show("pic4 : " + _gblPic4);
                //Alert.show("name : " + _gblName);
                //Alert.show("gender : " + _gblGender);
                //Alert.show("des : " + _gblDescription);

                tabNavMain.selectedIndex = 1;
                lblEditName.text = "Patient information : " +
_gblID + " : " + _gblName + " : ";

                imgLeft1.source = "profile_data/" + _gblID +
"/" + _gblPic1 ;
                imgLeft2.source = "profile_data/" + _gblID +
"/" + _gblPic2 ;
                imgLeft3.source = "profile_data/" + _gblID +
"/" + _gblPic3 ;
                imgLeft4.source = "profile_data/" + _gblID +
"/" + _gblPic4 ;

                txtAreaLeft.text = "Patient\n - Name : " +
_gblName + "\n - Gender : " + _gblGender + "\n - Age : " + _gblAge +
"\n - Mammographic : " + _gblMammo + "\n - Description : " +
_gblPhyTel + "\n\nPhysician \n- Physician ID : " + _gblPhyID + "\n -
Physician name : " + _gblPhyName + " \n - Physician Telephone : " +
_gblPhyTel;

```

```

        txtAreaRight.text = "";
        dgSub.dataProvider = _xmlMainb.sub.(mammo ==
_gblMammo);

        imgRight1.source = "";
        imgRight2.source = "";
        imgRight3.source = "";
        imgRight4.source = "";

        txtID0.text = _gblID ;
        txtDescription0.text = _gblMammo ;
        txtMammo0.text = _gblDescription ;
        txtName0.text = _gblName ;
        txtGender0.text = _gblGender ;
        datBirthday0.text =
event.currentTarget.selectedItem.birthdate_yymmdd.toString();
        txtStudy0.text =
event.currentTarget.selectedItem.study.toString();
        datStudyDate0.text =
event.currentTarget.selectedItem.study_date.toString();
        txtAccess0.text =
event.currentTarget.selectedItem.access.toString();
        txtMedicines0.text =
event.currentTarget.selectedItem.medicines.toString();
        txtPhyID0.text = _gblPhyID ;
        txtPhyName0.text = _gblPhyName ;
        txtPhyTel0.text = _gblPhyTel ;

    }

    protected function change_sub(event:ListEvent):void
    {
        var strID:String = "";
        var strPic1:String = "";
        var strPic2:String = "";
        var strPic3:String = "";
        var strPic4:String = "";
        var strName:String = "";
        var strGender:String = "";
        var strMammo:String = "";
        var strDescription:String = "";
        var strPhyID:String = "";
        var strPhyName:String = "";
        var strPhyTel:String = "";
        var strAge:String = "";

        strID =
event.currentTarget.selectedItem.id.toString();
        strPic1 =
event.currentTarget.selectedItem.rccr.toString();
        strPic2 =
event.currentTarget.selectedItem.lccl.toString();
        strPic3 =
event.currentTarget.selectedItem.lmloh.toString();
        strPic4 =
event.currentTarget.selectedItem.rmloh.toString();
        strName =
event.currentTarget.selectedItem.name.toString();

```

```

        strGender =
event.currentTarget.selectedItem.gender.toString();
        strMammo =
event.currentTarget.selectedItem.mammo.toString();
        strDescription =
event.currentTarget.selectedItem.description.toString();
        strPhyID =
event.currentTarget.selectedItem.phy_id.toString();
        strPhyName =
event.currentTarget.selectedItem.phy_name.toString();
        strPhyTel =
event.currentTarget.selectedItem.phy_tel.toString();
        strAge =
event.currentTarget.selectedItem.age.toString();

imgRight1.source = "profile_data/" + strID +
"/" + strPic1 ;
imgRight2.source = "profile_data/" + strID +
"/" + strPic2 ;
imgRight3.source = "profile_data/" + strID +
"/" + strPic3 ;
imgRight4.source = "profile_data/" + strID +
"/" + strPic4 ;

txtAreaRight.text = "Patient\n - Name : " +
strName + "\n - Gender : " + strGender + "\n - Age : " + strAge +
"\n - Mammographic : " + strMammo + "\n - Description : " + strPhyTel
+ "\n\nPhysician \n- Physician ID : " + strPhyID + "\n - Physician
name : " + strPhyName + " \n - Physician Telephone : " + strPhyTel;
    }

    protected function
btnRegNext1_clickHandler(event:MouseEvent):void
    {
        navRegContent.selectedIndex = 1;
    }

    protected function
btnRegNext2_clickHandler(event:MouseEvent):void
    {
        navRegContent.selectedIndex = 2;
    }

    // ==== edit ==
    protected function
btnRegNext01_clickHandler(event:MouseEvent):void
    {
        navRegContentEdit.selectedIndex = 1;
    }

    protected function
btnRegNext02_clickHandler(event:MouseEvent):void

```

```

    {
        navRegContentEdit.selectedIndex = 2;
    }

    // ===== insert data
    protected function
    button1_clickHandler(event:MouseEvent):void
    {

        if( txtRCCR.text == "" ){
            navRegContent.selectedIndex = 0;
            lblError1.text = "Please enter the
information in the boxes below are required.";
            txtRCCR.setFocus();
            return;
        }else if( txtLMLOH.text == "" ){
            navRegContent.selectedIndex = 0;
            lblError1.text = "Please enter the
information in the boxes below are required.";
            txtLMLOH.setFocus();
            return;
        }else if( txtLMLOH.text == "" ){
            navRegContent.selectedIndex = 0;
            lblError1.text = "Please enter the
information in the boxes below are required.";
            txtLMLOH.setFocus();
            return;
        }else if( txtRMLOH.text == "" ){
            navRegContent.selectedIndex = 0;
            lblError1.text = "Please enter the
information in the boxes below are required.";
            txtRMLOH.setFocus();
            return;
        }else if( txtDescription.text == "" ){
            navRegContent.selectedIndex = 0;
            lblError1.text = "Please enter the
information in the boxes below are required.";
            txtDescription.setFocus();
            return;
        }else if( txtMammo.text == "" ){
            navRegContent.selectedIndex = 0;
            lblError1.text = "Please enter the
information in the boxes below are required.";
            txtMammo.setFocus();
            return;
        }else if( txtID.text == "" ){
            navRegContent.selectedIndex = 1;
            lblError2.text = "Please enter the
information in the boxes below are required.";
            txtID.setFocus();
            return;
        }else if( txtName.text == "" ){
            navRegContent.selectedIndex = 1;

```

```

        lblError2.text = "Please enter the
information in the boxes below are required.";
        txtName.setFocus();
        return;
    }else if( txtGender.text == "" ){
        navRegContent.selectedIndex = 1;
        lblError2.text = "Please enter the
information in the boxes below are required.";
        txtGender.setFocus();
        return;
    }else if( txtStudy.text == "" ){
        navRegContent.selectedIndex = 1;
        lblError2.text = "Please enter the
information in the boxes below are required.";
        txtStudy.setFocus();
        return;
    }else if( datStudyDate.text == "" ){
        navRegContent.selectedIndex = 1;
        lblError2.text = "Please enter the
information in the boxes below are required.";
        datStudyDate.setFocus();
        return;
    }else if( txtAccess.text == "" ){
        navRegContent.selectedIndex = 1;
        lblError2.text = "Please enter the
information in the boxes below are required.";
        txtAccess.setFocus();
        return;
    }else if( txtMedicines.text == "" ){
        navRegContent.selectedIndex = 1;
        lblError2.text = "Please enter the
information in the boxes below are required.";
        txtMedicines.setFocus();
        return;
    }else if( datBirthday.text == "" ){
        navRegContent.selectedIndex = 1;
        lblError2.text = "Please enter the
information in the boxes below are required.";
        datBirthday.setFocus();
        return;
    }else if( txtPhyID.text == "" ){

        navRegContent.selectedIndex = 2;
        lblError3.text = "Please enter the
information in the boxes below are required.";
        //txtPhyID.setFocus();
        return;
    }else if( txtPhyName.text == "" ){

        navRegContent.selectedIndex = 2;
        lblError3.text = "Please enter the
information in the boxes below are required.";
        //txtPhyName.setFocus();
        return;
    }else if( txtPhyTel.text == "" ){
        navRegContent.selectedIndex = 2;
        lblError3.text = "Please enter the
information in the boxes below are required.";

```

```

        //txtPhyTel.setFocus();
        return;
    }

    startUpload();

}

// ===== e d i t   d a t a =====
protected function
click_edit(event:MouseEvent):void
{
    if( txtDescription0.text == "" ){
        navRegContentEdit.selectedIndex = 0;
        lblError01.text = "Please enter the
information in the boxes below are required.";
        txtDescription0.setFocus();
        return;
    }else if( txtMammo0.text == "" ){
        navRegContentEdit.selectedIndex = 0;
        lblError01.text = "Please enter the
information in the boxes below are required.";
        txtMammo0.setFocus();
        return;
    }else if( txtID0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        txtID0.setFocus();
        return;
    }else if( txtName0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        txtName0.setFocus();
        return;
    }else if( txtGender0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        txtGender0.setFocus();
        return;
    }else if( txtStudy0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        txtStudy0.setFocus();
        return;
    }else if( datStudyDate0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        datStudyDate0.setFocus();
        return;
    }else if( txtAccess0.text == "" ){
        navRegContentEdit.selectedIndex = 1;

```

```

        lblError02.text = "Please enter the
information in the boxes below are required.";
        txtAccess0.setFocus();
        return;
    }else if( txtMedicines0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        txtMedicines0.setFocus();
        return;
    }else if( datBirthday0.text == "" ){
        navRegContentEdit.selectedIndex = 1;
        lblError02.text = "Please enter the
information in the boxes below are required.";
        datBirthday0.setFocus();
        return;
    }else if( txtPhyID0.text == "" ){

        navRegContentEdit.selectedIndex = 2;
        lblError03.text = "Please enter the
information in the boxes below are required.";
        //txtPhyID.setFocus();
        return;
    }else if( txtPhyName0.text == "" ){

        navRegContentEdit.selectedIndex = 2;
        lblError03.text = "Please enter the
information in the boxes below are required.";
        //txtPhyName.setFocus();
        return;
    }else if( txtPhyTel0.text == "" ){
        navRegContentEdit.selectedIndex = 2;
        lblError03.text = "Please enter the
information in the boxes below are required.";
        //txtPhyTel.setFocus();
        return;
    }

    editUpload();
}
///===== u p l o a
d =====s

// upload file

// Called to add file(s) for upload
private function addFile1():void {
    _refAddFiles1 = new FileReferenceList();
    _refAddFiles1.addEventListener(Event.SELECT,
onSelectFile1);
    _refAddFiles1.browse();
}
private function addFile2():void {

```

```

        _refAddFiles2 = new FileReferenceList();
        _refAddFiles2.addEventListener(Event.SELECT,
onSelectFile2);
        _refAddFiles2.browse();
    }

    private function addFile3():void {
        _refAddFiles3 = new FileReferenceList();
        _refAddFiles3.addEventListener(Event.SELECT,
onSelectFile3);
        _refAddFiles3.browse();
    }

    private function addFile4():void {
        _refAddFiles4 = new FileReferenceList();
        _refAddFiles4.addEventListener(Event.SELECT,
onSelectFile4);
        _refAddFiles4.browse();
    }
    // == edit upload file
    private function editFile(pno:String):void{
        _gblUploadNumber = pno ;
        _refUdateFile = new FileReferenceList();
        _refUdateFile.addEventListener(Event.SELECT,
onSelectFileEdit);
        _refUdateFile.browse();
    }

    // Called when a file is selected
    private function onSelectFile1(event:Event):void {
        txtRCCR.text =
        _refAddFiles1.fileList[0].name;
        _objFile1 = _refAddFiles1.fileList[0];
    }
    private function onSelectFile2(event:Event):void {
        txtLCCL.text =
        _refAddFiles2.fileList[0].name;
        _objFile2 = _refAddFiles2.fileList[0];
    }
    private function onSelectFile3(event:Event):void {
        txtLMLOH.text =
        _refAddFiles3.fileList[0].name;
        _objFile3 = _refAddFiles3.fileList[0];
    }
    private function onSelectFile4(event:Event):void {
        txtRMLOH.text =
        _refAddFiles4.fileList[0].name;
        _objFile4 = _refAddFiles4.fileList[0];
    }

    // edit
    private function onSelectFileEdit(event:Event):void
{

```

```

        _winProgress =
winProgress(PopUpManager.createPopUp(this, winProgress, true));
        _winProgress.progressBar.label = "0%";
        _winProgress.title = "Change picture " ;
        _winProgress.txtFile.text = "Update File";

        PopUpManager.centerPopUp(_winProgress);

        var sendVars:URLVariables = new
URLVariables();

        sendVars.pno = _gblUploadNumber ;
        sendVars.id = _gblID;
        var request:URLRequest = new URLRequest();
        request.data = sendVars;
        request.url = "php/edit_pic.php";
        request.method = URLRequestMethod.POST;
        _refUploadFile = new FileReference();
        _refUploadFile = _refUdateFile.fileList[0];

        _refUploadFile.addEventListener(ProgressEvent.PROGRESS,
onUploadEditProgress);

        _refUploadFile.addEventListener(Event.COMPLETE,
onUploadEditComplete);

        _refUploadFile.addEventListener(IOErrorEvent.IO_ERROR,
onUploadIoError);

        _refUploadFile.addEventListener(SecurityErrorEvent.SECURITY_ERR
OR, onUploadSecurityError);
        _refUploadFile.upload(request, "file",
false);

    }

    private function startUpload():void {
        // 1
        _winProgress =
winProgress(PopUpManager.createPopUp(this, winProgress, true));
        _winProgress.progressBar.label = "0%";
        _winProgress.title = "Uploading file " +
_numCurrentUpload;
        _winProgress.txtFile.text = this["_objFile" +
_numCurrentUpload ].name;
        PopUpManager.centerPopUp(_winProgress);

        //2
        var sendVars:URLVariables = new
URLVariables();

        sendVars.action = "upload";
        sendVars.idPath = txtID.text;
        var request:URLRequest = new URLRequest();
        request.data = sendVars;
        request.url = _strUploadScript;
        request.method = URLRequestMethod.POST;
        _refUploadFile = new FileReference();

```

```

        _refUploadFile = this["_objFile" +
_numCurrentUpload ];
        // _refUploadFile = _objFile1;

        _refUploadFile.addEventListener(ProgressEvent.PROGRESS,
onUploadProgress);

        _refUploadFile.addEventListener(Event.COMPLETE,
onUploadComplete);

        _refUploadFile.addEventListener(IOErrorEvent.IO_ERROR,
onUploadIoError);

        _refUploadFile.addEventListener(SecurityErrorEvent.SECURITY_ERR
OR, onUploadSecurityError);
        _refUploadFile.upload(request, "file",
false);

    }

    private function editUpload():void{
        updateData();
    }

    // Get upload progress
    private function
onUploadProgress(event:ProgressEvent):void {
        var numPerc:Number =
Math.round((Number(event.bytesLoaded) / Number(event.bytesTotal)) *
100);

        _winProgress.progBar.setProgress(numPerc,
100);

        _winProgress.progBar.label = numPerc + "%";
        _winProgress.progBar.validateNow();
    }
    // edit //
    private function
onUploadEditProgress(event:ProgressEvent):void {
        var numPerc:Number =
Math.round((Number(event.bytesLoaded) / Number(event.bytesTotal)) *
100);

        _winProgress.progBar.setProgress(numPerc,
100);

        _winProgress.progBar.label = numPerc + "%";
        _winProgress.progBar.validateNow();
    }

    //////////////////////////////////////
    // Called on upload complete
    private function onUploadComplete(event:Event):void
{
        _numCurrentUpload++;
        PopUpManager.removePopUp(_winProgress);
        if (_numCurrentUpload <= 4) {
            startUpload();
        }
    }

```

```

        } else {
            //Alert.show("File(s) have been
uploaded.", "Upload successful");
            insertData();
        }
    }
    // edit //////////////////////////////////////
    private function onUploadEditComplete(e:Event):void
{
    PopUpManager.removePopUp(_winProgress);
    _xmlMainb = new XML(e.currentTarget.data);
    //lblTest.text = objxml.name.text();
    Alert.show("To the integrity of the data.\n
Please return to the patients window again.", "Update data
completed.");

    loadData();
}

// Called on upload io error
private function
onUploadIoError(event:IOErrorEvent):void {
    Alert.show("IO Error in uploading file.\n" +
event.toString(), "Error");
    PopUpManager.removePopUp(_winProgress);
    _winProgress == null;
    _refUploadFile.cancel();
    //clearUpload();
}

// Called on upload security error
private function
onUploadSecurityError(event:SecurityErrorEvent):void {
    Alert.show("Security Error in uploading
file.", "Error");

    PopUpManager.removePopUp(_winProgress);
    _winProgress == null;
    _refUploadFile.cancel();
    //clearUpload();
}

//===== i n s e r t   d a t a
=====

protected function insertData():void
{
    var ULoad:URLLoader = new URLLoader();
    var UVar:URLVariables = new URLVariables();
    var Ureq:URLRequest = new
URLRequest("php/insert_data.php");
    Ureq.method = URLRequestMethod.POST;
    ULoad.addEventListener(Event.COMPLETE,
insertComplete);

    UVar.strID = txtID.text;
    UVar.strRCCR = txtRCCR.text;

```

```

UVar.strLCCL = txtLCCL.text;
UVar.strLMLOH = txtLMLOH.text;
UVar.strRMLOH = txtRMLOH.text;
UVar.strMammo = txtDescription.text;
UVar.strDescription = txtMammo.text;
UVar.strName = txtName.text;
UVar.strGender = txtGender.text;
UVar.strBirthdate = datBirthday.text;
UVar.strStudy = txtStudy.text;
UVar.strStudy_date = datStudyDate.text;
UVar.straAccess = txtAccess.text;
UVar.strMedicines = txtMedicines.text;
UVar.strPhyID = txtPhyID.text;
UVar.strPhyName = txtPhyName.text;
UVar.strPhyTel = txtPhyTel.text;

//UVar.username = AlbumPicID;
Ureq.data = UVar;
Uload.load(Ureq);

}
protected function insertComplete(e:Event):void{
txtRCCR.text = "";
txtLCCL.text = "";
txtLMLOH.text = "" ;
txtLMLOH.text = "" ;
txtRMLOH.text = "";
txtDescription.text = "" ;
txtMammo.text = "" ;
txtID.text = "" ;
txtName.text = "";
txtGender.text = "";
txtStudy.text = "";
datStudyDate.text = "";
txtAccess.text = "";
txtMedicines.text = "";
datBirthday.text = "";
txtPhyID.text = "" ;
txtPhyName.text = "";
txtPhyTel.text = "";
// โหลดข้อมูลเข้า datagrid ใน tab patient อีกรอบ
_xmlMainb = new XML(e.currentTarget.data);
//lblTest.text = objxml.name.text();
dgPatient.dataProvider = _xmlMainb.sub;
_numCurrentUpload = 1;
Alert.show("Complete to insert Data.",
"Insert Data");
}

///===== u p d a t e   d a t a
=====

protected function updateData():void
{

var Uload0:URLLoader = new URLLoader();

```

```

        var UVar0:URLVariables = new URLVariables();
        var Ureq0:URLRequest = new
URLRequest("php/update_data.php");
        Ureq0.method = URLRequestMethod.POST;
        ULoad0.addEventListener(Event.COMPLETE,
updateComplete);

        UVar0.strID = txtID0.text;
        //UVar0.strRCCR = txtRCCR0.text;
        //UVar0.strLCCL = txtLCCL0.text;
        //UVar0.strLMLOH = txtLMLOH0.text;
        //UVar0.strRMLOH = txtRMLOH0.text;
        UVar0.strMammo = txtDescription0.text;
        UVar0.strDescription = txtMammo0.text;
        UVar0.strName = txtName0.text;
        UVar0.strGender = txtGender0.text;
        UVar0.strBirthdate = datBirthday0.text;
        UVar0.strStudy = txtStudy0.text;
        UVar0.strStudy_date = datStudyDate0.text;
        UVar0.straAccess = txtAccess0.text;
        UVar0.strMedicines = txtMedicines0.text;
        UVar0.strPhyID = txtPhyID0.text;
        UVar0.strPhyName = txtPhyName0.text;
        UVar0.strPhyTel = txtPhyTel0.text;

        //UVar.username = AlbumPicID;
        Ureq0.data = UVar0;
        ULoad0.load(Ureq0);

    }
    protected function updateComplete(e:Event):void{

        _xmlMainb = new XML(e.currentTarget.data);
        //lblTest.text = objxml.name.text();
        dgPatient.dataProvider = _xmlMainb.sub;
        _numCurrentUpload = 1;
        Alert.show("To the integrity of the data.\n
Please return to the patients window again.", "Update data
completed.");
    }

    ///===== L o a d   d a t a
    =====

    protected function loadData():void
    {
        var ULoad2:URLLoader = new URLLoader();
        var UVar2:URLVariables = new URLVariables();
        var Ureq2:URLRequest = new
URLRequest("php/load_data.php");
        Ureq2.method = URLRequestMethod.POST;
        ULoad2.addEventListener(Event.COMPLETE,
loadComplete);

        ULoad2.load(Ureq2);
    }

```

```

    }
    protected function loadComplete(e:Event):void{
        _xmlMainb = new XML(e.currentTarget.data);
        dgPatient.dataProvider = _xmlMainb.sub;
    }
    ///===== Load Chart 1
    =====

    protected function loadChart1():void
    {
        var ULoad2:URLLoader = new URLLoader();
        var UVar2:URLVariables = new URLVariables();
        var Ureq2:URLRequest = new
URLRequest("php/load_chart1.php");
        Ureq2.method = URLRequestMethod.POST;
        ULoad2.addEventListener(Event.COMPLETE,
loadCompleteChart1);
        ULoad2.load(Ureq2);
    }
    protected function
loadCompleteChart1(e:Event):void{
        _xmlChart1 = new XML(e.currentTarget.data);
    }
    ///===== Load Chart 2
    =====

    protected function loadChart2():void
    {
        var ULoad2:URLLoader = new URLLoader();
        var UVar2:URLVariables = new URLVariables();
        var Ureq2:URLRequest = new
URLRequest("php/load_chart2.php");
        Ureq2.method = URLRequestMethod.POST;
        ULoad2.addEventListener(Event.COMPLETE,
loadCompleteChart2);
        ULoad2.load(Ureq2);
    }
    protected function
loadCompleteChart2(e:Event):void{
        _xmlChart2 = new XML(e.currentTarget.data);
    }
    ///===== Load Chart 3
    =====

    protected function loadChart3():void
    {
        var ULoad2:URLLoader = new URLLoader();
        var UVar2:URLVariables = new URLVariables();
        var Ureq2:URLRequest = new
URLRequest("php/load_chart3.php");
        Ureq2.method = URLRequestMethod.POST;

```

```

        ULoad2.addEventListener(Event.COMPLETE,
loadCompleteChart3);
        ULoad2.load(Ureq2);

    }
    protected function
loadCompleteChart3(e:Event):void{
    _xmlChart3 = new XML(e.currentTarget.data);
}

]]>
</fx:Script>
<fx:Declarations>

    <!-- Place non-visual elements (e.g., services, value
objects) here -->
    <!-- Define custom colors for use as fills. -->
    <!-- พวกนี้เป็นสีของกราฟ เปลี่ยนเองได้ตามใจชอบเลยนะ -->
    <mx:SolidColor id="sc1" color="0x993333" alpha=".8"/>
    <mx:SolidColor id="sc2" color="green" alpha=".6"/>
    <mx:SolidColor id="sc3" color="0xFFCC66" alpha=".6"/>

    <!-- Define custom Strokes for the columns. -->
    <mx:SolidColorStroke id="s1" color="yellow" weight="2"/>
    <mx:SolidColorStroke id="s2" color="0xC0C0C0"
weight="2"/>
    <mx:SolidColorStroke id="s3" color="0xFFCC66"
weight="2"/>

</fx:Declarations>
<s:controlBarContent>
    <mx:Image source="dicomxxx.jpg" width="1341"
height="44"/>
</s:controlBarContent>
<mx:TabNavigator id="tabNavMain" x="2" y="28.35" width="1358"
height="724">
    <s:NavigatorContent label="Patient" width="100%"
height="100%" id="tabPatient">
        <mx:DataGrid id="dgPatient" x="3" y="0"
width="1353" height="673" doubleClickEnabled="true" >
            <mx:columns>
                <mx:DataGridColumn headerText="ID"
dataField="id" width="70" />
                <mx:DataGridColumn headerText="Name"
dataField="name" width="200"/>
                <mx:DataGridColumn headerText="Gender"
dataField="gender" width="40"/>
                <mx:DataGridColumn headerText="Date of
birth" dataField="birthdate" width="75"/>
                <mx:DataGridColumn headerText="Date of
birth format yymmdd" dataField="birthdate_yymmdd" width="75"
visible="false"/>
            </mx:columns>
        </mx:DataGrid>
    </s:NavigatorContent>
</mx:TabNavigator>

```

```

                                <mx:DataGridColumn dataField="mammo"
headerText="Mammographic findings" width="270"/>
                                <mx:DataGridColumn dataField="access"
headerText="Accession no" width="130"/>
                                <mx:DataGridColumn headerText="study
time" dataField="study" width="80"/>
                                <mx:DataGridColumn headerText="study
date" dataField="study_date" width="80" />
                                <mx:DataGridColumn
dataField="medicines" headerText="Medicines" width="150"/>
                                <mx:DataGridColumn
headerText="Description" dataField="description"/>
                                <mx:DataGridColumn dataField="rccr"
headerText="pic1" visible="false"/>
                                <mx:DataGridColumn dataField="lccl"
headerText="pic2" visible="false"/>
                                <mx:DataGridColumn dataField="lmloh"
headerText="pic3" visible="false"/>
                                <mx:DataGridColumn dataField="rmloh"
headerText="pic4" visible="false"/>
                                <mx:DataGridColumn dataField="phy_id"
headerText="phy_id" visible="false"/>
                                <mx:DataGridColumn dataField="phy_name"
headerText="phy_name" visible="false"/>
                                <mx:DataGridColumn dataField="phy_tel"
headerText="phy_tel" visible="false"/>
                                <mx:DataGridColumn dataField="age"
headerText="age" visible="false"/>
                                </mx:columns>
                                </mx:DataGrid>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="Viewer" width="100%"
height="100%" id="tabViewer">
                                <mx:TabNavigator x="19.7" y="21" width="340"
height="460" id="tabPicLeft">
                                <s:NavigatorContent label="R CC (R)"
width="100%" height="100%" id="tabPicLeft1">
                                <mx:Image x="8" y="7" width="323"
height="420" id="imgLeft1"/>
                                </s:NavigatorContent>
                                <s:NavigatorContent label=" L CC (L) "
width="100%" height="100%" id="tabPicLeft2">
                                <mx:Image x="8" y="7" width="323"
height="420" id="imgLeft2"/>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="L MLO(H) "
width="100%" height="100%" id="tabPicLeft3">
                                <mx:Image x="8" y="7" width="323"
height="420" id="imgLeft3"/>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="R MLO(H) "
width="100%" height="100%" id="tabPicLeft4">
                                <mx:Image x="8" y="7" width="323"
height="420" id="imgLeft4"/>
                                </s:NavigatorContent>
                                </mx:TabNavigator>
                                <mx:DataGrid x="729" y="17" width="617"
height="651" id="dgSub" change="change_sub(event)">

```

```

                <mx:columns>
                    <mx:DataGridColumn headerText="ID"
dataField="id" visible="false"/>
                    <mx:DataGridColumn headerText="Name"
dataField="name" width="200"/>
                    <mx:DataGridColumn headerText="Gender"
dataField="gender" width="40"/>
                    <mx:DataGridColumn headerText="Date of
birth" dataField="birthdate" visible="false"/>
                    <mx:DataGridColumn dataField="mammo"
headerText="Mammographic findings"/>
                    <mx:DataGridColumn dataField="access"
headerText="Accession no" visible="false"/>
                    <mx:DataGridColumn headerText="study
time" dataField="study" visible="false"/>
                    <mx:DataGridColumn
dataField="medicines" headerText="Medicines" visible="false"/>
                    <mx:DataGridColumn
headerText="Description" dataField="description" visible="false"/>
                    <mx:DataGridColumn dataField="rccr"
headerText="pic1" visible="false"/>
                    <mx:DataGridColumn dataField="lccl"
headerText="pic2" visible="false"/>
                    <mx:DataGridColumn dataField="lmloh"
headerText="pic3" visible="false"/>
                    <mx:DataGridColumn dataField="rmloh"
headerText="pic4" visible="false"/>
                    <mx:DataGridColumn dataField="phy_id"
headerText="phy_id" visible="false"/>
                    <mx:DataGridColumn dataField="phy_name"
headerText="phy_name" visible="false"/>
                    <mx:DataGridColumn dataField="phy_tel"
headerText="phy_tel" visible="false"/>
                    <mx:DataGridColumn dataField="age"
headerText="age" visible="false"/>
                </mx:columns>
            </mx:DataGrid>
            <s:TextArea id="txtAreaLeft" x="20" y="487"
width="341" text="Patient&#xd;&#xd;&#xd;&#xd;&#xd;Physician &#xd;-
Physician ID&#xd;- Physician name&#xd;- Physician Telephone"
height="161" fontFamily="Arial"/>
            <s:TextArea id="txtAreaRight" x="374" y="487"
width="338" text="Patient&#xd;&#xd;&#xd;&#xd;&#xd;Physician &#xd;-
Physician ID&#xd;- Physician name&#xd;- Physician Telephone"
height="162" fontFamily="Arial"/>
            <mx:TabNavigator x="372.7" y="20" width="340"
height="460" id="tabPicRight">
                <s:NavigatorContent label="R CC (R)"
width="100%" height="100%">
                    <mx:Image x="8" y="8" width="323"
height="420" id="imgRight1"/>
                </s:NavigatorContent>
                <s:NavigatorContent label=" L CC (L)"
width="100%" height="100%">
                    <mx:Image x="8" y="8" width="323"
height="420" id="imgRight2"/>
                </s:NavigatorContent>

```

```

                                <s:NavigatorContent label="L MLO(H) "
width="100%" height="100%">
                                <mx:Image x="8" y="8" width="323"
height="420" id="imgRight3"/>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="R MLO(H) "
width="100%" height="100%">
                                <mx:Image x="8" y="8" width="323"
height="420" id="imgRight4" scaleContent="true"/>
                                </s:NavigatorContent>
                                </mx:TabNavigator>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="Upload" width="100%"
height="100%" id="tabUpload" >
                                <mx:TabNavigator x="189" y="43" width="949"
height="513" id="navRegContent">
                                <s:NavigatorContent label="Mammographics
Screening" width="100%" height="100%">
                                <s:NavigatorContent label="Upload "
width="100%" height="100%">
                                <s:NavigatorContent label="Upload
" width="1017" height="497">
                                <s:Button x="328" y="70"
label="Browse" click="addFile1()"/>
                                <s:Button x="328" y="120"
label="Browse" click="addFile2()"/>
                                <s:Button x="328" y="170"
label="Browse" click="addFile3()"/>
                                <s:Button x="328" y="220"
label="Browse" click="addFile4()"/>
                                <s:TextInput x="150" y="70"
id="txtRCCR"/>
                                <s:TextInput x="150"
y="120" id="txtLCCL"/>
                                <s:TextInput x="150"
y="170" id="txtLMLOH"/>
                                <s:TextInput x="150"
y="220" id="txtRMLOH"/>
                                <s:RichText x="74" y="72"
text="R CC (R)" color="#000000"/>
                                <s:RichText x="74" y="121"
text="L CC (L)" color="#000000"/>
                                <s:RichText x="74" y="176"
text="L MLO(H)" color="#000000"/>
                                <s:RichText x="74" y="227"
text="R MLO(H)" color="#000000"/>
                                <s:RichText x="463" y="72"
text="Mammographic findings" color="#000000"/>
                                <s:TextInput x="630"
y="190" id="txtDescription" width="292"/>
                                <s:Button x="760" y="380"
label="Next" id="btnRegNext1"
click="btnRegNext1_clickHandler(event)"/>
                                <s:RichText x="463" y="191"
text="Description" color="#000000"/>
                                <s:TextArea x="632" y="67"
id="txtMammo" width="289" height="106"/>

```

```

                                <s:Label x="207" y="28"
width="547" height="20" verticalAlign="middle" textAlign="center"
color="#FF0E0E" id="lblError1" fontSize="18" fontFamily="Arial"/>
                                </s:NavigatorContent>
                                </s:NavigatorContent>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="Patient Detail"
width="100%" height="100%" >
                                <s:RichText x="75" y="69" text="ID"
color="#000000"/>
                                <s:RichText x="75" y="122" text="Name"
color="#000000"/>
                                <s:TextInput x="156" y="64"
id="txtID"/>
                                <s:TextInput x="156" y="114"
id="txtName" width="196"/>
                                <s:TextInput x="157" y="159"
id="txtGender"/>
                                <s:RichText x="75" y="172"
text="Gender" color="#000000"/>
                                <s:RichText x="75" y="222" text="Date
of birth" color="#000000"/>
                                <s:RichText x="407" y="224" text="Study
Date" color="#000000"/>
                                <s:RichText x="409" y="72" text="Study
time" color="#000000"/>
                                <s:RichText x="409" y="123"
text="Accession no " color="#000000"/>
                                <s:RichText x="409" y="173"
text="Medicines" color="#000000"/>
                                <mx:DateField x="196" y="215"
showToday="false" id="datBirthday" formatString="YYYY-MM-DD" />
                                <mx:DateField x="571" y="219"
showToday="false" id="datStudyDate" formatString="YYYY-MM-DD" />
                                <s:TextInput x="568" y="64"
id="txtStudy"/>
                                <s:TextInput x="568" y="114"
id="txtAccess"/>
                                <s:TextInput x="568" y="164"
id="txtMedicines" width="260"/>
                                <s:Button x="760" y="380" label="Next"
id="btnRegNext2" click="btnRegNext2_clickHandler(event)"/>
                                <s:Label x="212" y="26" width="558"
height="20" verticalAlign="middle" textAlign="center" color="#FF0E0E"
id="lblError2" fontSize="18"/>
                                </s:NavigatorContent>
                                <s:NavigatorContent label="Physician Detail"
width="100%" height="100%">
                                <s:RichText x="95" y="85" text="ID"
color="#000000"/>
                                <s:TextInput x="222" y="75"
id="txtPhyID"/>
                                <s:RichText x="95" y="130" text="Name"
color="#000000"/>
                                <s:RichText x="95" y="176"
text="Telephone" color="#000000"/>

```

```

id="txtPhyName"/>
id="txtPhyTel"/>
label="Upload" click="button1_clickHandler(event)"
id="btnRegUpload"/>
height="20" verticalAlign="middle" textAlign="center" color="#FF0E0E"
id="lblError3" fontSize="18"/>
</s:NavigatorContent>
</mx:TabNavigator>
</s:NavigatorContent>
<s:NavigatorContent label=" Edit " width="100%"
height="100%">
<mx:TabNavigator x="189" y="43" width="949"
height="513" id="navRegContentEdit">
<s:NavigatorContent label="Mammographics
Screening" width="100%" height="100%">
<s:NavigatorContent label="Upload "
width="100%" height="100%">
<s:NavigatorContent label="Upload
" width="1017" height="497">
<s:Button x="158" y="68"
label="Browse for change a picture" click="editFile('1')"/>
<s:Button x="158" y="118"
label="Browse for change a picture" click="editFile('2')"/>
<s:Button x="158" y="168"
label="Browse for change a picture" click="editFile('3')"/>
<s:Button x="158" y="218"
label="Browse for change a picture" click="editFile('4')"/>
<s:RichText x="74" y="72"
text="R CC (R)" color="#000000"/>
<s:RichText x="74" y="121"
text="L CC (L)" color="#000000"/>
<s:RichText x="74" y="176"
text="L MLO(H)" color="#000000"/>
<s:RichText x="74" y="227"
text="R MLO(H)" color="#000000"/>
<s:RichText x="463" y="72"
text="Mammographic findings" color="#000000"/>
<s:TextInput x="633"
y="190" id="txtDescription0" width="292"/>
<s:Button x="760" y="380"
label="Next" id="btnRegNext0"
click="btnRegNext01_clickHandler(event)"/>
<s:RichText x="464" y="191"
text="Description" color="#000000"/>
<s:TextArea x="633"
y="66.6" id="txtMammo0" width="289" height="106"/>
</s:NavigatorContent>
</s:NavigatorContent>
<s:Label x="157" y="26" width="621"
height="20" verticalAlign="middle" textAlign="center" color="#FF0E0E"
id="lblError01" fontSize="18" fontFamily="Arial"/>
</s:NavigatorContent>
<s:NavigatorContent label="Patient Detail"
width="100%" height="100%">

```

```

color="#000000"/>
color="#000000"/>
enabled="false"/>
id="txtName0" width="196"/>

id="txtGender0"/>
text="Gender" color="#000000"/>
of birth" color="#000000"/>
date" color="#000000"/>
time" color="#000000"/>
text="Accession no " color="#000000"/>
text="Medicines" color="#000000"/>
showToday="false" id="datBirthday0" formatString="YYYY-MM-DD" />
showToday="false" id="datStudyDate0" formatString="YYYY-MM-DD" />
id="txtStudy0"/>
id="txtAccess0"/>
id="txtMedicines0" width="260"/>
id="btnRegNext3" click="btnRegNext02_clickHandler(event)"/>
height="20" verticalAlign="middle" textAlign="center" color="#FF0E0E"
id="lblError02" fontSize="18"/>
</s:NavigatorContent>
<s:NavigatorContent label="Physician Detail"
width="100%" height="100%">
color="#000000"/>
id="txtPhyID0"/>
color="#000000"/>
text="Telephone" color="#000000"/>
id="txtPhyName0"/>
id="txtPhyTel0"/>
label="Upload" click="click_edit(event)" id="btnRegUpload0"/>
height="20" verticalAlign="middle" textAlign="center" color="#FF0E0E"
id="lblError03" fontSize="18"/>
<s:RichText x="75" y="69" text="ID"
<s:RichText x="75" y="122" text="Name"
<s:TextInput x="156" y="64" id="txtID0"
<s:TextInput x="156" y="114"
<s:TextInput x="157" y="159"
<s:RichText x="75" y="172"
<s:RichText x="75" y="222" text="Date
<s:RichText x="407" y="224" text="Study
<s:RichText x="409" y="72" text="Study
<s:RichText x="409" y="123"
<s:RichText x="409" y="173"
<mx:DateField x="196" y="215"
<mx:DateField x="571" y="219"
<s:TextInput x="568" y="64"
<s:TextInput x="568" y="114"
<s:TextInput x="568" y="164"
<s:Button x="760" y="380" label="Next"
<s:Label x="182" y="26" width="585"
color="#FF0E0E"
</s:NavigatorContent>
<s:NavigatorContent label="Physician Detail"
width="100%" height="100%">
color="#000000"/>
id="txtPhyID0"/>
color="#000000"/>
text="Telephone" color="#000000"/>
id="txtPhyName0"/>
id="txtPhyTel0"/>
label="Upload" click="click_edit(event)" id="btnRegUpload0"/>
height="20" verticalAlign="middle" textAlign="center" color="#FF0E0E"
id="lblError03" fontSize="18"/>

```

```

        </s:NavigatorContent>
    </mx:TabNavigator>
    <s:Label x="193" y="12" text="Please select patient
who will edit on the page patient." height="20" width="943"
color="#000000" verticalAlign="middle" textAlign="center"
id="lblEditName" fontFamily="Courier New" fontSize="20"/>
    </s:NavigatorContent>
    <s:NavigatorContent label="Report" width="100%"
height="100%" id="tabReport">
        <mx:ColumnChart x="113" y="420" id="graph2"
width="355" height="198" showDataTips="true"
dataProvider="{_xmlChart2.sub}" color="0x000000">
            <mx:horizontalAxis>
                <mx:CategoryAxis
categoryField="gender"/>
            </mx:horizontalAxis>
            <mx:series>
                <mx:ColumnSeries displayName="Female"
yField="gender_f" xField="" fill="{scl}"
stroke="{s1}"/>
                <mx:ColumnSeries displayName="Male"
yField="gender_m" xField="" fill="{sc2}"
stroke="{s2}"/>
            </mx:series>
        </mx:ColumnChart>
        <mx:ColumnChart x="741" y="426" id="graph3"
width="355" height="192" dataProvider="{_xmlChart3.sub}"
showDataTips="true" color="0x000000">
            <mx:horizontalAxis>
                <mx:CategoryAxis categoryField="gender"
/>
            </mx:horizontalAxis>
            <mx:series>
                <mx:ColumnSeries displayName="Female"
yField="f_age" xField="" fill="{scl}"
stroke="{s1}"/>
                <mx:ColumnSeries displayName="Male"
yField="m_age" xField="" fill="{sc2}"
stroke="{s2}"/>
            </mx:series>
        </mx:ColumnChart>
        <mx:ColumnChart id="graph1"
height="305"
width="1318"
paddingLeft="5"
paddingRight="5"
showDataTips="true"
dataProvider="{_xmlChart1.sub}"
x="10" y="60"
color="0x000000">
            <mx:horizontalAxis>
                <mx:CategoryAxis categoryField="mammo"
/>

```

```

        </mx:horizontalAxis>

        <mx:series>
            <mx:ColumnSeries
                xField="mammo"
                yField="mammo_num"
                displayName="Mammographic
findings"
                fill="{s3}"
                stroke="{s3}"
            />
        </mx:series>
    </mx:ColumnChart>
    <s:Label x="555" y="34" text="Calcifications Type"
color="#000000" fontSize="14" width="333" verticalAlign="middle"
textAlign="center"/>
    <s:Label x="118" y="391" text="Statistics of the
patient" color="#000000" fontSize="14" width="333"
verticalAlign="middle" textAlign="center"/>
    <s:Label x="756" y="398" text="Age average"
color="#000000" fontSize="14" width="333" verticalAlign="middle"
textAlign="center"/>
    <s:Label x="26" y="46" text="Number"
color="#FCFF03"/>
    <s:Label text="symptoms" color="#FCFF03"
fontStyle="normal" textDecoration="none" fontWeight="bold" y="326"
x="1286"/>
    <s:Label x="758" y="407" text="Age"
color="#FCFF03"/>
    <s:Label x="129" y="403" text="Number"
color="#FCFF03"/>
    <s:Label x="475" y="599" text="Gender"
color="#FCFF03"/>
    <s:Label x="235" y="632" text="Female"
color="#000000"/>
    <s:Label x="343" y="633" text="Male"
color="#000000"/>
    <s:Label x="866" y="627" text="Female"
color="#000000"/>
    <s:Label x="980" y="628" text="Male"
color="#000000"/>
    <s:Label x="1105" y="599" text="Gender"
color="#FCFF03"/>
    </s:NavigatorContent>
</mx:TabNavigator>
</s:Application>

```

## **BIOGRAPHY**

<b>NAME</b>	Miss Siripan Pancharoen
<b>DATE OF BIRTH</b>	27 July 1982
<b>PLACE OF BIRTH</b>	Bangkok, Thailand
<b>INSTITUTIONS ATTENDED</b>	Mahidol University, 2005: Bachelor of Management (Management Information System) Ramkhamheung, 2005: Bachelor of Science (Political) Mahidol University, 2010: Master of Science (Technology of Information System Management)
<b>HOME ADDRESS</b>	35/23 Mu.3 Taweewittana Soi 19 Taweewittana Rd. Taweewittana, Bangkok 10170
<b>EMPLOYMENT ADDRESS</b>	Office of Engineering Consultant Faculty of Engineering Mahidol University 25/25 Puttamonton 4 Rd. Puttamonton, Nakornpratom Tel. 0-2441-9859 # 15