ABSTRACT

This project is aimed to facilitate nurses with decision support feature and benefit the management of the hospital through increased speed of data manipulation, automated processing, essential report generation, and also good patient care services rendered using an efficient, reliable and new-friendly method of computerization to solve the shortcoming of drawbacks of the current systems used in hospitals in Malaysia today.

This project, which focuses on research and development is developed using the latest most accepted technologies of today and hence would widely accepted by the hospital industry in Malaysia. The HMIS features automated workload assessment, defaulting charting respond, decision support, automated computations , charts form and reports data, and easier rostering process. The design of patient assessment application module and nursing care plan module captures nursing assessment and planning data using computer. The system also aimed to provide an efficient patient assessment recording, reduce costs, and improve discharge planning and early identification of patients needs. On the whole, the project is aimed to overcome the problems faced by the industry and expedite the processes involved in the health care sector. Object oriented methods development approach used to elicit functional requirements and to model proposed system.

ACKNOWLEDGEMENT

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CHAPTER 1

INTRODUCTION

1.1 Project Overview

Hospital Information System for the past few years is one of the most important development in the field of medical. The database and network environment is now the underlying framework of the management system and has the fundamentally changed the way many hospital organizations operate.

In actual, the use of computers in medical field is now not yet fully used to help a doctor to manage the information and continued with decision making to support the doctors and nurses.

According to the research by Stephen E.Smith [1] it is found that the Hospital Information System, which uses computers to help a doctors in many ways. The clinical or Hospital Information System helps in the aspect of accessing the patient's records references and etc.

In reality, the purpose of the development of such system is to reduce the manual work and also to minimize space and errors. There are several changes to the health-case sector that are leading more on their practice and their lives.

The Hospital Management Information System is a system that was accomplished to fulfill the requirements and deliver a system to facilitate the hospital management or organization in numerous ways. This system, is flexible to be used by the top-level

management staffs who are obviously the doctors and also the administration staffs who consist of nurses.

In facts, Hospital Management Information system is an effort to transform the existing computerized database system to an improved and enhanced management system using advanced technology.

HMIS will improves the operations and management in a hospital where it helps to manage information, requirements and record keeping as well as updating operations and procedures to increases patient satisfaction and profitability.

1.2 HMIS Development Motivation

Currently technology in the field of computing changes more as time passes by until today, it has emerged as one of the most advanced technology. Today the computer technology is most needed in human's life in every aspect. One of the intended computer usage fields would be in aspect of management.

From the purpose explained above, this phenomenon is the motivation for the development of this HMIS. In addition, implementation of such system will of course help to widen the usage of computer technology in our country.

Besides it also helps human to organize activities systematically, helps in saving time and administration cost, and overcomes the problems faced easily.

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1.3 Objectives

The aim of this project is to build a comprehensive Hospital Management Information prototype, which enables integrated healthcare information and services across the entire department in the hospital, in the nursing perspective. Below are the specific objectives.

- Improved inter professional collaboration (nurses)

- Better integration of care and rapid readjustment of care plans through sharing of patient progress and response to care

- Care plan prior to patient arrival and more timely care

- Less data entry duplication and error and seamless flow of information

- Improved presentation of information

- Improved availability of up to date, timely, consistent and appropriate information for decision making and the ability to analyze information

- Increase efficiency and effectiveness of care

- Address roles and responsibilities of team member

- Improve speed of request (for swapping duties)

- Reduce administrative tasks and paperwork

- Reduced cost of care where appropriate

- To support quality monitoring

- Reduce time on designing and amending rosters

- More accurate timesheets and personnel data

- Quicker retrieval of personnel information

- Accurate the record working time and hours for nurses

Implementation of Hospital Management Information System. The following are the modules which will be included:

1.4 Project Scope

- Patient assessment
- Workload assessment and rostering
- Nursing Care Plan
- Patient Charting

The full HMIS is not within the scope of this project. This project concentrate on the

1.5 Major Functional Specification

Below are the functional specification of the modules above. However, based on the Hospital Kuala Lumpur facilities, the specification of the modules would be added and modified to best serve the hospital needs. This will ensure a smooth and closer working relationship.

Table 1.1: Major Functional Specification

```
                              HMIS
                                |
        _____|_____
       |                                                 |
Management oriented                               Patient oriented
       |                                                 |
       |                          _____|
       |                         |                       |
Financial-economical     Patient-management           Medical
                                                         |
                                                     Nursing

                                              ▪ Patient assessment
                                              ▪ Workload
                                                Assessment and
                                                rostering
                                              ▪ Care planning
                                              ▪ Patient Charting
```

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Implementation of Hospital Management Information System. The following are the modules which will be included:

- Patient assessment

- Workload assessment and rostering

- Nursing Care Plan

- Patient Charting

The full HMIS is considered as large system. Thus, I will only concentrate on the nursing perspective module.

1.5 Major Functional Specification

Below are the functional specifications of the application. However, based on the Business Requirement Analysis, the specifications of the modules would be added and modified to best suite the business process. This will ensure software and business logic compatibility.

Table 1.1: Major Functional Specification

Application/Site Features	Functions/Solution Offered
Patient Assessment	• Allows nurses to manage charges and record assessments, flow sheets, and clinical pathways. As customizable as physician documentation, the patient assessment module includes: a Code Recorder that automatically captures times, dates and users during codes; Nursing Notes, a quick way to record routine notes or track the time a consultant was paged; and Nursing Flow sheet, a quick visualization of vital signs and other assessments on a chronologically

	organized template.
Workload Assessment and Rostering	• The assignment diary for each nurse can be accessed by authorized users in order to assign the work for each shift over, for example entire month. The roster than can be printed and distributed. • Rooms or patients can be assigned to specific nurses in each shift. Te allocation list can be printed for distribution. • Provide follow up reports and link to the hospital financial routines
Nursing Care Plan	• Giving every patient an individual care plan and following it up also contain functions that assist in selecting the appropriate care plan • Evaluating follow-up and manipulating data for further analysis and study
Patient Charting	• On screen forms allow the user to chart all subjective and objective assessments, treatment and response, patient education, family therapy, and patient disposition. • Keeps all profiles of patients like name, age, identification number and patient index number. • All medical history, family health records, blood group, drug allergy and lifestyle habits will also be recorded and found. • Search facility is also available.

1.6 Research Plan and Method

- The research will be primarily based upon internet materials, journals articles and books. Updated internet materials will able to provide current information on the development of HMIS. Current issues and trends of hospital management system will be researched to find out the importance of computerized system in a hospital environment

- Books will be scrutinized to get more knowledge about management system development based on business concepts.

- Interview will be helpful to gather data and user requirements on hospital management system

- Study on the development tools for the system and development methodologies (object-oriented system development methodology) will be made

- Identify the requirements of the system and determine software and hardware

- Design the system based on case study of few existing systems, feasibility and user requirements

1.7 Project Plan

ID	Task Name	Start	Finish	Duration
1	Project Identification	3/16/2004	4/1/2004	13d
2	Gathering Project Information	4/1/2004	4/30/2004	22d
3	Identify User Requirement	4/5/2004	5/18/2004	31d 4h
4	Hardware And Software Requirement	4/5/2004	5/18/2004	31d 4h
5	Database Design	4/30/2004	8/2/2004	66d 4h
6	Interface Design	5/3/2004	7/20/2004	56d 4h
7	Logical Design	5/4/2004	7/12/2004	49d 4h
8	Database Development And Testing	6/2/2004	9/10/2004	73d
9	Web Development And Testing	6/3/2004	9/7/2004	68d 4h
10	User Documentation	8/6/2004	9/14/2004	27d 4h
11	System Testing	8/9/2004	9/16/2004	29d
12	Maintenance	9/2/2004	9/30/2004	20d 4h

Table 1.2: Gantt Chart For The Project Plan

1.8 Expected Outcome

The outcome of this project is to provide a prototype for the system that would fulfill the requirement and deliver it to facilitate the hospital nurses and benefit the management in various ways. In which the prototype can be handled easily and users gain satisfaction through increased speed of data manipulation automated processing, essential reports generations for the use of nurses and also good patient care services rendered using efficient, reliable and user-friendly management system.

1.9 Structure and Contents of the Report

Summary of chapter layout gives an overview of the major phases involved in this project development. [2] There are eight major chapters, list down as below:

Chapter 1: Introduction

This chapter gives an overview of the major phases involved in this project development. The nursing management concept is explained clearly and is known as Hospital Management Information System (HMIS). Apart from that, details about the system objectives, project scope, project research plan and methods, project planning and scheduling and the expected outcome of the project are also mentioned here. The scope of HMIS is identified and problems that can be resolved by the organization and its benefits of implementing this system in local hospital are also mentioned.

Chapter 2: Literature Review

This chapter contains the compilation of all materials read and surfed on the internet, which is online with the current project. Case study on Hospital Management system and Nursing System, the advantages and challenges they face are also provided. Discusses the research that was done on the existing systems and the feasibility study concerning the proposed solution. Also discusses methods used for the survey upon local hospital (without specialization) in details, such as interviews and other methods of survey.

Chapter 3: System Analysis

This chapter explains the methodology used to developed the system and also discussion about the functional and non-functional that is needed in the development of the HMIS system. Here analysis of the development tools are also provided.

Chapter 4: System Design

This chapter elaborate the design of the system according to the user requirements. Description regarding the design of HMIS system, using data flow diagram or other charts and also includes the database design and the user interface design. This chapter also concerns on the system architecture and functional aspects of the system

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature review is important, as it is a study of materials and sources that will help to strengthen the foundation of the project. It started by knowing very little of the project in hand. It is only through research on electronic and printed materials, we are able to have a better understanding and awareness. Literature review generally helps to:

- Identify user needs
- Evaluate the system concept and feasibility
- Create the system definitions

2.2 Definitions

2.2.1 What is a Computerized Management?

The computerized management of electronic as well as paper-based documents. Document management systems generally include the following components:

- A database to organized stored data
- A search mechanism to quickly find specific documents

Document management system are becoming more important as it becomes increasingly obvious that the paperless office is an ideal way that can never be achieved. Instead, document management system strive to create systems that can handle paper and electronic documents together

2.2.2 What is Computer-Based Information System?

The computer-based information system usually has a few main components, which are tools, software, database, telecommunication, human being, and procedures. All these components play a role in collecting, manipulating, storing or keeping and processing data into an information form that can be used. For example, system that currently used by banks (eg. Maybank2U.com).

2.3 Research On Existing And On Development Hospital Management System

I have made a research on 9 hospitals and 1 on development hospital system, TPC that is to be implement in all the hospitals and clinics in Malaysia. All of the analyzed hospitals are in Selangor and Kuala Lumpur and 1 of it is in Perak. Below are the details of each hospital system.

2.3.1 Selayang Hospital

Selayang Hospital in Selangor has set a national record as the first hospital to implement a fully integrated information system called Total Hospital Information System (T.H.I.S.). T.H.I.S. is made up of various hardware and software applications integrated with clinical, financial and administrative systems and equipment such as imaging and laboratory analyzers to allow a perfect flow of information across a hospital network.

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The system is expected to improve the quality of services in Government hospitals as it reduces paper and duplication of work and enables easy access to patient data and records. It is also expected to reduce waiting time at Government hospitals and improve bill collection. The Selayang hospital was planned as a pilot project under the Government's Information System Strategic Plan developed in 1994 to improve efficiency in hospital services using Information Technology (IT). Construction of the hospital started in 1996. Building, construction, hardware, software and information system. Currently, it is reveals that not all IT systems are in full operation, and the hospital is experiencing some problems. Another big challenge of going "paperless" is the human resistance to change. They have to manage change and change management process has to be in place.
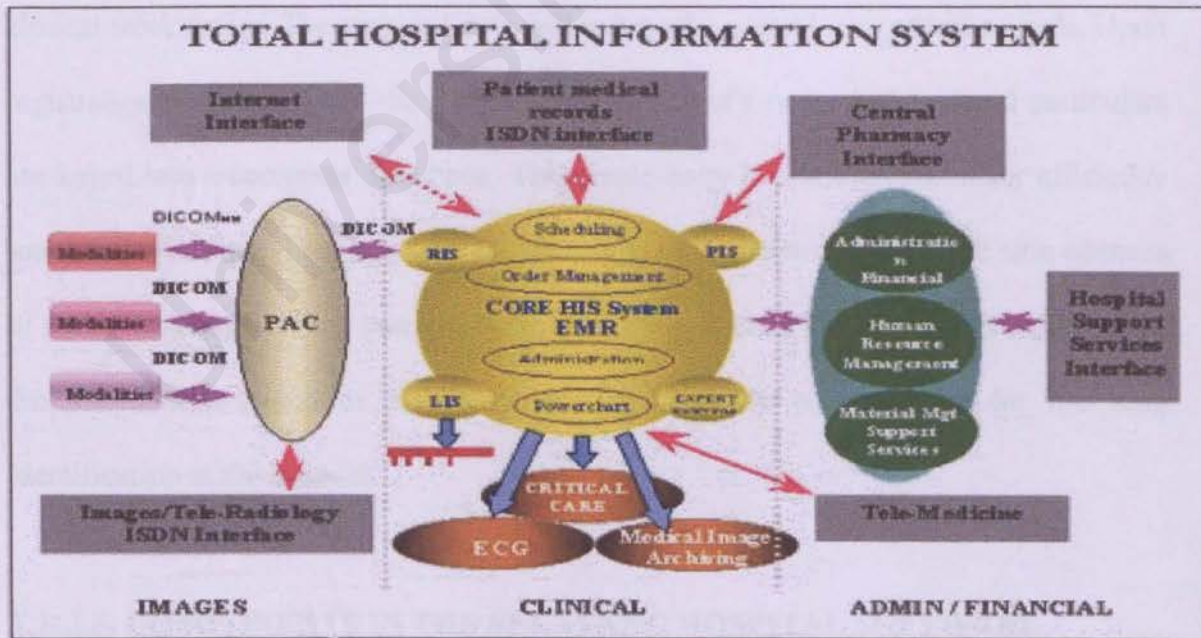
Figure 2.1: Total Hospital Information System Diagram

According to Selayang Hospital's IT Project Manager, Dr. Syed Amin Husaini, there were many problems and challenges in implementing T.H.I.S. For one, there is no single software package that can provide a hospital wide solution. Multiple software packages from different vendors had to be interfaced to achieve a total hospital overcome in some sections of the hospital. However, the Selayang Hospital has already set itself efficiency targets which necessitate the staff to use T.H.I.S. to manage their workload and improve their productivity.

Basically under T.H.I.S., three major aspects of hospital operation, that is, clinical, images, and administration and finance have gone "electronic", and are networked to each other. At the core are the clinical services where all medical records are electronic. Electronic Medical Record (EMR) provides storage of patient data. This data is available to authorized medical personnel at any location, at any time using a single, integrated clinical workstation. The archived data will reduce the possibilities of lost records. Upon registration and throughout the hospital stay, a patient's name and personal particulars are keyed into a computer only once. This single entry is considered a major efficiency tool for Government hospitals as it reduces time and paperwork. There are slim chances of mistaken identity as the barcode at the back of a patient's identity card is scanned and the information stored in the computer. This barcode will be used for life long identification at the hospital.

T.H.I.S. COMPONENTS IN THE SELAYANG HOSPITAL SOFTWARE
Applications

Various Clinical Systems & Financial and Administrative Systems

Operating Systems

- Digital Open VMS for the Hospital Information System
- Solaris for the Picture Archiving and Communication System
- Microsoft Windows NT for the rest

Database

- Oracle Relational Database
- Siemens PACS runs on its own proprietary database for image distribution

Office Automation

- MS-Office
- Internet Information Server
- Microsoft Exchange Server

Interfaces

- Foreign System Interface
- Medical Device Interface

Hardware

- Open VMS Servers, NT Servers, Unix Servers
- PCs, PACS workstation, printers, network equipment and bar code readers

Networking

- ATM switching technology
- Virtual LAN
- Structured cabling system

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Under the Hospital Information System (HIS), doctors enters their information and place their orders for laboratory tests, drugs or further examination through the computers. The Pharmacy Information System (PIS) is a drug ordering system which keeps an inventory of all drugs and also alerts medical personnel on contra indications (when conflicting drugs are prescribed). The Radiology Information System (RIS) allows doctors to order for X-rays and view the results. The Laboratory X-rays are scanned and viewed in special monitors (Above) Samples of patient data information Information System (LIS) records all lab tests, results and verifications done at the hospital for analysis and record purposes.

The Critical Care System is geared towards the intensive care unit where patients can be monitored remotely and information accessed via computer monitors. Currently the PIS and the Critical Care systems are not fully operational. The Picture Archive & Communications System (PACS) scans and stores all X-ray images in a huge Sienet server. This removes the need for X-rays films and passing of films from one section of the hospital to another. Doctors and radiologists can view the X-rays in special monitors located at various parts of the hospital. In addition, they can send the X-ray images to the Kuala Lumpur General Hospital electronically for referrals and second opinions for neurosurgical cases. Teleradiology and teleconsultation are thus made possible. Although it is the first electronic hospital, the finance and administration systems at the Selayang Hospital currently run on both paper and non-paper systems.

As a Government hospital, it has to continue using paper forms to comply with Government rules and regulations on reporting and documentation to various ministries

and Government agencies. Hard copies are generated to meet the requirements of the Ministry of Health, Jabatan Akauntan Negara, Jabatan Audit, Perbendaharaan and Jabatan Perkhidmatan Awam.

BENEFITS OF TOTAL HOSPITAL INFORMATION SYSTEM

Single Patient Record

- Patient record easily accessible

- Provides a lifetime health record

- Single entry multiple use of data

- No forms requisition required (for orders)

- Results reporting is instantaneous

- X-ray management

Nursing Care

- Improves - more time made available

- Duplication work taken away

- Task assignment made very simple

- Reduction of noise in the ward

- Peaceful environment

In reality the care providers, the easy access to information and reduction in paper work should bring productivity improvements. Workload is expected to be more manageable as work lists are generated automatically in the information system. For example, once

an order is issued for drugs or an X-ray, the information will be collected in a work list which is routed to the respective sections of the hospital. The staff on duty will know exactly their workload for the day. In the longer term, the Government itself will benefit in terms of revenue collection as both clinical and financial data are integrated. Any procedures, examinations and laboratory investigations carried out for patients will have charges automatically triggered to the patient bill. This will enable the hospital to collect payment as soon as the patient applies for discharge.

Some of the registered patients have already noticed that Selayang Hospital is different from other Government hospitals. Perhaps the most pleasant change is the shorter waiting time for services. In the collection of prescribed drugs, for example, a patient can get his medicine as soon as he reaches the drug counter as the list of drugs would have been relayed electronically from the clinic to the pharmacy section.
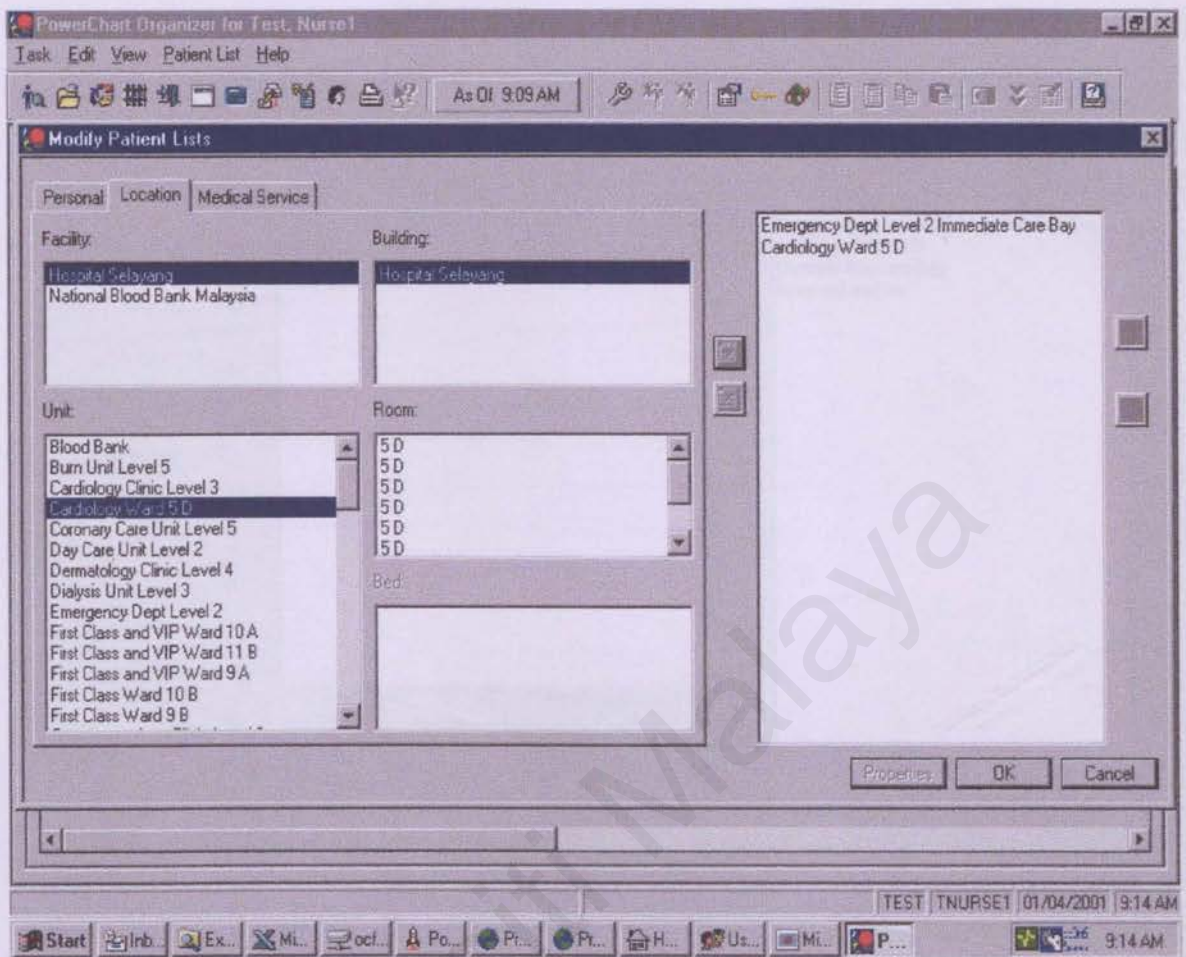
Figure 2.2: Example 1 of T.H.I.S System Screen (Modify Patient List)
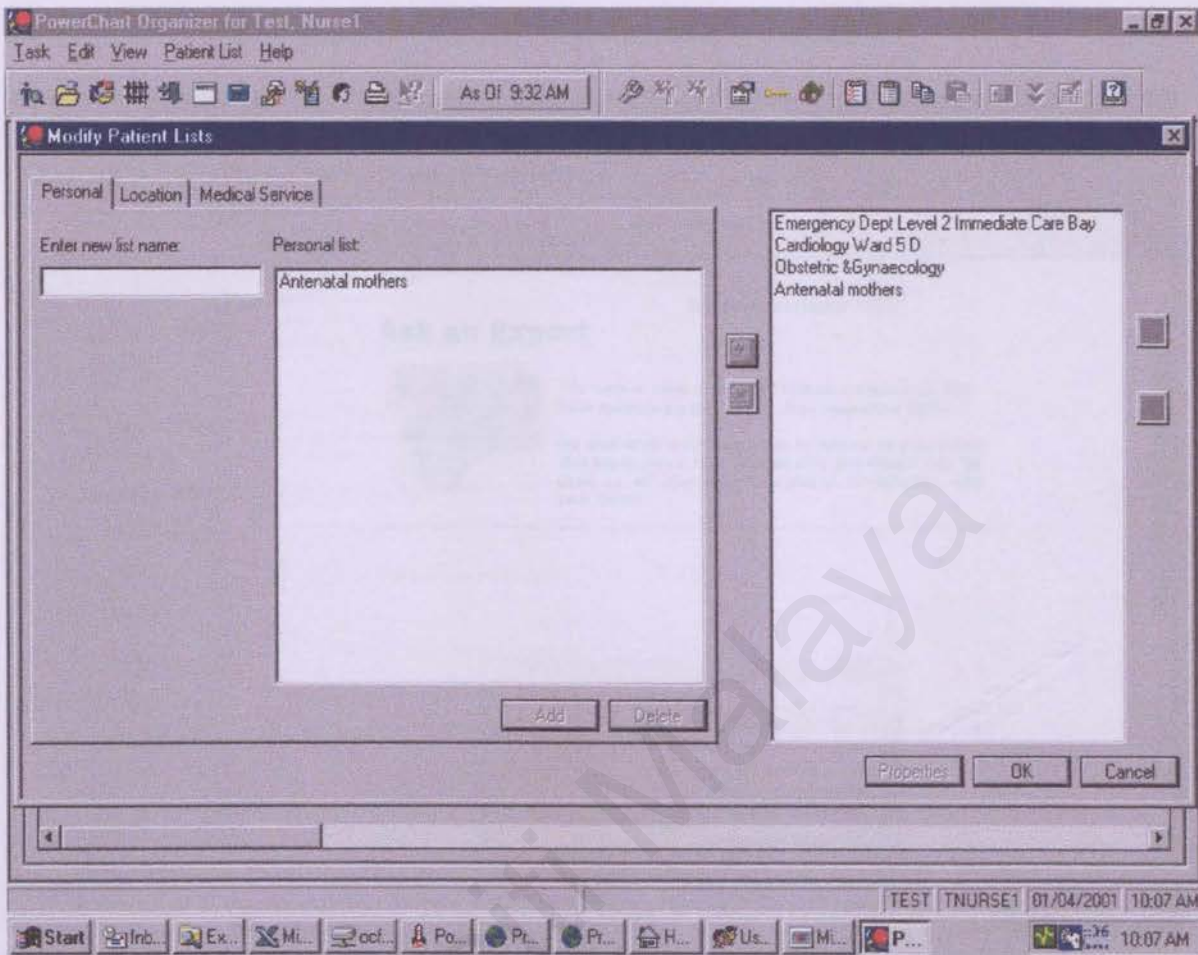
Figure 2.3: Example 2 of T.H.I.S System (Patient List)

2.3.2 Hospital Fatimah Ipoh

This website consists of and provides information about the hospital to the user. Besides that, there are two other additional information provides to the user that is "Ask the Expert" and "Email patient". Email patients provide service to the user to send emails to their relative or friend who is admitted at the hospital. This message will be printed by the staff that is in charge, and then the message will be delivered within 24 hours.

Whereas the "Ask the Expert" is a question and answer session where a patient can ask the clinical consultant about any disease they wish to know about.
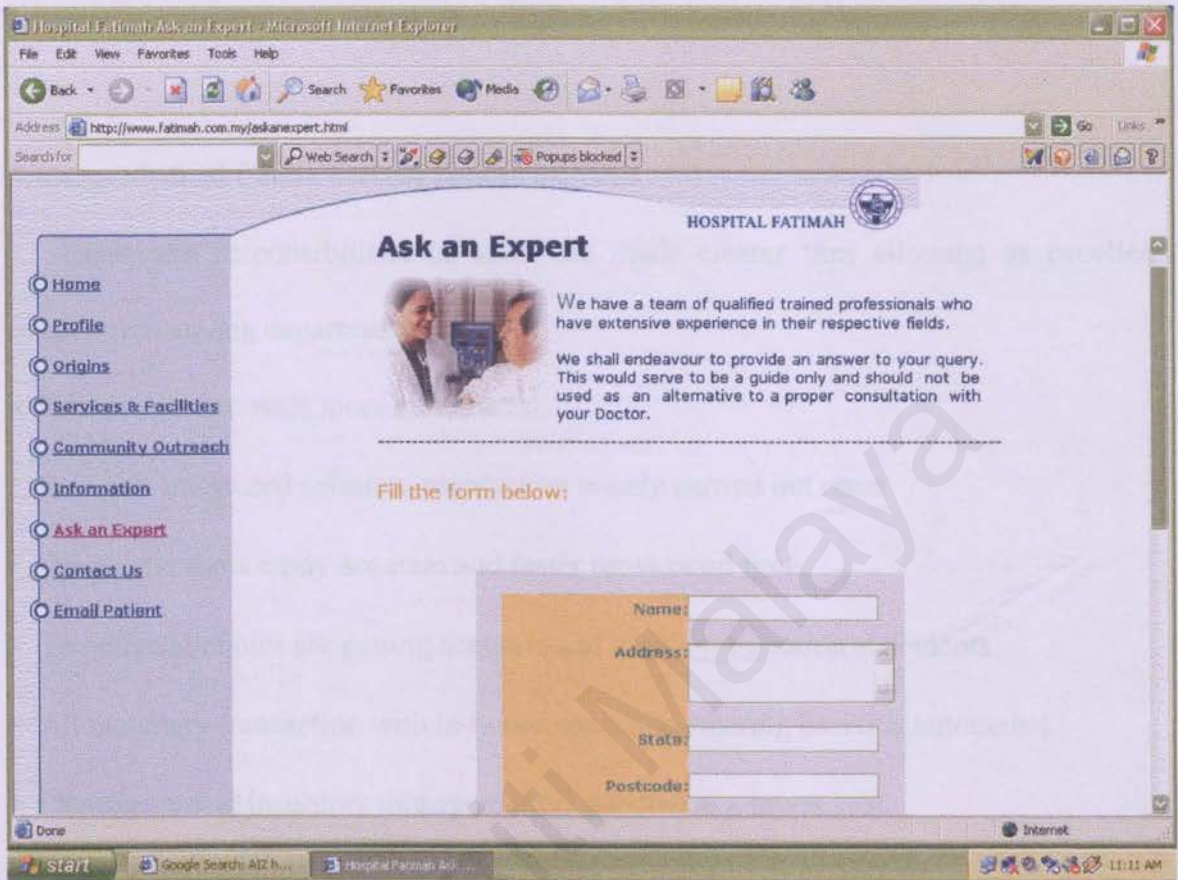
Figure 2.4: Ask An Expert Screen for Fatimah Hospital, Ipoh

2.3.3 Andalas Medical Centre (Hospital Management systems)

Andalas Medical Centre, a newly-formed hospital at Persiaran Tengku Ampuan Rahimah , Klang , it is a 60 bed multi-specialty hospital providing out-patient, in-patient and diagnostics services. The management realized that every aspect of management policy had to be properly defined so that they could take advantage of on an in-built knowledge of a good management solution as well as the bringing down of the learning curve by assigning the job of workflow definition and computerization to Hospital

Management System which is developed by AIZ. The objectives of this system is to provide a total management control over daily operation besides assisting executives in monitoring overall performance of the hospital

Andalas Medical Centre success factors includes:

- Roles and responsibilities of users are made clearer thus allowing as excellent cooperation among departments.

- Patient care becomes more systematic.

- Being an integrated solution, registration is only carried out once.

- Diagnostic units enjoy accurate and faster turnaround time.

- The referral clinics are getting accurate and timely transaction statements.

- All monetary transaction with in-house specialist (sharing basis) is automated.

- Pharmaceutical inventory management is handled at a lower cost.

Figure 2.5: Example of Medical Examination Screen allows the doctor to perform full medical checkup of a registered patient.

Figure 2.6: Vaccination Screen to prompt the doctor to remind patients for their next vaccination.

2.3.4 Hospital University Kebangsaan Malaysia

Hospital UKM (HUKM) is a provider of primary and tertiary care for the community in the areas surrounding Cheras. To ease the burden of the Accident and Emergency Department that was often swamped with patients that came in for non-critical outpatient care, the management at the hospital decided to setup a new outpatient center where these non critical patients could be referred called PMS (Provider Management System).

The hospital administration assessed that their existing HIS solution could not meet the

unique needs of this referral center due to the very complex and the difficult to use system. Thus they began evaluating solutions from several software vendors.

The evaluation was focusing on the following criteria:

- Clinical Workflow based

- Ability to manage pharmaceutical inventory within the centre.

- Capable of capturing demographic information quickly

- Capability to capture and store Electronic Medical Records using standard Ministry of Health (MOH) coding conventions such as ICD9/ ICD10

- Windows based, Y2K compliant solution.

- Ease of use to minimize training requirements

The management of HUKM was convinced that if a software solution could meet these requirements, it would achieve their goals of computerization, which were to enhance efficiency, improve patient to management to eventually serve the patients better. The main objectives of this system is to introduce a flexible Clinical Management System to provide the hospital with a systematic and efficient patient database as well as medical records, drug management, electronic on-line prescription, drug ordering, reporting and billing facilities.

The workflow solution is illustrated in the diagram with explanation below.
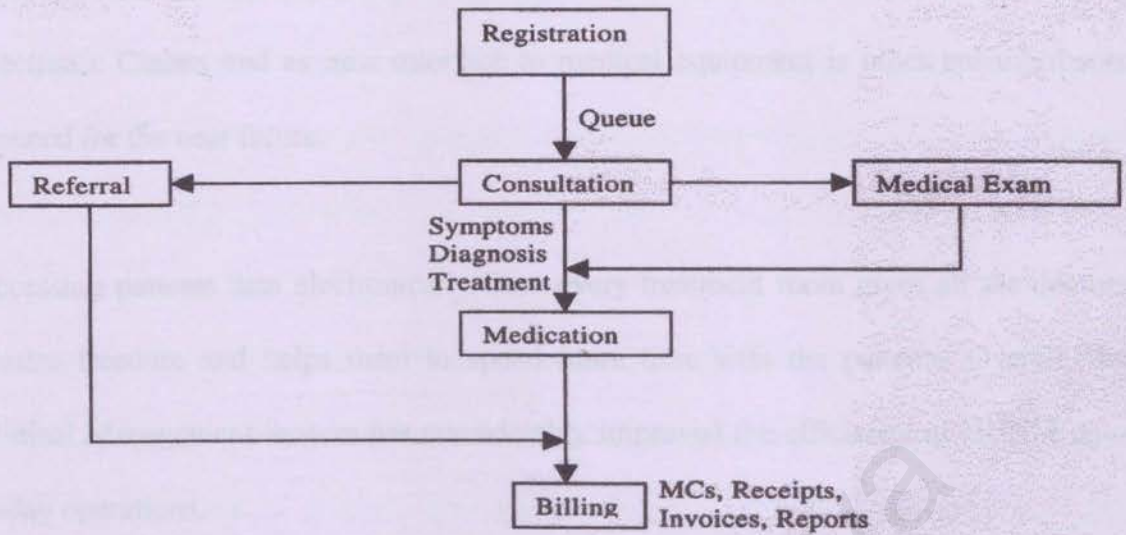
Figure 2.7: Workflow For Provider Management System (PMS) HUKM

The core workflow starts with the registration procedure done by a nurse. Thereafter, a doctor will be assigned to the patient in queue. The assigned doctor will then retrieve the patient's details from the system, proceed with consultation, note the symptoms, identify the diagnosis, administer treatment, perform medical examination if necessary and keys-in an on-line prescription. Once the pharmacy has received the prescription, it will immediately dispense the medication to the patient. After dispensing the medication, the cashier will print out the receipt and, if necessary, medical leave for the patient. In case the patient needs to be referred for emergency, HUKM will then print the referral letter for the patient.

The standard reports available through the Provider Management System (PMS), encompass Patient Medical Reports, financial summaries and drug utilization reports.

They all have been customized to HUKM's requirements. Thus they serve as valuable tools to enhance the capability to manage the referral center. The submission of Electronic Claims and as new interface to medical equipment is other enhancements planned for the near future.

Accessing patients data electronically from every treatment room gives all the doctors greater freedom and helps them to spend more time with the patients. Overall, the Clinical Management System has considerably improved the efficiency of HUKM day-to-day operations.
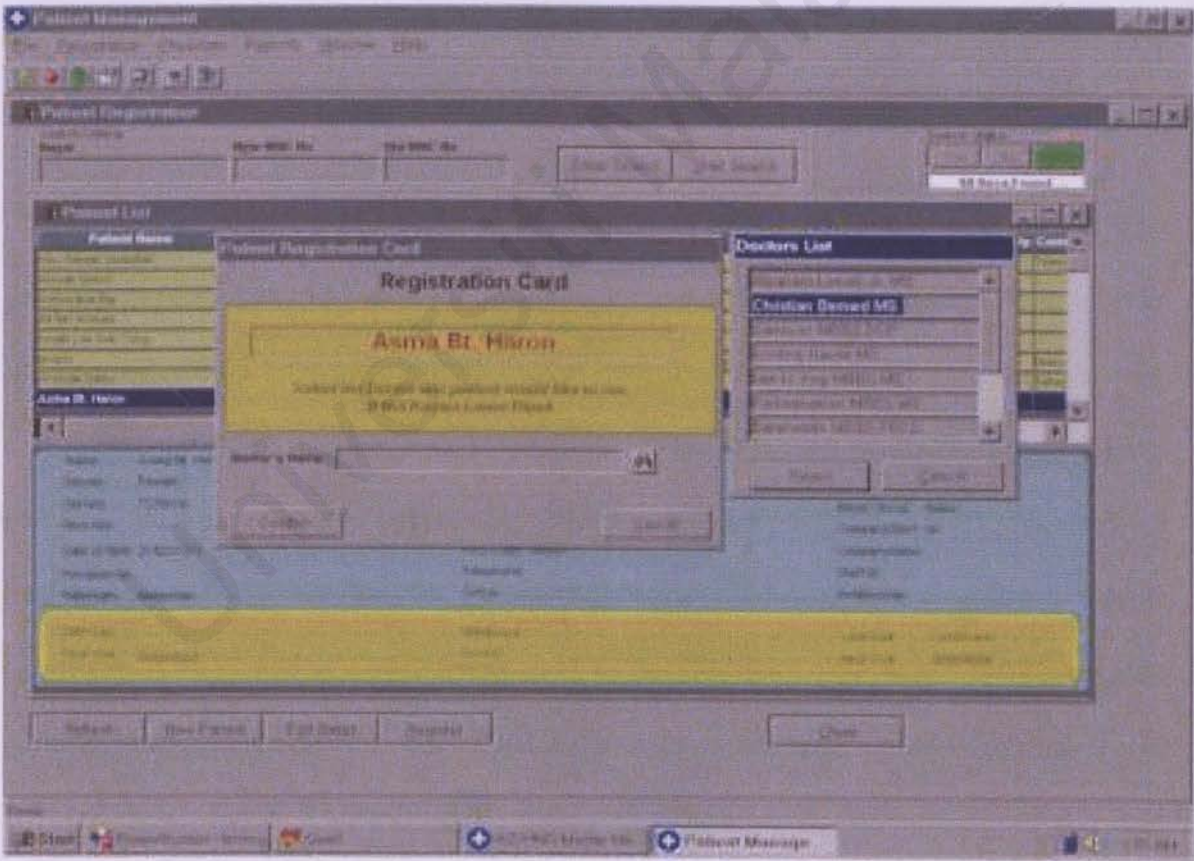
Figure 2.8: Patient Registration Screen for PMS System

Another system that is being used in the hospital is the Case-Mix system. The Case-Mix system is introduce reduce costs in healthcare financing in the country. Under the system, patients would know in advance the costs and the duration of the treatment as everything would be laid down.

The government and other healthcare financiers would have a structure of disease conditions and would be able to determine the costs and funding a hospital needed to attend to each type of disease. The system would also help hospitals to be more appropriately funded in the future and to better manage their care costs. HUKM took the initiative to implement the system in July last year to improve its services and resource management, and the outcome had been reported to be good.

In July 2002, Hospital UKM officially implements the Case-Mix System as the first hospital in Malaysia. The aim of the project is to use case-mix system as a tool to improve efficiency and quality of in-patient care in the hospital. A case-mix team was established and placed in the Medical Record Office. A series of briefing and training sessions was carried out to ensure that the project received full support clinicians and supporting staff in the hospital. International Refined Diagnostic Related Group (IRDRG), ICD-10 and ICD-9CM was used to develop the iso-resource groups for this project. Costing analysis was carried out using a combination of top-down approach and activity-based costing. Intermediate software programmed was developed to link IRDRG grouper with the existing hospital information system. Coders code the diagnoses and procedures directly from discharge notes and entered into the existing

system.

The system has managed to provide highly important input to improve the hospital information system. Development of cost-weights within the case-mix groups will enable the hospital to embark on policies to improve efficiency in the near future.

2.3.5 Policlinic Kumpulan City, Kuala Lumpur (Provider Management System and developed the Clinical Management system)

Poliklinik Kumpulan City is a group of 18 clinics spread over Klang Valley. This established chain of clinics were using manual system whereby patients' information were recorded onto 4" x 6" cards. The management did not have adequate control over the clinic workflow and was greatly affected by high staff turnover. To work efficiently, the management required a proper workflow system which could facilitate timely and accurate financial information as well as administrative details, drug inventory, patient management and medical record.

Figure 2.9: Family History Screen For PMS System

The objectives of the system is to provide a flexible Clinical Management System to enable the clinic group to have better control over patient management, drug inventory, electronic medical records, billing and patient medical examination. The Clinical Management System collects patient details and the medical record are then generated electronically. More importantly, this system supports the newly established workflow and performance at each level.

The Clinical Management System was built on an Open System environment running on the Windows NT and Windows 95. It provides friendly graphical user interface with greater ease-of-use, ease-to-learn and flexibility to both the doctor and nurses. The implemented clinics have a client server environment with paperless operations.

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The workflow consists of a nurse registering the patient. Thereafter, a doctor will be assigned to the patient in queue. The assigned doctor will then retrieve the patient's details from the system, proceed with consultation, note the diagnosis, administer treatment, prescribe medication and referral for a X-ray. The patient will then be put on Open Patient Listing pending the X-ray report. Once the patient returns from the X-ray room, the nurse will retrieve the prescribed drugs and prepare the medication. After dispensing the medication, the nurse will print out the receipt and medical leave, if necessary, for the patient.

Hence, all information captured including the X-ray report, are stored as Electronic Medical Record which can be retrieved at any point in time. Furthermore, various reports can be generated ie Patient, Medical, Monthly Report for financial purposes. These reports can also be used as Audit Trail, Claims and Panel Billing. Without a proper Clinic Management System, Poliklinik Kumpulan City would not have had sufficient control over the performance of the clinic, its staff or their profitability.

2.3.6 Tele-Primary Care System (TPC)

TPC is on development Hospital Management System for local hospitals and clinics in Malaysia. This project is being executed for the Ministry of Health (MoH) to automate certain business processes in their primary health care center.

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The core purpose of this project is to build a Clinical Information System (CIS), which centralizes specialist healthcare and ensuring communication between state level hospitals to district level hospitals and health center. CIS would also ensure that all relevant specialist healthcare related information is provided to primary healthcare centers, where such information is lacking. The system recommended would provide MOH with the scope of growth to an integrated Clinical Information System. As the proposed CIS takes advantage of the latest Distributed Computing Architecture, the application has in-built n-tier architecture.

The objective of this project is to build a comprehensive Clinical Information System, which enables integrated healthcare information and services across all MOH tertiary and primary hospitals and health clinics. Components that are included in the CIS would include Patient Registration (patient information, healthcare history, allergies), Diagnostics Module (disease diagnostics, medication recommendation, health center recommendation), Lab Order (electronic and standardized test result forms), Radiology, Pharmacy (drugs inventory control, availability, ordering), Billing (hospital and health clinics billing)

MOH would like to implement this project in 5 pilot state hospitals in Johor, Selangor, Negeri Sembilan, Sarawak and Sabah for the beginning before proceeding to the entire states if the system is successful. The objective of this approach implementation is reflected in the following reasons:

- To ensure a smooth rollout of the project. This is to make sure that each state is implemented successfully before jumping into the next one. Since all hospitals and health centers are going to be integrated, all CIS modules at each state hospital must be implemented successfully in order for the entire system to run smoothly. Any disruption in the implementation of any state hospital will affect the other states hospitals.

- The IT personnel is allowed to embrace the introduction of new technology progressively before transferring the knowledge to the end-users.

- End-users will be introduced to the technology progressively, thus avoiding any phobia or procrastination towards the application.

- By spreading investment across different phases, MOH will be capitalizing on its capital and technology acquired.

These are the modules and recommendation for the system based on the MOH requirements:

1) Implementation of Clinical Information System. The following are the modules which will be included:

  - Patient Registration

  - Diagnostics

  - Lab Order

  - Radiology

- Pharmacy
- Billing

2) Creating online SOP documents for 200 volumes

3) Integration with MSC Telemedicine application

4) Integration with existing Inpatient and Outpatient Management System

Based on the functional requirements study, the Tele-Primary Care System can be developed into several application modules in order to provide clinical information management and tele-consultation facilities, which can improve the overall operations and services of primary health care clinics under the Malaysian Ministry of Health. The architecture of Tele-Primary Care System is based on client-server model comprises the following eleven major modules and six optional modules.

1. Patient Registration Module

2. Patient Master Record Module

3. Appointment Module

4. Consultation Module

5. Dispensary Module

6. Inventory Module

7. Administration Management Module

8. Maintenance Module

9. Report and Statistic Management Module

10. Security Management Module

11. Laboratory Management Module

12. Dental Module [Optional]

13. Financial Management Module [Optional]

14. School Health Module [Optional]

15. Rehabilitation Module [Optional]

16. Short-Messaging Module [Optional]

17. Public-Key Infrastructure Module [Optional]

TPC COMPONENTS

The proposed solution based on this architecture will have the application and database to be hosted on Sun 4500/5500 Server as the preferred hardware on a Solaris platform. The proposed platform renders MOH with the flexibility and scalability to grow internally and/or externally without resorting to any major renovation or re-design to cater for the increase in data traffic.

The database, design and development tool that will be used for the development customization are Oracle Developer.

In summary, our technical solution for the Clinical Information System shall consist of the following components;

Application Development Tool	Oracle Developer
Network Operating System	Sun Solaris
Database	Oracle 8i

Table 2.1: Components of TPC

The Oracle tools and technology proposed are the latest solutions that adhere to the open systems architecture. With the proposed solutions, MOH will be able to move into a Internet environment easily and without incurring new investments in technology. All the tools proposed are inherently designed with Internet computing capabilities.

2.3.7 Pantai Medical Centre, Bangsar

The 230-bed Pantai Medical Centre is part of the Pantai Group of Hospitals, which includes seven private hospitals throughout Malaysia. The first system implemented is comprehensive and included among others, functions for patient management, patient billing, order management, pharmacy and materials management. In addition, the original version also handles the appointment system, operating theatre management, dietary management, financial systems and interfaces to third party systems such as laboratory information and PABX.

The latest upgrade provided to Pantai Medical Centre is aimed at consolidating functionalities to enable the hospital to provide even better service to their patients. The hospital is also presented with a richer user interface that enables them to obtain all the

key information at their fingertips. The hospital can spend their time focusing on their core services, that is, providing optimum healthcare services to their patients.

The HIS has resulted in:

- Reduced waiting time for patients during discharge and payment as the HIS will auto-calculate all charges

- Better inventory management

- Strong audit trails to protect patient records

- Rich set of functions to cater for most hospital functions and for all management analyses.

The system provide a full range of HIS solutions for Pantai Medical Center covering hardware and software with the design and implementation in the areas of:

1. Patient management

- handling all administrative matters pertaining to patients

2. Patient accounting

- designed to cater for both Government and private accounting systems

3. Order management

- reducing time spent in generating or amending ancillary orders for patients

4. Pharmacy system

- direct interface with material management

5. Material management
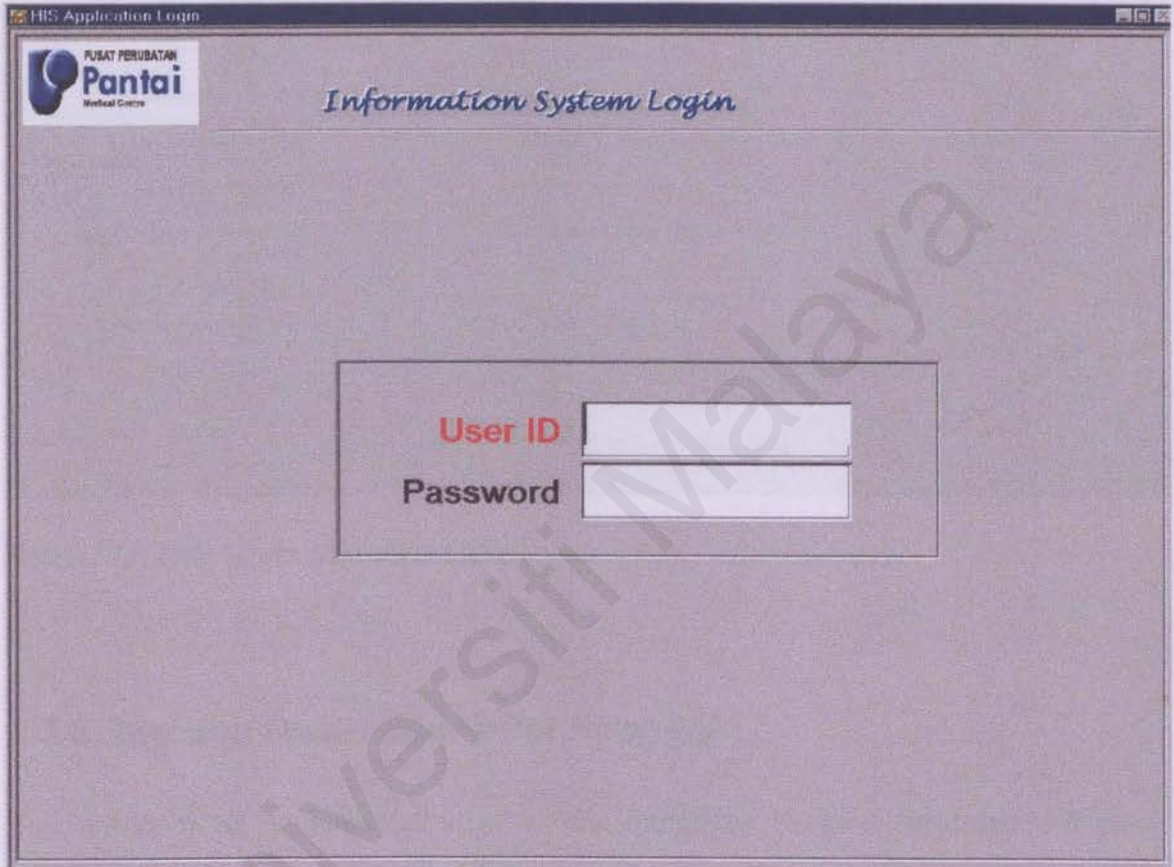
- handling creation of stock or non-stock material

6. Appointments facilities

- quick, easy and comprehensive to electronically maintain doctor appointments

7. Financials system

- Auto-calculate all charges and maintain accurate and up-to-date billings

Figure 2.10: System Login Screen

Figure 2.11: Main Screen for Patient Billing

2.3.8 Ampang Puteri Specialist Hospital

The system is an implementation of a fully integrated Hospital Information System called CHIRON for Ampang Puteri Specialis Hospital at 1 Jalan Mamanda 9 Ampang. The software includes modules for Patient Master Index, Inpatients, Outpatients, Appointments and Scheduling and Financial Accounting System. The system runs on an AMP PDS cabling infrastructure and fiber collapsed backbone accommodating for over 250 nodes. Running on HP 9000 server and distributed across 5 storeys. Combination of Intelligent Client Workstation and Dumb Terminals running on UTP cabling

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infrastructure. There was comprehensive training for users (especially nurses) and the

hospital's technical support team on how to use the system .
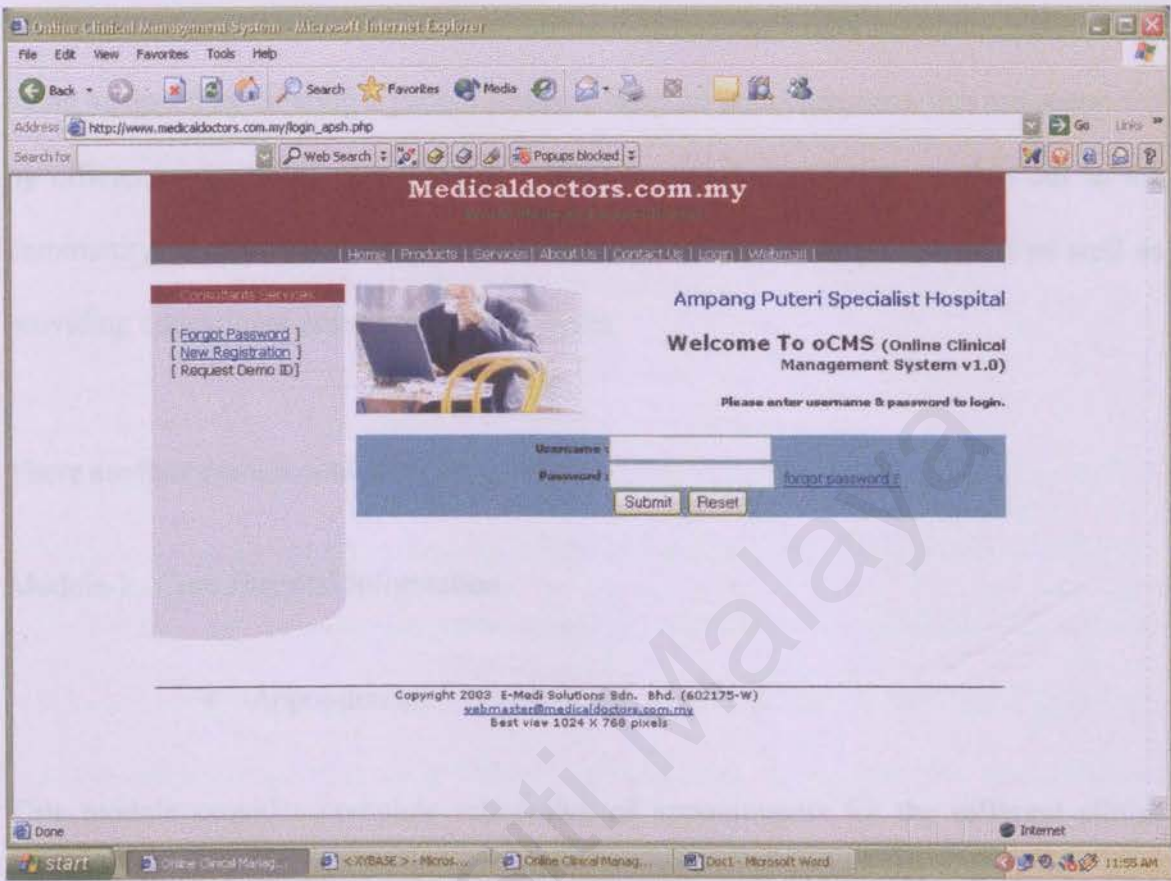
Figure 2.12: System Login Screen

2.3.9 Subang Jaya Medical Centre

The implementation comprises of a full HIS for this 375-bed hospital. The system

features the Copernicus Core module, Pharmacy module and the interface to the existing

Oracle Financial system. Subang Jaya Medical Centre needs a full patient administration

system that can grow with the hospital in order to satisfy its present and future

requirements.

The scope of work for this system is to implement HIS and Pharmacy module and their integration with the already installed Oracle Financial Management System Subang Jaya Medical Centre promotes the lifetime wellness of its community members. This role is being achieved by creating a patient centered hospital with caregivers that are supported by efficient infrastructure, technology and processes. Subang Jaya reaches out to the community through networking with other hospitals & general practitioners as well as providing educational outreach for the patients.

There are four main modules in this system:

Module 1 : Core Hospital Information

- Appointment

This module provides complete scheduling of appointments for the different clinics based on availability of various hospital resources, like doctors, equipment etc. The software gives a graphical view of the time slots available for booking, besides giving details on the percentage of appointment(s) fixed for doctors each day. Expert functionality covers features as the configuration and maintenance of the hospital master calendar, clinic timings within the master calendar and the setup of doctor and clinic sessions, including the flexibility to set absence times within a given session. The system has the facility to capture Do On Arrival (DOA) and Trace On Arrival (TOA) instructions for each appointment thereby facilitating the counter staff to ensure that proper steps are taken without any time delay when the patient arrives for the visit.

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The system also provides various alerts, reports and other features. Some examples are an alert if a patient has more than one appointment on the same day, or an appointment with the same doctor, waiting time exceeding alarm, cancellation report by clinic and session, several standard letters (cancellation, conformation) and several types of booking lists.

- Patient Master Index

The patient registration module allows for the capture of basic patient details as well as financial related information. Capturing financial information of the patient at this stage itself allows the hospital to streamline its billing and collection efficiently. The module optimizes and automates outpatient workflow from creation of individual visits and clinical consultations, right up to billing and collection of charges. The system allows registration staff to register a new patient, capturing personal information (contact details, allergies and biohazards etc.) and financial information (third party payers-eligibility, conditions and amounts).

- Visit Management

The system allows users to perform admissions, maintaining of bed board, bed-pricing structure, bed allocation, (and transfer) and maintains up-to-date bed-status information. It also enables consultation, procedures and charges to be conducted in a similar fashion as for outpatients. This module also enables an interim bill to be generated, as well as

close the visits with its final billing. The system alerts housekeeping staff of any changes of the bed allocations e.g. bed requires cleaning, and provides various reports like patient status and admission report by doctor. It tracks the individual productivity of the staff involved in the process, thereby helping the management to focus on personnel whose productivity is not up to desired levels.

- P.M.F Tracking

Even after an electronic medical record is implemented, for medico-legal purposes, certain details will still have to be maintained on paper. Examples are consent forms, legacy medical records, medical records from other facilities, etc. In order to ensure that the Patient Medical Folder can always be located within the hospital, the system provides a sophisticated tracking module. This system handles the tracking of the Patient's Medical Folder within the organization. Bar-code scanners can be utilized to rapidly check in patients' folders. Appointments, operations and other such activities

- HL7 Interface

The system has been developed taking into consideration the standards that exist in the Healthcare IT industry. Therefore the system provides HL7 interface for ADT, Diagnosis and Charging. This ensures that the system is adaptable to third party solutions which would be in a position to receive and send data using the HL7 specifications.

Module 2: Material Management And Pharmacy

- Dispensing

The system handles all aspects of the dispensing function - irrespective of whether the patient consults a doctor either in the outpatient clinic or the wards. In all cases where medication is required, the doctor can prescribe this on-line in the clinical module.

The prescription is then sent automatically down to the main pharmacy where the labels can be printed directly (either automatically or after intervention by the pharmacist). This eliminates the time consuming and error-prone transcription step. After the medication is picked, labeled and handed over to the patient the pharmacy staff prints a bill for the drugs, collect money, and issue a receipt to the patient. Optionally the system also integrates with the HIS system to keep track of the bills raised.

- Purchasing

All aspects of the purchasing function, including purchase of drugs, fixed assets etc., are handled by this system. The system has the facility to generate stock purchase orders in addition to the normal purchase orders. The system also detects if the updated stock level falls below a certain level based on predefined algorithms. If so, the system will issue a warning to inform staff to top up the inventory. A user can top up the inventory by creating a purchase request and getting approval for that. Once approved, the user generates a purchase order with most of the data obtained from the master files of drugs and suppliers maintained in the system. The purchase order is then printed and sent out to a supplier. The system has the NPMI codes integrated into the system thereby having a standard for identification/codification of drugs.

- Inventory Management

The system is very comprehensive in its coverage - drugs, consumables; assets are all covered under this module. When the supplier provides items against the purchase order, the items will be received by appropriate staff that will inspect, store items, and enter the receipt of items into the system. The system will update the purchase order with the items received. The system has a provision to accept items which come under the category of "Bonus" when other items are purchased in addition to the facility of

accepting alternate items for those ordered. The system provides for unlimited stores, rental items, blanket purchase orders, consignment items, stock transfers, department issues, stock take and stock adjustment.

Module 3: Clinical Workstation

This module will handle the clinical and order entry functions. It will form the doctor's desktop from where the doctor can access the HIS, combining medication history, laboratory orders and prescription generation. The heart of the system is an Electronic Medical Record, which integrates clinical findings, lab/histopathology orders, clinical diagnosis, prescriptions and disposition of patients across multiple visits. It standardizes the recording of consultation notes and streamlines visit management by managing order entry and results reporting across various departments such as biochemistry laboratory, histopathology, and nurses' workstation. This module has the following standards built in: ICD-9, NDC & LOINC. Further there is a HL7 interface available, which ensures that the software can integrate itself with any other external application. The charges are automatically calculated at the moment of ordering. Prescriptions issued from this module will be passed electronically to the pharmacy module where the labels will be automatically printed and stocks deducted.

Module 4: Operation Theater Scheduling

The OTS forms a tightly integrated part of the HIS solution. It shares critical masters (like surgery master checklist) with the HIS, including medical alerts and allergy data. The OTS has an option where the pre-surgery and post-surgery details are captured in detail. These details include the doctors, resources, tests to be done, medication to be give and so on. Graphical resource and theatre scheduling plays a critical role in helping an OT department improve the quality of its managing time and service.

This module has links to MMS for automatic ordering and charging.

Table 2.2: System Features

Criterion	Feature	Benefit
Security Standards	HIPAA, X.12	• Ensures compliance with HIPAA standards while ensuring privacy of the patient information • Latest electronic standards adaptation ensures faster processing of information
Data Standards	ICD-9, CPT4 and NDC	• Data sharing, migration, export, import is made seamless due to adherence to these standards. • Interface with any third party or existing software therefore is executed easily.
Efficient data entry	In all modules templates are provided which can be updated on the run	• More data is captured with less time / effort • Increases user satisfaction/ efficiency and decreases resistance to implementation
Design	Business rule based	• When changes or customization have to be done the time taken and rework done is less, as it involves changing only rules and not codes, as is done in other

		• non-rule based products. • Implementation time is less • Lesser level dependence on the software provider for maintenance and changes. • More clarity on business processes, allowing for the management to rethink the way work is being done.
Interface to devices	Barcode readers, Hand-held PC's and Laboratory devices (DICOM standard)	• High degree of automation is possible • Reliability of data is very high
HL7 Ver. 2.3	Fully Compatible	• Meets international Healthcare data transfer standards • Ensures that system is ready for integration with any external system following the HL7 standard
Integration to Email/Fax/ Paging services	Seamless integration	• E mail and fax messages can be sent from within the software itself in addition to paging via SMS, rather than having to come out of the application. Saves time and considerable cost. • Ensures that key personnel like doctors are kept informed on instances.
Data presentation	Data push technology	• Data is presented to the user on dates/events etc as specified, eliminating the need for excessive memory based manual follow up. This is different from mere exception or variance reporting and more helpful for decision-making and course correction.
Language Support	Local language compatible along with Unicode support	• Ensures that implementation is easy and fast as adaptation time is reduced by removing any barriers • No requirement for users to learn new language • Reduces cost of implementation and increased usage
Linking	Drill down	• User's have the flexibility to navigate through data across modules as and when required. • Ensures that information is made available at the right time.

2.3.11 Kuala Lumpur General Hospital

Kuala Lumpur General Hospital is one of the hospitals in Malaysia that is currently a non computer-based hospital. Their daily operation is still using papers and storing information in cabinets with indexing . To obtain the information needed the nurses have to search from the stack of documents that have been sorted and this takes plenty of time, in which this can be done in minutes with a computer system.

Hospital activities such as nursing care, administrations, laboratories, are all managed separately, in different operational units with many hierarchical levels. Communications in the hospitals are complex, including complex regulations and extensive use of standards and paper work.

Nurses flexibly used forms as they wanted or needed. Many of the forms were set out as structured templates, the nurses often fill left blank or added free-form notations evolving the forms to meets their own needs. The forms used are drawn up in functional columns of common activities such as observation, medications, that need to be carried out for the patients assigned to the nurse. Different nurse have different preferences for gathering an information overview of all the patients in the ward. Some used the printed Nursing work sheet, most however used the blank template from that had been locally developed, photocopies and shared around, as they felt this gave them more flexibility. Still others prefer to used small note book that can fit in their pocket because they could keep the useful information. Not only do different individuals have their own preference

for types of form and used of forms, but also each ward had their own local conventions and preferences.

An observation sheet at the end of patient's bed became the point of communication between the doctors and the nursing staff looking after the patient. There are many reports that nurses and doctors need frequently, providing this the information to the doctors as when required is not possible as it may be a time consuming process as the records need to be updated frequently and recalculated. For a more accurate report to be handed over, all the reports have to be double-checked by the authorized person. The nurses have to flip the pages manually to compare the data from one file with another in order to confirm or decide to give any medication which might cause allergies.

As for rostering, the nursing sister have to do it manually in papers with given templates and she have to update the roster if any circumstances occur like staff taking emergency leave or MC. The nursing sister will first do a temporary roster using pencil. After it is confirm than only she will make a master roster for the staff to view their assignment and duties. If any changes have to be made, the nursing sister will just cancel and update the master roster for that particular staff. Sometimes by the end of the week a new clean master roster is re-write if the previous roster is to congested with correction. Roster made for the allocations of staff shifts usually done once in forth night.

There is a billing system in Kuala Lumpur General Hospital. But this system is just a small system (standalone), for interim bills only, and some of the task still have to be done manually.

Figure 2.13: Example of Printed Receipt To Be Given To Patient as per Discharge.

2.4 Discussion Of Interview Analysis And Research Analysis

The overall aim of the study was to compare the computer based and paper based
nursing documentation system regarding time investment, user acceptance, user
requirement and to find out the task to be carried out by nurses (work segregations).
From the interviews made, it was found that there are two basic nurse categories that are
staff nurse and community nurse. Staff nurse has the responsibility for many tasks in the
ward. As for the community nurse, has the responsibilities associated for a smaller

number of patient, and not all the task that are carried by the staff nurse can be carried by the community nurse. This can be illustrated by different ways of giving medicine. The staff nurse can give injections and all the prescribe medicine but the community nurse can only give regular medicine for the patients. The nurse have to give daily report every day. Obviously there is a need for passing information from one shifts to the other. There is also a need for information in other connections. Regardless of the way nursing is organized, the nurses take the responsibility for the totally of the ward. This requires the nurses to have an overview of the ward. In order to give the patients the best care, the nurses need to know about each one for the patients in the ward. This overviews is a combinations of knowledge about each patients and knowledge about who is on duty and who is responsible for carrying out the various task. To summarize all the nurses gather information in order to plan and carry on their work, both in relation to caring of patients and to the coordination of different task. In the non- computer, as we all know there is the paper based system use to which all the information gets are all recorded in paper in a form based and put in files and lastly stores it in the cabinet that has been index. The forms correspond to the phases of nursing process. The information assessment is usually documented shortly after the patients has been admitted . this also applies to the nursing care plan, which may be changed according to the patient's condition. The planned tasks are executed and then signed by each shift on a corresponding form. Each shift writes a short nursing report. As to find previous patient record, nurses have to search from stack of documents that have been sorted and this takes plenty of time, in which this can be done in minutes with a computer system.

The Power Chart is the name of the system used in Selayang Hospital. The system is rather simple. The systems produces some paper reports. This reports replace the scraps that the nurses use during shift. At the beginning of each shift, there is a meeting where one nurse from the preceding shift gives the new-comers a status report. Each of them writes the most important information on their own scraps, during the shift, the nurses use the scraps to look up information, and to write down important observations and happenings. The systems shows information about the patients who are now staying in the ward in a matter of seconds. The information are structured according to the beds of the patients. This shows that electronic documentations improved in many ways in areas which reflect nursing quality. But there is an argument by nurses that says that they will prefer a system which can alert a doctor to view their observation and assessment and made further assessment and treatment to be given to the patients. And some of the nurses also says that they prefer paper kind of work for jotting observation information as paper is easily portable and carried to the point of needs, and paper is easy to fold up and carry in pockets or hang form identification badges with minimal intrusion, but as to search for information of patients, that have been made by others they prefer it to be computed. Another big challenge of going "paperless" is the human resistance to change. They have to manage change and change management process has to be in place. All hospital staff (nurses) underwent an intensive training programmed on how to use the various computers in the respective departments. Still, the lack of confidence in using the system has been one of the major problems. Time is an important factor in the development of documentation and the time used can probably be reduced when the staff received additional training in using computers. As conclusions, some of the nurses prefer both techniques of documenting information.

The majority of computerized hospitals in Malaysia do not have the facility to generate the roster automatically, but the module has been suggested to be implemented in the Tele-Primary Care system (TPC). Rostering and working load is done manually by the nursing sister for all the nurses and attendance, while it is set up by the matron for the nursing system schedule. Setting up a roster is a very tedious job. Before this there was a system developed for Selayang Hospital called UTD system, but this system fails as it does not fulfill the user requirement as proposed by the hospital. This system sets a few sets of schedule timetable and this have to be choosed by the user which one they want to use and this will be used forever. The user have no freedom to change and set up the rosters as times goes based on time conditions. As asked to the nursing sister in the interview session, they really appreciate if there is a rostering system to be used, to make their job easier as all the nurses can just do and electronic request for emergency leave or for swapping duties, and this will alert them to change the roster for the week or so but some of them finds that an automatically generated roster was time consuming to review, results were not always useable, and the criteria and priorities required to generate an adequate roster were too complex. These are the user requirements for the rostering module:

- Database containing the nurses details.

- Should be able to printout this information

- Should be able to specify when nurses are unavailable for work.

- Should be able to print out individual rosters.

- Should be able to print out the shifts.

- Should be able to add notes for each week.

- Be able to print out the 12 week roster containing:

    ➢ Who is doing what shift on what week?

    ➢ Who is on holiday that week?

    ➢ The notes for each week.

- Have easy to use online help

- Be able to generate Roster and Shift Web   pages and place them on a
  web server

- Be accompanied by a user manual

The Ministry of Health also introduced the Case-Mix System (which is currently use in
HUKM) in Malaysia through a top-down research project in 1998 developed by the 3M
Inc. Nationwide implementation of case-mix system were delayed due to many factors

including failure to convince the policy makers on the relevant of case-mix in resource allocation and the absence routine data collection on medical procedures. The pilot project of the system would be tested soon in 12 hospitals in the country [35], and if found effective would be extended to other hospitals. The hospitals are the three university hospitals of UKM (Cheras), USM (Kubang Kerian, Kelantan) and UM (Petaling Jaya) and nine government hospitals throughout the country.

Everyone are looking forward to paperless hospitals that will allow all aspects of the care of a patient to be truly integrated and maximized for the patient's benefit so that timely and appropriate involvement can be made, while medical records will be readily available and quickly retrievable. IT will also strengthen management of hospitals and facilitate data collection and management and allow on line quality monitoring and audit activities and introduction of telemedicine in its various forms.

2.5 Conclusion

It has been known long time ago, that the hospital that is managed manually is not efficient, the users of electronic management system are estimated to bring a very drastic change in the nursing field. This chapter covered all the process involved in the data gathering. Actually technology in the field of computing changes more as time passes by until today, it has emerged as one of the most advanced technology. Today the computer technology is most needed in human's life in every aspect. One of the intended computer usage fields would be in the aspect of hospitalization. From the purpose explained above, this phenomenon is the motivation for the development of this system. In addition, implementation of such system will of course help to widen the usage of computer technology more in our country.

CHAPTER 3

METHODOLOGY AND

SYSTEM ANALYSIS

3.1 Introduction

A system development process is a set of activities, methods, best practice, deliverables, and automated tools that stakeholders use to develop and maintain information system and software [2]

In this chapter, I will focus upon the system analysis phase of the system development project (HMIS), which consist of preliminary investigation, requirement analysis and decision analysis. These phases are collectively to as system analysis. Process of system analysis will be successful when:

- Define system analysis and relate the term to these phases of the system development
- Describe the system analysis approach for solving the system problems
- Describe these phases in term of propose, participants, input, output, techniques method and steps.
- Identify specific system tools and techniques

3.2 Object Oriented System Development Methodology

Object-oriented development offers a different model from the traditional software development approach, which is based on functions and procedures. In another words, OOSD is a way to develop a software by using self-contained modules or objects that can be easily replace, modified, and reused. In object oriented environment, software is collection of discrete objects that encapsulate their data as well as the functionality to model real-world objects [3]. Each object has attributes (data) and methods (functions).

In object-oriented system, everything is an object and each object is responsible for itself. The object-oriented development emphasizes its cooperative philosophy by allocating tasks among the objects of the application [3]. In other words, rather than writing a lot of code to do all the things that have to be done, it can create a helpers that take on an active role and that form a community whose interaction become an applications.

3.3 Why an Object Orientation?

Object-oriented methods enable us to create sets of objects that work together to produce software that better model the problem domains than produced by traditional techniques. The system are easy to adapt to changing requirement, easier to maintain, more robust and promote better design and code reuse. Object-oriented development allows us to create modules of functionality. Here are some reasons why I choose object oriented method for HMIS development:

- It give higher level of abstraction
- Seamless transition among different phases of software development
- Encouragement of good programming techniques
- Promotions reusability

3.4 The Object-Oriented Approaches

The OOSD consists of:

- Object-oriented analysis (OOA)

- Object-oriented information modeling

- Object-oriented design (OOD)

- Prototyping and implementation

- Testing, iteration and documentation
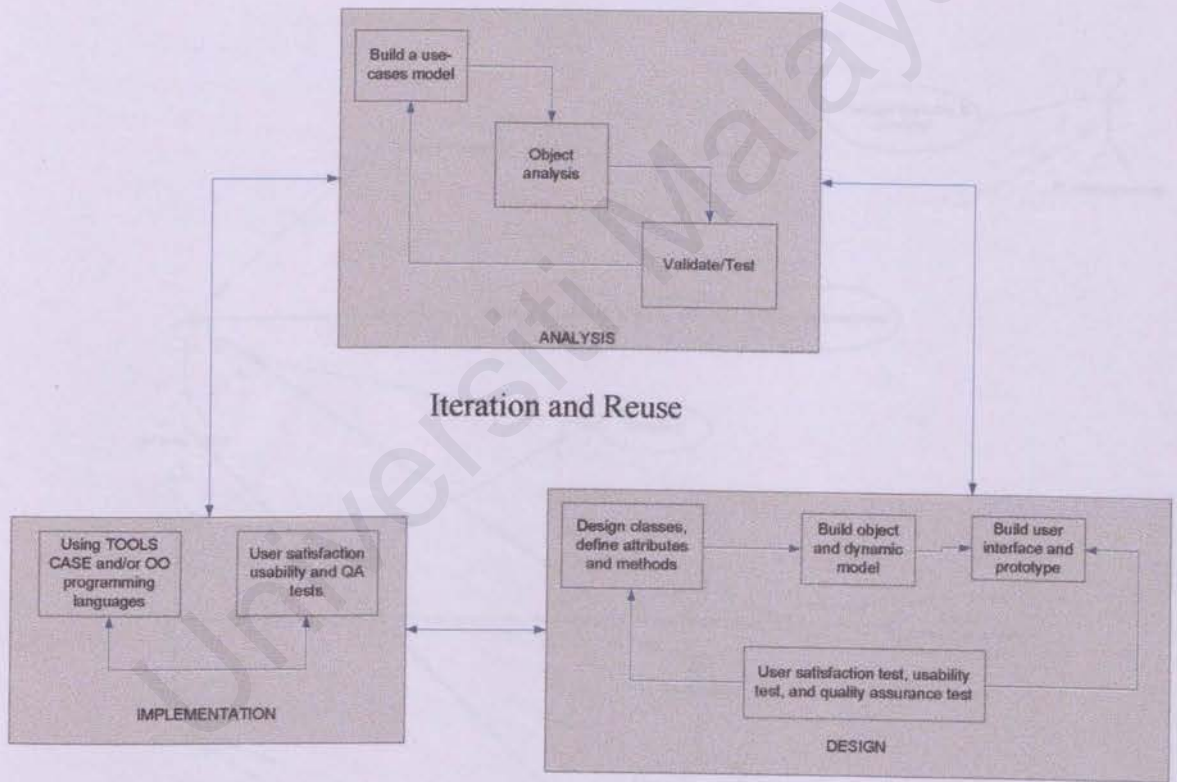
Figure 3.1: Object Oriented Development Process[3]

3.5 System Analysis Phase

3.5.1 Object-Oriented Analysis

3.5.1.1 Overall Use Case Model
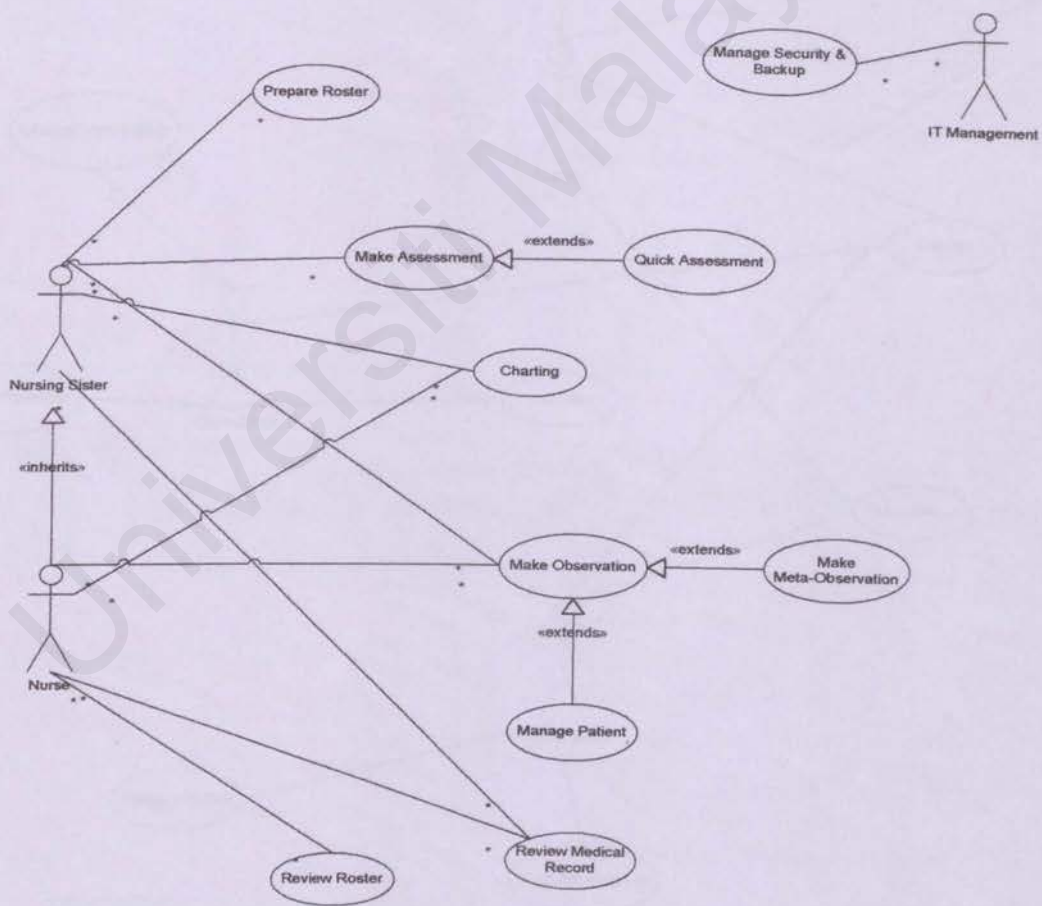
Figure 3.2: Overall Use Case Diagram For HMIS

3.5.1.2 Workload Assessment and Rostering Module
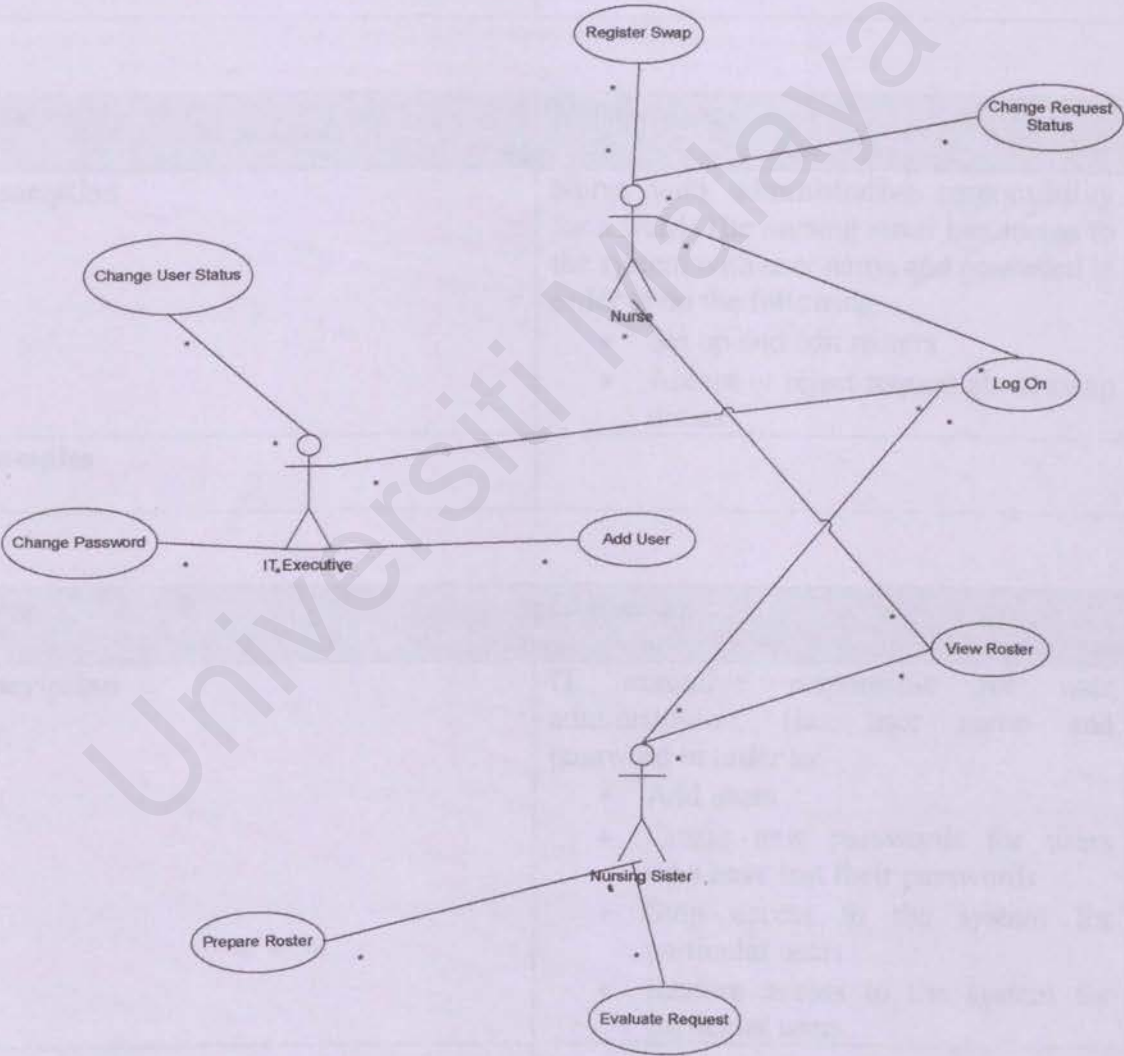
Figure 3.3: Workload Assessment And Rostering Use Case Diagram For HMIS

Table 3.1: Workload Assessment And Rostering Actors

Actor	Nurse
Description	The nurse has access to the system in order to do the following: • View own roster • Register request for swap duties • View result request
Examples	Staff nurse, Community nurse, attendance

Actor	Nursing Sister
Description	Nurse with administrative responsibility for a ward. The nursing sister has access to the system with user name and password in order to do the following: • Set up and edit rosters • Accept or reject request about swap duties
Examples	

Actor	IT Executive
Description	IT executive responsible for user administration. Has user name and password in order to: • Add users • Create new passwords for users who have lost their passwords • Stop access to the system for particular users • Restore access to the system for particular users
Examples	

Table 3.2: Workload Assessment And Rostering Use Cases

Use Case	1. Log on
Actor	Nurse, Head nurse, IT Management
Trigger	A nurse, the nursing sister or the IT executive who wishes to use the system
Pre-Condition	Non
Post Condition	The actor is logged on to the system with determined access rights
Normal Flow of Event	1. the actor enters username and password 2. the system verifies user name and password 3. the systems logs the actor on the sets access rights according to the actor type

Variation	2a. The actor is logged on to the system for the first time
	    2a1. Include use case "change password"
	    continues from step 3

Related Information	

Use Case	2. Change password
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the nursing sister or the IT executive who wishes to change the password
Pre-Condition	The actor is logged on to the system
Post Condition	The actor has received a new password. The password has been registered to the system
Normal Flow of Event	1. the actor chooses to change the password 2. the system lets the actor enter a

	password
	3. the system verifies the password and save it
Variation	3a. The password does not satisfy the password rules
	3a1. The system sends an error message containing a description of the password rules and asks the actor to enter new password
	continues from step 3
Related Information	The password must at least contain 6 digits, at least one number and start with a letter.
	This use case is included by the use case "log on"

Use Case	3. Add User
Actor	IT executive
Trigger	The actor is logged on to the system
Pre-Condition	The user is new
Post Condition	None
Normal Flow of Event	1. The actor chooses to register a new user
	2. The system gets information about the new user from the personnel management system and generates a user name and password
Variation	None
Related Information	Personal information will be name, employee number and position code. The use name must have maximum 10 digits and will contain first name, initials.
	The password must have at least 6 digits, contain at least one number and start with a letter

Use Case	4. Change User Status
Actor	IT executive
Trigger	The IT executive is logged on to the system
Pre-Condition	None
Post Condition	The user has been registered to the system
Normal Flow of Event	1. The actor chooses to change user status and enters the user's personal information 2. The actor chooses to deactivate the user's access 3. The system sets user access in the user object to no access.

Variation	2a. The actor chooses to activate the user
	    2a1. The system restore the user's access to the system
	    the end of use case
	2b. The actor requires a new user password
	    2b1. The system generates, display and saves password
	    the end of use case

Related Information	A change of status may be one of the following: • A user looses to the system, is deactivated, because he or she is on leave or has left the ward • A deactivated user is activated • A user has lost his/her password and receives a new one

Use Case	5. Prepare Roster
Actor	Nursing sister
Trigger	The nursing sister selects roster from a menu
Pre-Condition	The nursing sister is logged on to the system. A template for the rosters is available in

	the system
Post Condition	A roster for the next period has been set up
Normal Flow of Event	1. The actor chooses to set up a roster 2. The system display the screen for rosters. The nursing sister may select nurses and duties in the drop-down list 3. The actor fills in the duties for the period and which nurse will have which duty 4. the system checks that the proposed roster works and saves it

Variation	2a. The actor chooses to import an existing roster
	    2a1. The actor selects time period
	    2a2. The system display appropriate rosters
	    2a3. The actor select roster.
	    The use case continues from step 3
	4a. The proposed roster is not working
	    4a1. The system displays an error message stating why the work schedule is not working
	    4a2. The actor makes the necessary changes.
	    The use case continues from step 4

Related Information	

Use Case	6. Evaluate Request
Actor	Nursing sister
Trigger	The nursing sister wishes to view registered request for swaps of duties
Pre-Condition	One or more requests have been agreed to by a nurse, but have not been accepted or rejected.
Post Condition	Zero or more request have been accepted or rejected. The roster has been updated with accepted swaps
Normal Flow of Event	1. The actor asks to see request for evaluation

<table>
<tr><td></td><td>2. The system display the request
3. The actor clicks on the request
4. The system displays the details of the request
5. The actor evaluate the request
6. The use case continues from step 2 if there are more requests to evaluate
7. The system updates the roster with the accepted swaps</td></tr>
<tr><td>Variation</td><td>3a. The actor wishes to end the use case
    3a1. The actor states that she/he wants to end
    the use case end
6a. The roster violates work time regulations
    6a1 The system displays an error massage stating that the request must be rejected
    the use case continues from step 2 if there are any more request to evaluate</td></tr>
<tr><td>Related Information</td><td></td></tr>
</table>

Use Case	7. View Roster
Actor	nursing sister, Nurse
Trigger	The nursing sister or nurse wishes to view a specific roster
Pre-Condition	The actor must be logged on to the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to see the roster 2. The actor fills in time period using the format ddmmyyy 3. The system displays the roster for the given time period
Variation	3a. There are no rosters for the given time period 3a1. The system displays an error message and asks the actor to select a valid time period

Use Case	8. Register swap
Actor	Nurse
Trigger	The nurse wants to swap a duty with another nurse
Pre-Condition	The actor must be logged on to the system. The duty in question must be registered in the roster for this period
Post Condition	A swap status "request" has been saved in the system or the user has received an error message
Normal Flow of Event	1. The actor notifies that he/she want to swap duties 2. The system displays the roster for the current time period 3. The actor selects the duties he/she want to swap 4. The system checks that the swap does not violate work time regulations 5. The system saves the swap
Variation	4a. The swap violates work time regulations 4a1. The system displays an error message stating that the swap will violate work time regulations, and asks the actor to select a different duty to swap with The use case continues from step 4
Related Information	

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Use Case	9. Check request status
Actor	Nurse
Trigger	A nurse having registered one or more requests to swap duties wishes to see if the swaps have been accepted
Pre-Condition	The actor must be logged on to the system The nurse must have registered one or more requests
Post Condition	None
Normal Flow of Event	1. The actor chooses to see status for his/her requests 2. The system displays requests with status=1, not agreed to by other nurse 3. The system displays requests with status=2, not accepted because of violation of work time regulations 4. The system displays requests with status=3, not accepted by head nurse 5. The system displays requests with status=A, accepted
Variation	
Related Information	

Figure 3.4: Patient Assessment Use Case Diagram

Table 3.3: Patient Assessment Actors

Actor	Nurse
Description	The nurse has access to the system in order to do the following: • Make patient assessment • View patient assessment made • Change, evaluate, update the assessment
Examples	Staff nurse, Community nurse

Actor	Nursing Sister
Description	Nurse with administrative responsibility for a ward. The nursing sister has access to the system with user name and password in order to do the following: • Make patient assessment • View patient assessment made • Change, evaluate, update the assessment • Review assessment made by nurse
Examples	

Actor	IT executive
Description	IT executive responsible for user administration. Has user name and password in order to: • Add users • Create new passwords for users who have lost their passwords • Stop access to the system for particular users • Restore access to the system for particular users
Examples	

Table 3.4: Patient Assessment Use Cases

Use Case	1. Log on
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the nursing sister or the IT executive who wishes to use the system
Pre-Condition	Non
Post Condition	The actor is logged on to the system with determined access rights
Normal Flow of Event	1. the actor enters username and password 2. the system verifies user name and password 3. the systems logs the actor on the sets access rights according to the actor type

Variation	2a. The actor is logged on to the system for the first time
	    2a1. Include use case "change password"
	    continues from step 3

Related Information	

Use Case	2. Change password
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the nursing sister or the IT executive who wishes to change the password
Pre-Condition	The actor is logged on to the system
Post Condition	The actor has received a new password. The password has been registered to the system
Normal Flow of Event	1. the actor chooses to change the password 2. the system lets the actor enter a password 3. the system verifies the password and save it

Variation	3a. The password does not satisfy the password rules
	3a1. The system sends an error message containing a description of the password rules and asks the actor to enter new password
	continues from step 3
Related Information	The password must at least contain 6 digits, at least one number and start with a letter.
	This use case is included by the use case "log on"

Use Case	3. Observation
Actor	Nurse, nursing sister
Trigger	The nursing sister or nurse selects observation from a menu
Pre-Condition	The nursing sister and nurse is logged on to the system.
	A template for the observation is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to create a an observation of patient
	2. The actor select patient to where the observation to be made
	3. The system display the screen for patient observation.
	4. The actor fills in the observation for future assessment and care plan
	5. The system save the observation
Variation	
Related Information	This use case has connection and can be link to "patient assessment module" and "patient charting"

Use Case	4. Evaluate Physical Appearance
Actor	Nurse, nursing sister
Trigger	The actor wishes to make an evaluation of physical appearance
Pre-Condition	The actor is logged on to the system. The patient must be valid A template for the noting the observation is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to create an evaluation on patient 2. The actor select patient 3. The system display the screen for physical evaluation 4. The actor fill in the observation information 5. The system save the information
Variation	
Related Information	This use case has connection and can be link to "patient assessment module" and "patient charting"

Use Case	5. Add User
Actor	IT executive
Trigger	The actor is logged on to the system
Pre-Condition	The user is new
Post Condition	None
Normal Flow of Event	1. The actor chooses to register a new user 2. The system gets information about the new user from the personnel management system and generates a user name and password

Variation	None
Related Information	Personal information will be name, employee number and position code. The use name must have maximum 10 digits and will contain first name, initials. The password must have at least 6 digits, contain at least one number and start with a letter

Use Case	6. Change User Status
Actor	IT executive
Trigger	The IT executive is logged on to the system
Pre-Condition	None
Post Condition	The user has been registered to the system
Normal Flow of Event	1. The actor chooses to change user status and enters the user's personal information 2. The actor chooses to deactivate the user's access 3. The system sets user access in the user object to no access.

Variation	2a. The actor chooses to activate the user
	    2a1. The system restore the user's access to the system
	    the end of use case
	2b. The actor requires a new user password
	    2b1. The system generates, display and saves password
	    the end of use case

Related Information	A change of status may be one of the following: • A user looses to the system, is deactivated, because he or she is on leave or has left the ward • A deactivated user is activated • A user has lost his/her password and receives a new one

Use Case	7. Assessment per arrival
Actor	Nurse, nursing sister
Trigger	A nurse, the nursing sister who wishes to make assessment on arrival of patient
Pre-Condition	The actor is logged on to the system The assessment form is available in the system The patient is a new patient
Post Condition	None
Normal Flow of Event	1. The actor chooses make an assessment on patient 2. Assessment is made and all the information is save in the system database
Variation	
Related Information	

Use Case	8.Comment
Actor	Nurse, nursing sister
Trigger	A nurse, the nursing sister who make comment based on assessment per arrival
Pre-Condition	The actor is logged on to the system The comment form is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses make comment based on assessment made 2. The comment form is display by the system 3. The actor enters the comment and the information is save in the system
Variation	
Related Information	

3.5.1.4 Nursing Care Plan Module
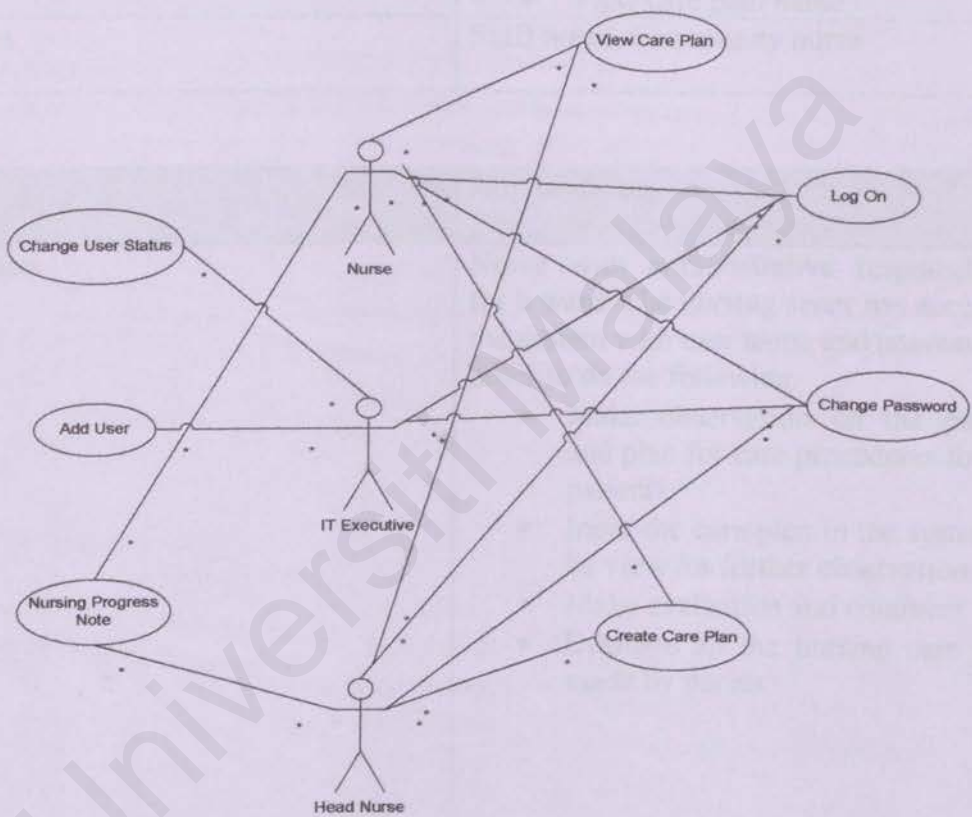
Figure 3.5: Nursing Care Plan Use Case Diagram

Table 3.5: Nursing Care Plan Actors

Actor	Nurse
Description	The nurse has access to the system in order to do the following: • Make observation on the patient and plan for care procedures for the patients. • Input the care plan in the system to be view for further observation • Make evaluation and comment • View care plan made
Examples	Staff nurse, Community nurse

Actor	Nursing Sister
Description	Nurse with administrative responsibility for a ward. The nursing sister has access to the system with user name and password in order to do the following: • Make observation on the patient and plan for care procedures for the patients. • Input the care plan in the system to be view for further observation • Make evaluation and comment • Evaluate all the nursing care plan made by nurses
Examples	

Actor	IT executive
Description	IT executive responsible for user administration. Has user name and password in order to: • Add users • Create new passwords for users

	who have lost their passwords
	• Stop access to the system for particular users
	• Restore access to the system for particular users
Examples	

Table 3.6:Nursing Care Plan Use Cases

Use Case	1. Log on
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the nursing sister or the IT executive who wishes to use the system
Pre-Condition	Non
Post Condition	The actor is logged on to the system with determined access rights
Normal Flow of Event	1. the actor enters username and password 2. the system verifies user name and password 3. the systems logs the actor on the sets access rights according to the actor type

Variation	2a. The actor is logged on to the system for the first time
	    2a1. Include use case "change password"
	    continues from step 3

Related Information	

Use Case	2. Change password
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the nursing sister or the IT executive who wishes to change the password
Pre-Condition	The actor is logged on to the system

Post Condition	The actor has received a new password. The password has been registered to the system
Normal Flow of Event	1. the actor chooses to change the password 2. the system lets the actor enter a password 3. the system verifies the password and save it
Variation	3a. The password does not satisfy the password rules 3a1. The system sends an error message containing a description of the password rules and asks the actor to enter new password continues from step 3
Related Information	The password must at least contain 6 digits, at least one number and start with a letter. This use case is included by the use case "log on"

Use Case	3. Create Care Plan
Actor	Nurse, nursing sister
Trigger	The nursing sister selects care plan from a menu
Pre-Condition	The head nurse is logged on to the system. A template for the care plan is available in the system
Post Condition	A care plan for the next assessment session has been set up
Normal Flow of Event	1. The actor chooses to create a care plan for the patient based on the patient's condition 2. The actor select patient to where the care plan to be conducted to. 3. The system display the screen for care plan. 4. The actor fills in the care plan for the period and which nurse will have to proceed with the care plan 5. The system save the plan for future view and for future assessment

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Variation	
Related Information	This use case has connection and can be link to "patient assessment module" and "patient charting"

Use Case	4. Nursing Progress Note
Actor	Nurse, nursing sister
Trigger	The actor wishes to make a progress note
Pre-Condition	The actor is logged on to the system. The actor has carry out the care plan that has been plan before A template for the noting is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to create a progress notes based on the conditions, improvement and development of the patient after each assessment and care plan carried out 2. The actor select patient to progress notes should be chart 3. The system display the screen for noting. 4. The actor note the patient progress 5. The system save the plan for future view and for future assessment
Variation	
Related Information	This use case has connection and can be link to "patient assessment module" and "patient charting"

Use Case	5. Add User
Actor	IT executive
Trigger	The actor is logged on to the system
Pre-Condition	The user is new
Post Condition	None
Normal Flow of Event	1. The actor chooses to register a new user 2. The system gets information about the new user from the personnel management system and generates a user name and password
Variation	None
Related Information	Personal information will be name, employee number and position code. The use name must have maximum 10 digits and will contain first name, initials. The password must have at least 6 digits, contain at least one number and start with a letter

Use Case	6. Change User Status
Actor	IT executive
Trigger	The IT executive is logged on to the system
Pre-Condition	None
Post Condition	The user has been registered to the system
Normal Flow of Event	4. The actor chooses to change user status and enters the user's personal information 5. The actor chooses to deactivate the user's access 6. The system sets user access in the user object to no access.
Variation	2a. The actor chooses to activate the user 2a1. The system restore the

	user's access to the system
	the end of use case
	2b. The actor requires a new user password
	    2b1. The system generates, display
	    and saves password
	    the end of use case

Related Information	A change of status may be one of the following:
	  • A user looses to the system, is deactivated, because he or she is on leave or has left the ward
	  • A deactivated user is activated
	  • A user has lost his/her password and receives a new one

Use Case	7. View Care Plan/ progress note
Actor	Nurse, nursing sister
Trigger	A nurse, the nursing sister who wishes to view the care plan
Pre-Condition	The actor is logged on to the system The patient care is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to see the plan made and the progress note 2. The actor fills in the search box with patients name or ID number 3. The system search for patient as per request and display the care plan or the progress note

Variation	3a. The actor chooses to view an existing care plan and note by patient
	    2a1. The actor selects time period
	    2a2. The system display appropriate notes and plan
	    The use case continues from step 3

Related Information	

3.5.1.5 Patient Charting Module
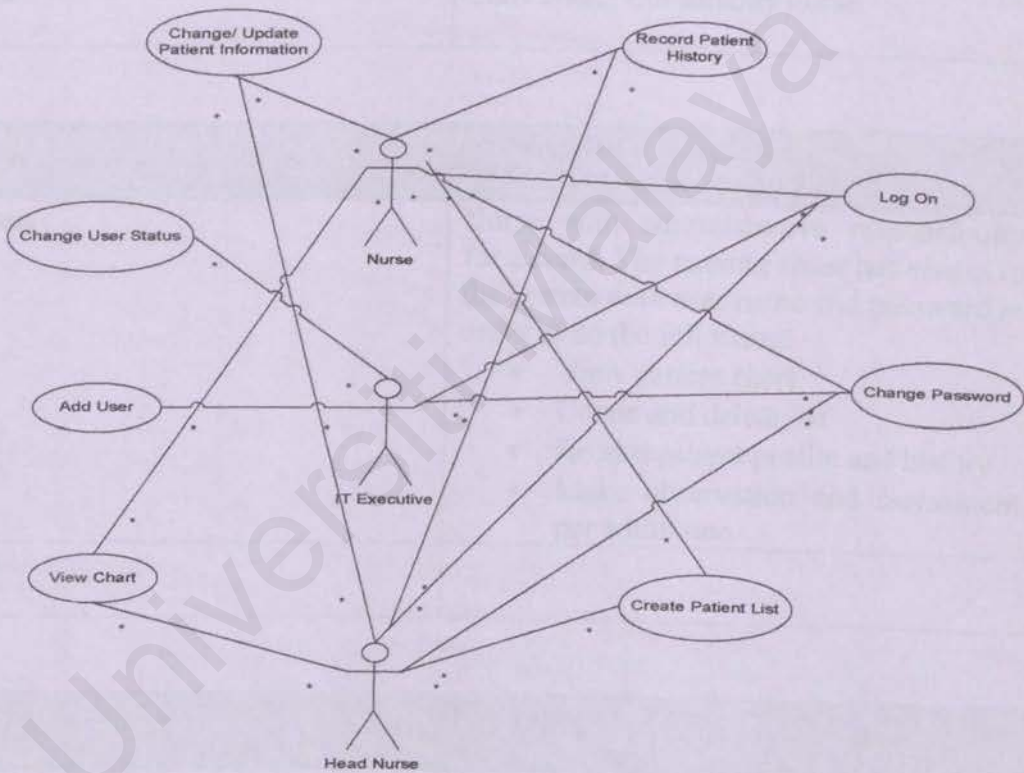
Figure 3.6: Patient Charting Use Case Diagram

Table 3.7: Patient Charting Actors

Actor	Nurse
Description	The nurse has access to the system in order to do the following: • View patient chart • Create and delete list • Record patient profile and history • Make observation and assessment per admission
Examples	Staff nurse, Community nurse

Actor	Nursing Sister
Description	Nurse with administrative responsibility for a ward. The nursing sister has access to the system with user name and password in order to do the following: • View patient chart • Create and delete list • Record patient profile and history • Make observation and assessment per admission
Examples	

Actor	IT executive
Description	IT executive responsible for user administration. Has user name and password in order to: • Add users • Create new passwords for users who have lost their passwords • Stop access to the system for particular users • Restore access to the system for particular users

Examples	

Table 3.8: Patient Charting Use Cases

Use Case	1. Log on
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the nursing sister or the IT executive who wishes to use the system
Pre-Condition	Non
Post Condition	The actor is logged on to the system with determined access rights
Normal Flow of Event	1. the actor enters username and password 2. the system verifies user name and password 3. the systems logs the actor on the sets access rights according to the actor type

Variation	2a. The actor is logged on to the system for the first time
	    2a1. Include use case "change password"
	    continues from step 3

Related Information	

Use Case	2. Change password
Actor	Nurse, nursing sister, IT executive
Trigger	A nurse, the head nurse or the IT executive who wishes to change the password
Pre-Condition	The actor is logged on to the system
Post Condition	The actor has received a new password. The password has been registered to the system
Normal Flow of Event	1. the actor chooses to change the password 2. the system lets the actor enter a

	password
	3. the system verifies the password and save it
Variation	3a. The password does not satisfy the password rules
	3a1. The system sends an error message containing a description of the password rules and asks the actor to enter new password
	continues from step 3
Related Information	The password must at least contain 6 digits, at least one number and start with a letter.
	This use case is included by the use case "log on"

Use Case	3. Create / Add Patient List
Actor	Nurse, nursing sister
Trigger	A nurse, or nursing sister who wishes to create or add to a patient list
Pre-Condition	The actor is logged on to the system. A template for patient listing is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to create a new patient list 2. The system display the screen for patient listing 3. The actor fills in all the information about the patients that are needed for documentation and future review.
Variation	None
Related Information	Some of the personal information of the patient are send by the registration department as the patient registered and assign to the ward. This use case is included by the use case in the "patient assessment module" and "nursing care module"

Use Case	4. View Patient List
Actor	Nurse, nursing sister
Trigger	A nurse, the nursing sister who wishes to view the patient list
Pre-Condition	The actor is logged on to the system The patient list is available in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to see the chart 2. The actor fills in the search box with patients name or ID number, or the actor can view the list by whole. 3. The system search for patient as per request and display the chart.

Variation	3a. There are no such patient exist
	    3a1. The system sends an error message and asks the actor to put in a valid information.
	    The use case continues from 2

Related Information	

Use Case	5. Add User
Actor	IT executive
Trigger	The actor is logged on to the system
Pre-Condition	The user is new
Post Condition	None
Normal Flow of Event	3. The actor chooses to register a new user 4. The system gets information about the new user from the personnel management system and generates a user name and password
Variation	None
Related Information	Personal information will be name, employee number and position code. The

| | use name must have maximum 10 digits and will contain first name, initials. |
| | The password must have at least 6 digits, contain at least one number and start with a letter |

Use Case	6. Change User Status
Actor	IT executive
Trigger	The IT executive is logged on to the system
Pre-Condition	None
Post Condition	The user has been registered to the system
Normal Flow of Event	7. The actor chooses to change user status and enters the user's personal information 8. The actor chooses to deactivate the user's access 9. The system sets user access in the user object to no access.

Variation	2a. The actor chooses to activate the user
	    2a1. The system restore the user's access to the system
	    the end of use case
	2b. The actor requires a new user password
	    2b1. The system generates, display and saves password
	    the end of use case

Related Information	A change of status may be one of the following: • A user looses to the system, is deactivated, because he or she is on leave or has left the ward • A deactivated user is activated • A user has lost his/her password and receives a new one

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Use Case	7.Change and update patient information
Actor	Nurse, nursing sister
Trigger	A nurse or nursing sister who wishes to update the patient information
Pre-Condition	The actor is logged on to the system The information to be updated must be valid in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to change patient's personal information 2. The system display the patient list containing the particular patient's information 3. The actor change the information 4. The system check and save the information
Variation	
Related Information	A change of status may be one of the following: • The information enters before are invalid • New information are gather during assessment

Use Case	9. Record patient's history
Actor	Nurse, nursing sister
Trigger	Nurse or nursing sister who wishes to record patient's history
Pre-Condition	The actor is logged on to the system The Patient must be valid in the system
Post Condition	None
Normal Flow of Event	1. The actor chooses to record the patient history profile 2. The actor chooses the patient whom the history must be recorded 3. The system display the screen and template of patient history

	4. The actor fill in all the information needed
	5. The system check and save the record
Variation	
Related Information	2a. The patient chooses are not in the database
	2a1. The system display an error messaging asking the actor to key in the valid patient
	the use case continues from 3

3.5.2 Activity diagram
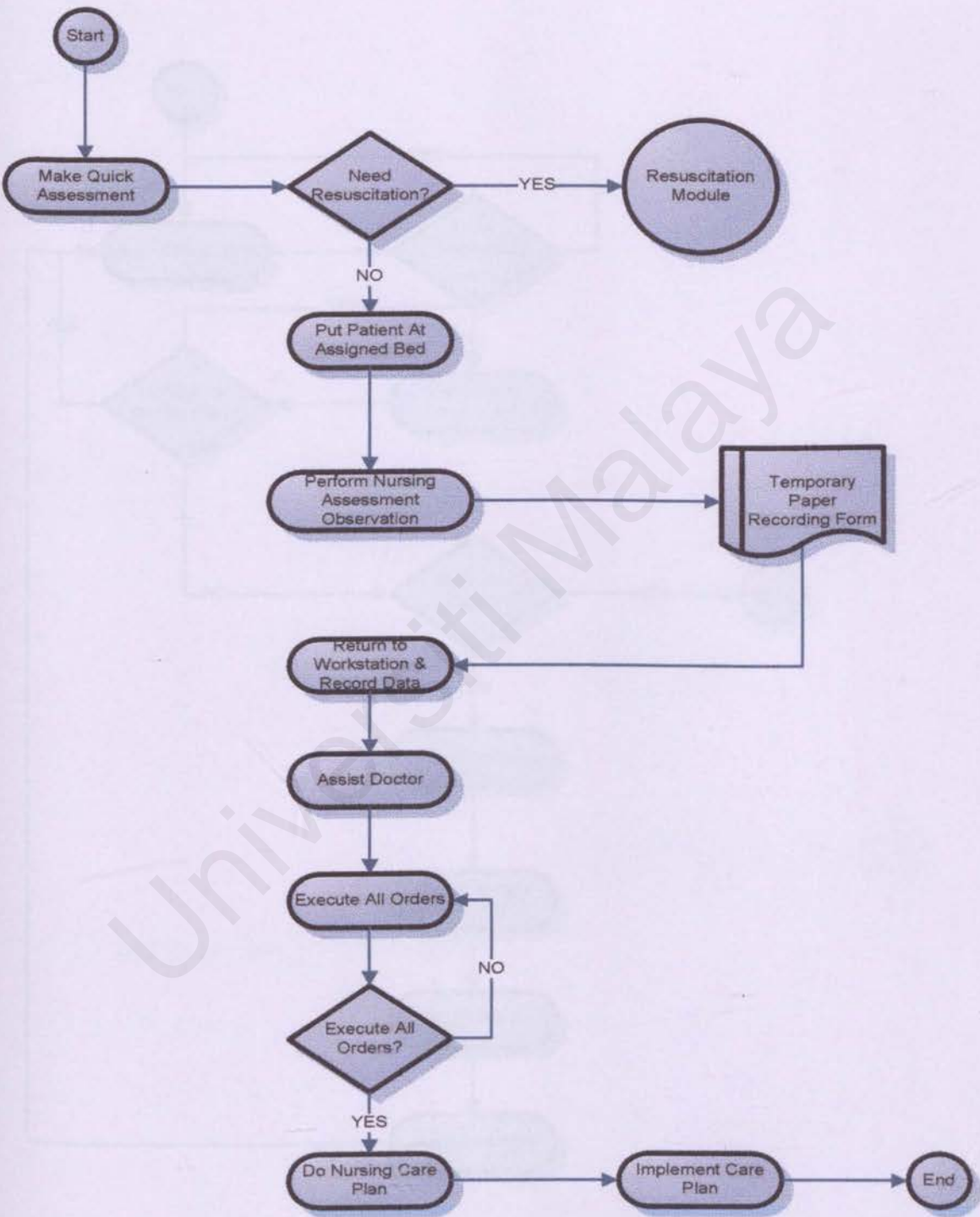
3.5.2.1 Patient Assessment Module

Figure 3.7: Activity Diagram For Patient Assessment
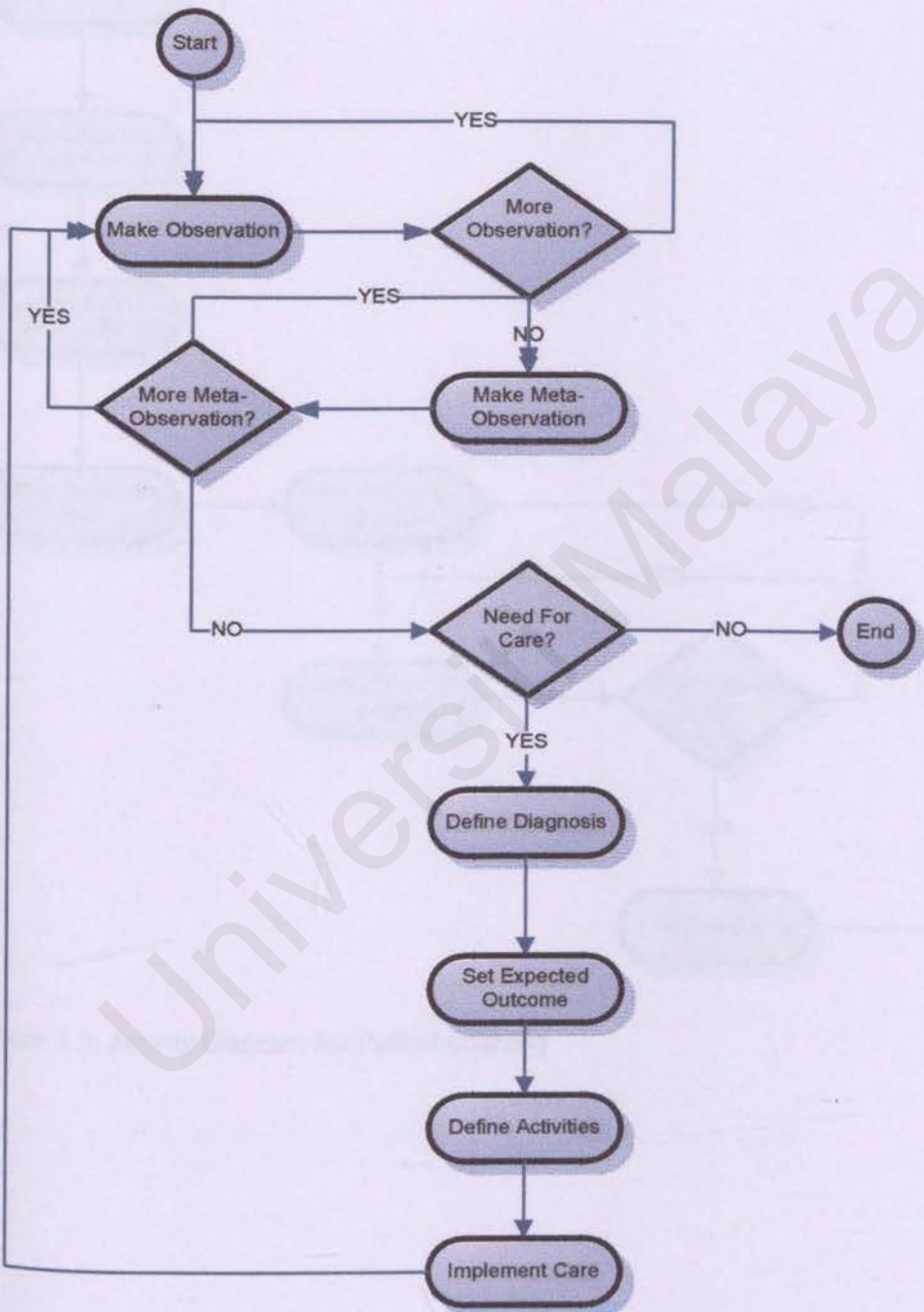
3.5.2.2 Nursing Care Plan Module

Figure 3.8: Activity Diagram For Nursing Care Plan
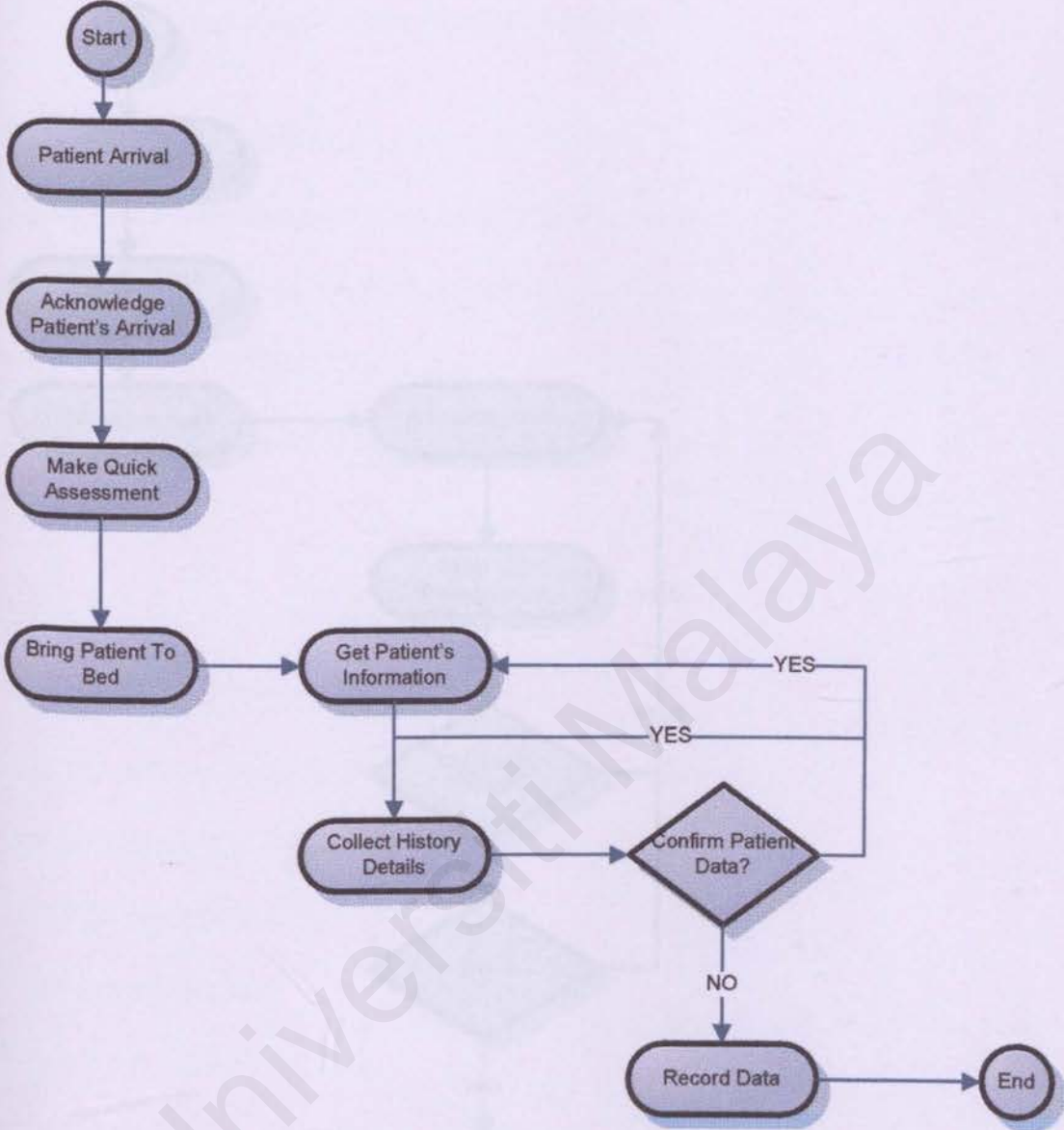
3.5.2.3 Patient Charting Module

Figure 3.9: Activity Diagram For Patient Charting

3.5.2.4 Workload Assessment And Rostering Module

```
                    Start

                  Check Request

                  Identify Staff
                    Member

   Categories Staff  ──────→  Allocate Shifts  ←──────┐
                                   │                    │
                                   ↓                    │
                              Give Out                  │
                              Assignment      YES       │
                                   │                    │
                                   ↓          YES       │
                              Any Swap  ──────────────→ │
                              Duties?                   │
                                   │                    │
                                  NO                    │
                                   ↓                    │
                              Any EL/ MC?  ─────────────┘
                                   │
                                  NO
                                   ↓
                                  End
```
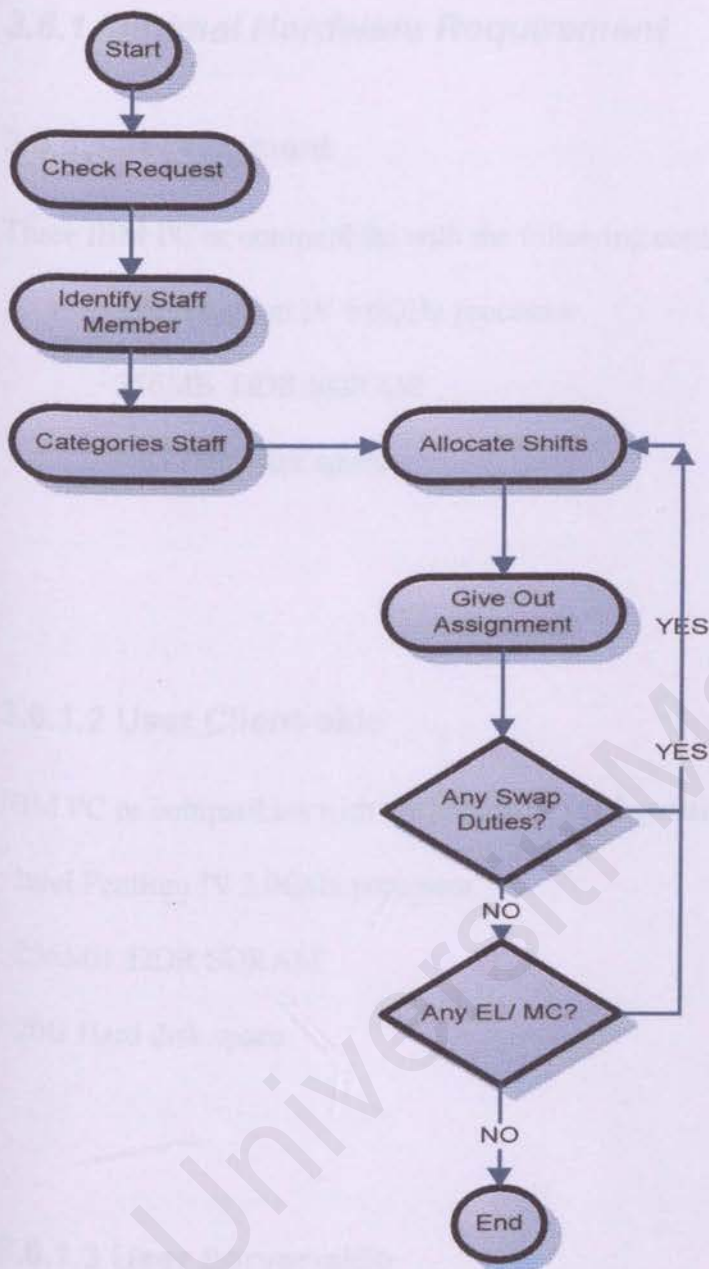
Figure 3.10: Activity Diagram For Workload Assessment And Rostering

3.6 Requirement Analysis Phase

3.6.1 Minimal Hardware Requirement

3.6.1.1Development

Three IBM PC or compatibles with the following configurations

- · Intel Pentium IV 3.0GHz processor

- · 256MB DDR SDRAM

- · 40G Hard disk space

3.6.1.2 User Client-side

IBM PC or compatibles with the following configurations.

· Intel Pentium IV 3.0GHz processor

· 256MB DDR SDRAM

· 20G Hard disk space

3.6.1.3 User Server-side

IBM PC or compatibles with the following configurations

· Intel Pentium IV 2.8GHz processor

· 256MB DDR SDRAM

· 40G Hard disk space

3.6.2 Minimal Software Requirement

3.6.2.1 Development

- Platform: Microsoft Windows XP Professional

- RDBMS: MS SQL Server 2000 Enterprise Edition

- Technologies: IIS, ASP.NET, HTML, VB.Net

- Site Development & Customization: Visual Studio 6.0 & Visual Studio.NET, Microsoft Dreamweaver

3.6.3.2 User Client-side

· Windows 200/XP/NT Workstation

· Microsoft SQL Server 2000 (optional)

· Microsoft Word 98/2000 (optional)

3.6.4.3 User Server-side

· Windows NT Server/200 Server Professional 1

· Microsoft SQL Server 2000 (optional)

· Microsoft Word 98/2000 (optional).

3.7 Alternative Solution

In view with the problems existing in the hospital explained earlier, an alternative solution has been drawn up:

3.7.1 Client / Server Based Application

In the client/server based application system, the entire organization is networked. This is a complete standalone system, where there is much functionality that can be included to meet the organization's requirements. This system validates the input data, update the scheduling and also generates many other reports that the management might require from time to time[6]. The nurse can enter data details of the particular new patient into the system through the patient charting module.

Apart from these functions, operations such as to add and update can also be done at more than one locations, two nurses can open one single patient information file, but of course with locking features. Not only security, but data consistency to would be increased. Different user in the same hospital would be able to operate the system even though they are not located at different places. For example, the nurse could run charting patients on the system, and at the same time a doctor might review the history details of patient or give diagnosis treatment in the room. But both user have different level of access to the system, meaning that only authorized personal with the level of permitted user access level would be able to use the system. As required by the management, all reports can be generated by the given criteria.

3.8 Conclusion

This chapter covered all the process involved in the analysis phase. Formally, system analysis is the dissection of the system information it's components pieces. As a problem-solving phase, it precedes systems design. With respect to information system development, system analysis is the preliminary investigation phase. Each phase of the system analysis can be understood in the context of the information system building blocks: DATA, PROCESS, INTERFACE. [6]. The result of the system analysis are stored in later phases and projects.

CHAPTER 4

SYSTEM DESIGN

4.1 Introduction

In this chapter covered more about the design phase in the HMIS system development methodology. In order to understand the process involves in the system design a few aspect should understood very well such as activities involve in design phase, identify and differentiate between several system design strategies. There are many strategy or techniques for performing system design like modern structured design, OOD, prototyping and etc. In HMIS, OOD technique is used in the design phase.
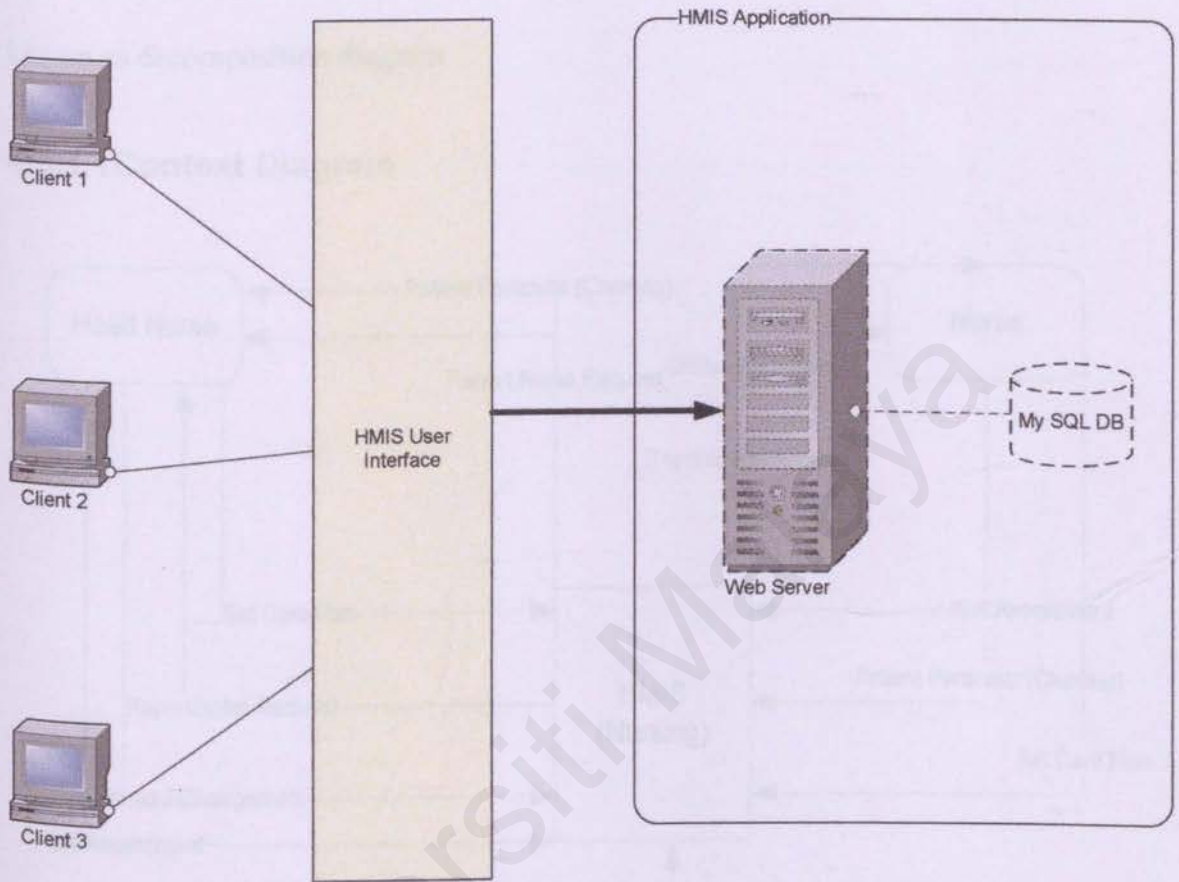
4.2 System Design Definition

Figure 4.1: General System Architecture

4.3 Design Phase for HMIS

4.3.1 Design The Application Architecture

The purposed of this first task is to specify application architecture. Application architecture defines the technologies to be used by (and used to build)one or more or all the system in term of its data process, interface and network components. This task will concern on DATA, PROCESS and INTEFACE[sad] This task is accomplished by the analyzing the data models, process models, and target solution will be made. Basically

the physical data flow diagram (DFD) that used to present the physical data process and data process in the system. DFD defined as depict the flow of the data through the system and the work or processing performed by that system. DFD planning tool also known as decomposition diagram.
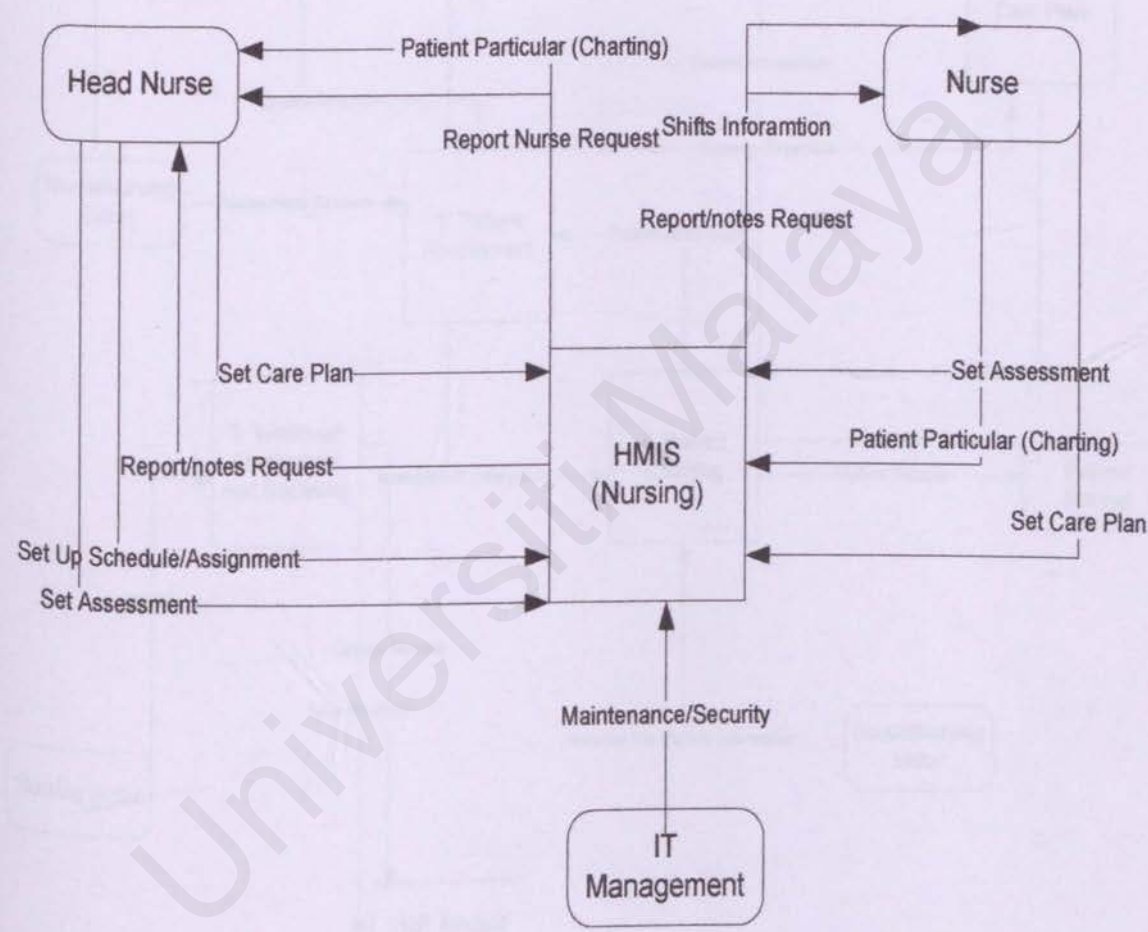
4.3.1.1 Context Diagram

Figure 4.2: Context Diagram For HMIS

4.3.1.2 Data Flow Diagram
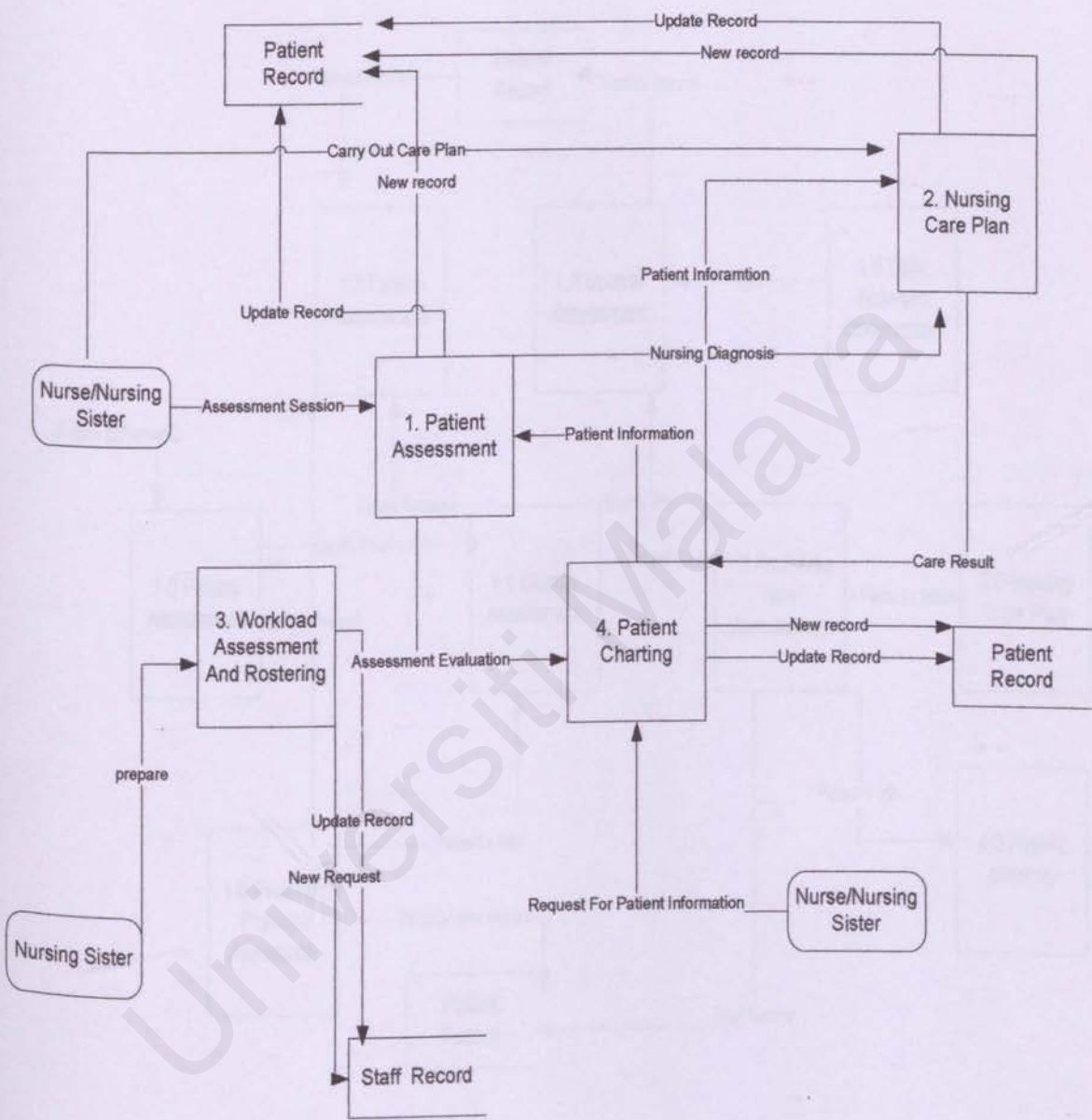
Data Flow Diagram – Level 1

Figure 4.3: Data Flow Diagram For HMIS

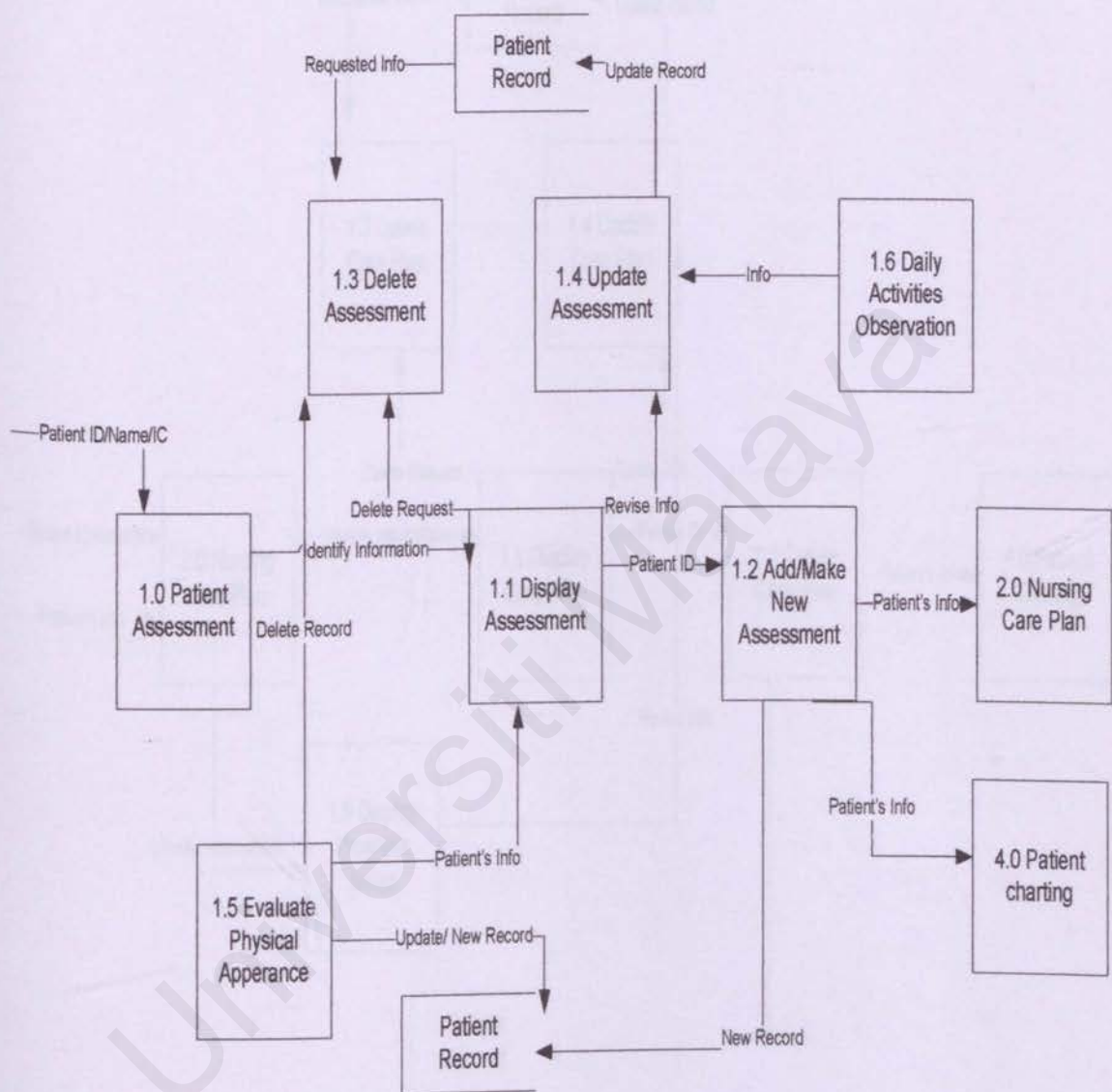**Data Flow Diagram – Level 2**

1. Patient Assessment

Figure 4.4: Data Flow Diagram For Patient Assessment
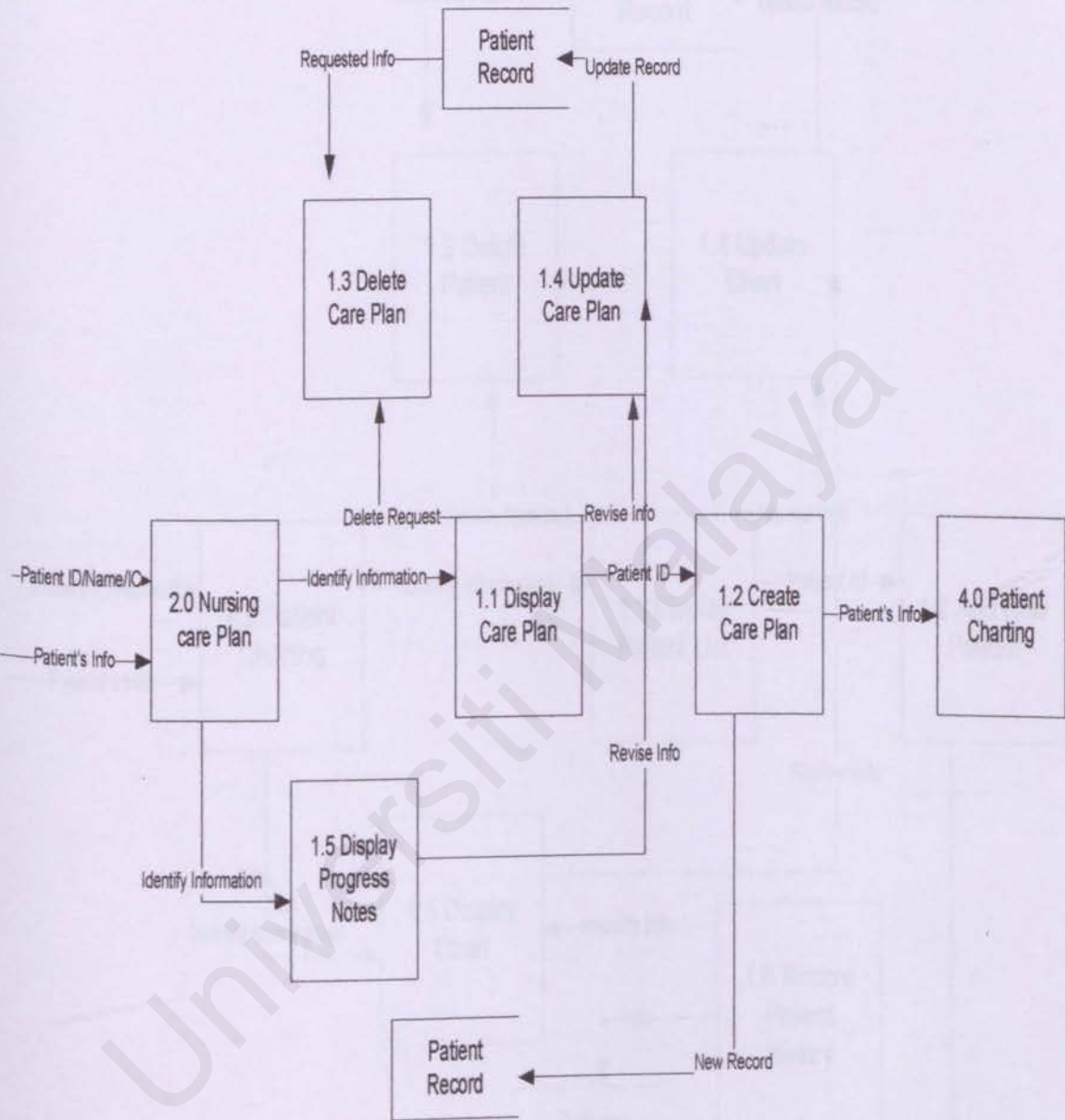
2. Nursing Care Plan

Figure 4.5: Data Flow Diagram For Nursing Care Plan
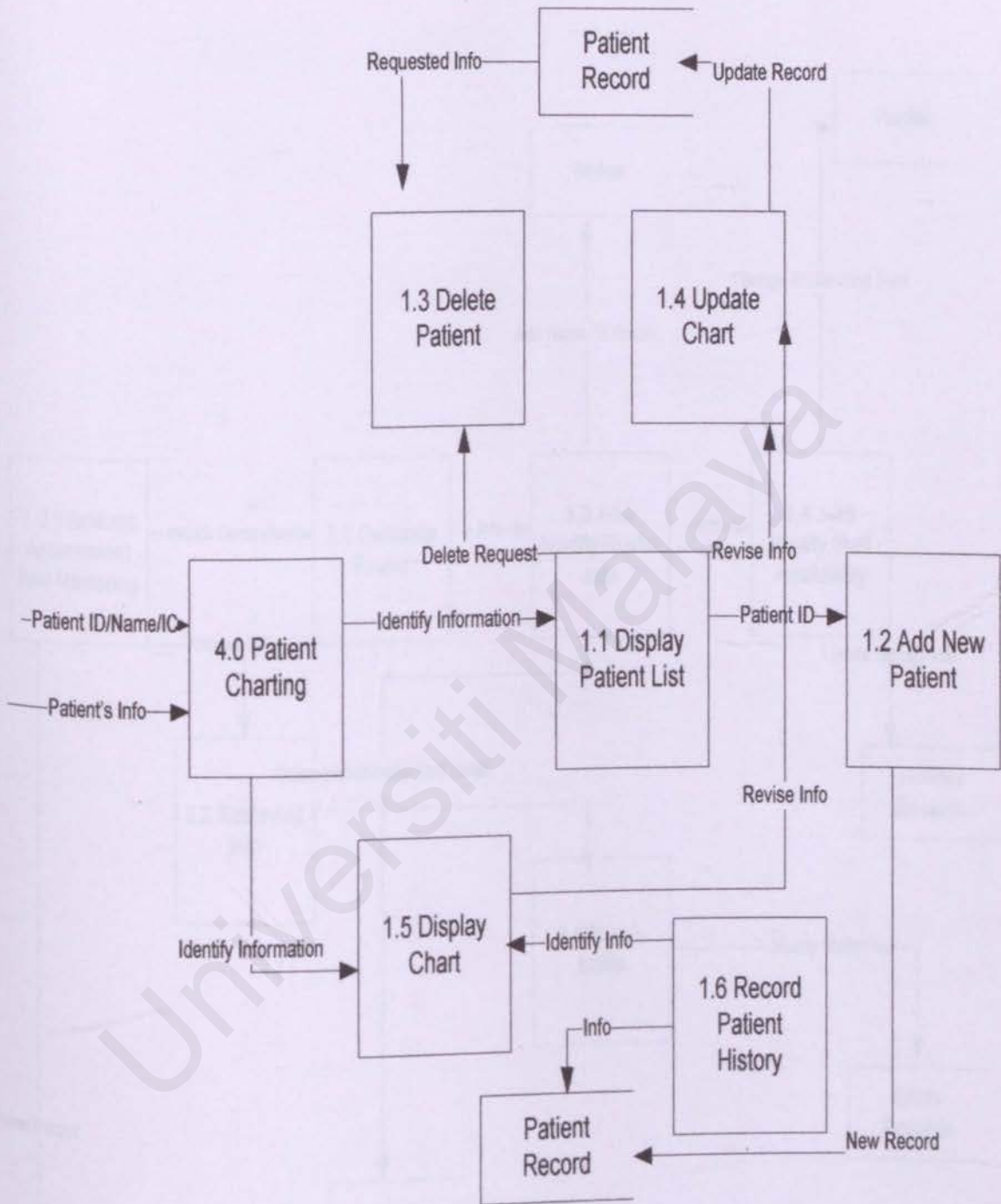
3. Patient Charting

Figure 4.6: Data Flow Diagram For Patient Charting

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4. Workload Assessment And Rostering
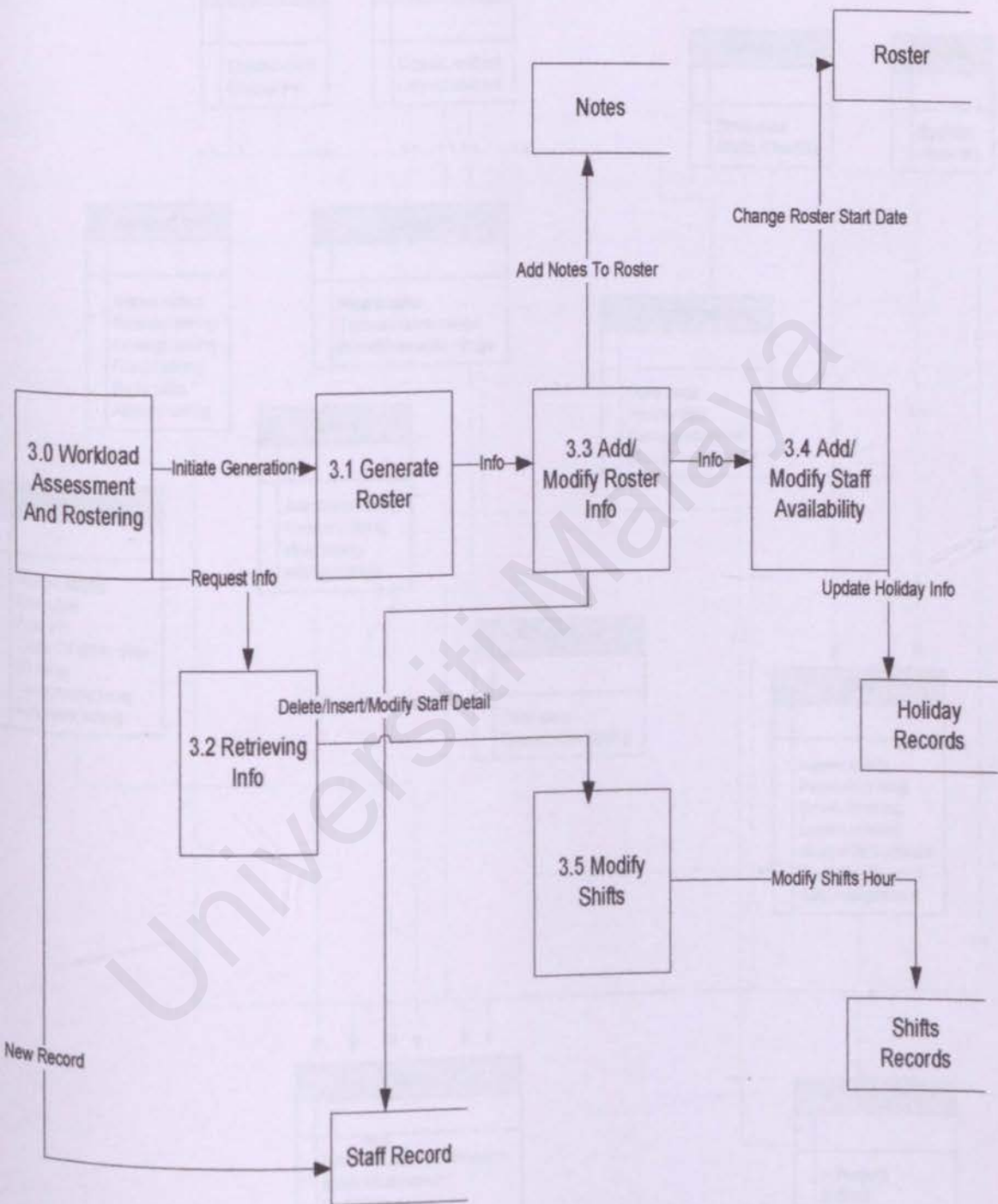
Figure 4.7: Data Flow Diagram For Workflow Assessment And Rostering

4.3.1.3 Object Class Diagram
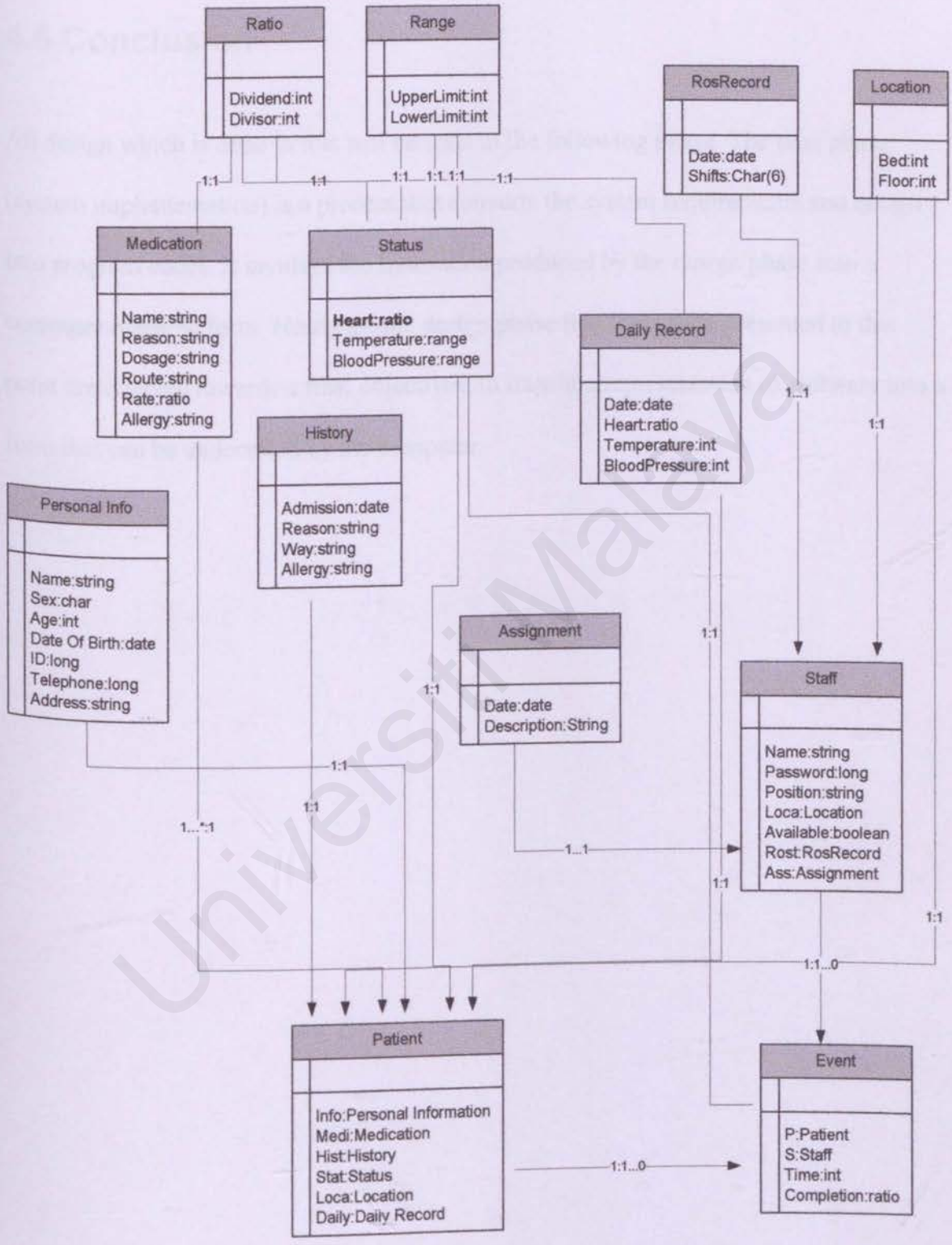
Figure 4.8: Object Class Diagram For HMIS

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4.6 Conclusion

All design which is done in this will be used in the following phase. The next phase (system implementation) is a process that converts the system requirements and design into program codes. It involves the translation produced by the design phase into a computer readable form. Nearly all the design phase that have been presented to this point are directed towards a final objectives: to translate representation of software into a form that can be understood by the computer.

CHAPTER 5

IMPLEMENTATION

5.1 Introduction

New system usually represent a departure from the way business is currently done; therefore, the analyst must provide for a smooth transition from the old system to the new system and help users cope with normal; start-up problems. Thus, the implementation phase delivers the production system into operation (day-to-day operation)
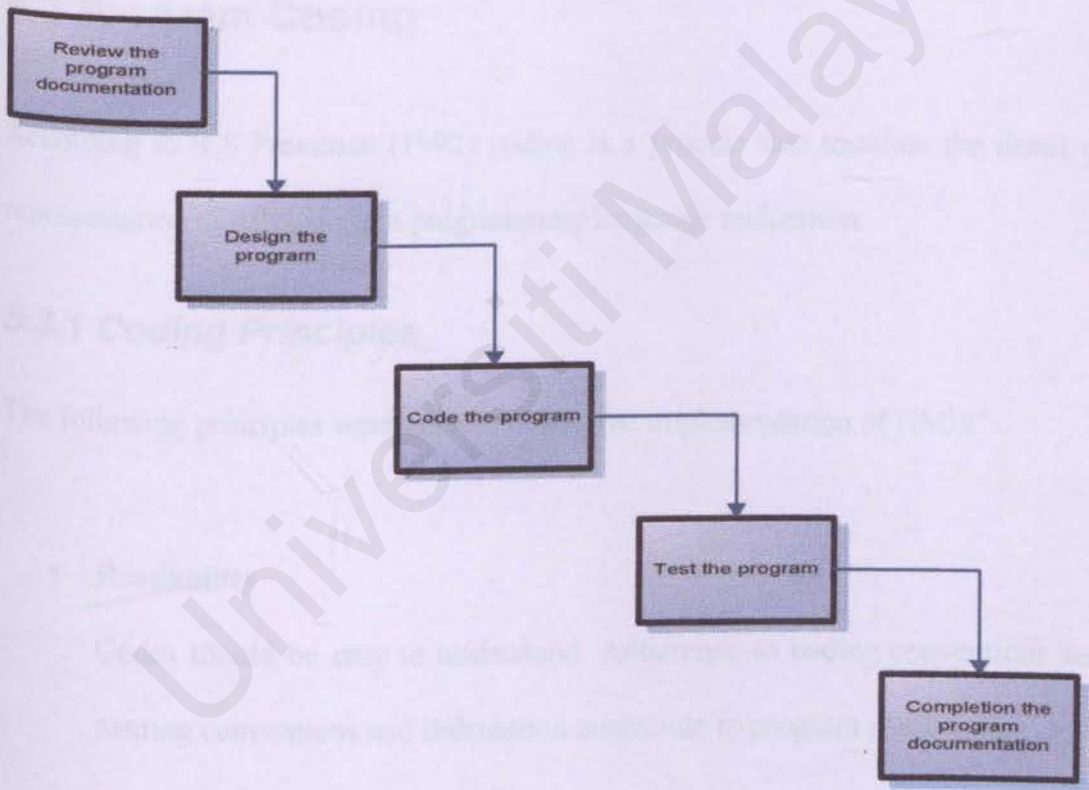

Figure 5.1: The five steps of Program Development [2]

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5.2 Review the Program Documentation

5.2.1 Review the Program Documentation

The first step in the program development is top review the program documentation that was prepared during the previous phases. The program documentation of HMIS consist of simple process description, layout, data dictionary entries and the source documents. This documentation helps me to understand better the work that needs to be covered during this coding phase.

5.3 Program Coding

According to R.S Pressman (1992) coding is a process that translate the detail design representation of software into programming language realization.

5.3.1 Coding Principles

The following principles were applied during the implementation of HMIS"

- **Readability**

  Codes should be easy to understand. Adherence to coding conventions such as naming conventions and indentation contribute to program readability.

- **Maintainability**

  Codes should be easily revised or corrected. To facilitate maintenance, codes should be readable, modular and as general as possible.

- **Robustness**

The codes should be able to handle cases of user error by responding appropriately.

- **Code Comments**

  Codes should be provided with comments so that it will be easier to understand by others if it needs to be corrected

```
'****************
'  PAGING
'****************

'*****************************************************************************
****
'
'  The Page_* methods move the CurrentPageIndex to the appropriate
'  previous or next page for the 2 grid controls.
'

'*****************************************************************************
****

    Protected Sub Page_Terr(ByVal sender As [Object], ByVal e As
DataGridPageChangedEventArgs)
        ' Hide the 2nd and 3rd table if they were visible
        ETTableColumn.Visible = False
        EmpTableColumn.Visible = False

        TerritoryGrid.CurrentPageIndex = e.NewPageIndex
        BindList_Terr()
    End Sub 'Page_Terr
```

Figure 5.2: Code Comment Sample From the System

5.3.2 Naming Convention

Usage of this naming convention in HMIS is intended to produce a system that is easily adjusted or modified according to the current needs of the programmer. Besides that, the development of this system is also done systematically, without any errors.

The table 5.1 below shows the types of identifiers used:

Prefix table that is used

Table 5.1: Prefix

Prefix	Controls	Example
Cmd	Command Button	cmdStaff
Frm	Form	FormPatientAssessment
Lbl	Label	lblMessage
Txt	Text boxes	txtMRN
Dblist	DataBound List	DbListUserName

5.3.3 External Documentation

In HMIS, the external documentation contains User Manual that explains the steps for using the system. The information that consists in this document is the steps to install and the way HMIS operates. A few screens that are in HMIS are used to describe the procedures for the operation of HMIS.

5.4 Input and Output

Input and output type of entry is important in overall system. There is at times where the system is able to detect the right format of data entry. In HMIS, each time a data is entered, the error can be detected. Below are a few guidelines for the input data entry to get the output:

- Valid data input only

- Use a simple or easy input format

- Keep a label for each data input

- Have appropriate choice for each input

- Assign an accurate or correct range for a few values

- Place labels for each output

- A suitable design for each report

5.5 Valid Input

Usage of valid data helps the system to do or accomplish all the system operation according to the structure of program flow. In HMIS when the data that is entered is of different formats, that data will be tested and later prompts a message to the user.

5.5.1 Testing Required Field

Some of the entry fields are required in order to submit the data to the database, such as the Patient MRN number, date and time and etc. If the required data is not entered, then the system will prompt message to the user to enter data in the require field before the save button can be use.

```
<asp:TextBox id="MRN" runat="server" Font-Size="8pt"
Width="304px"></asp:TextBox>
<asp:RequiredFieldValidator id="RequiredFieldValidator1" runat="server"
Display="Dynamic" CssClass="NormalRed"
ControlToValidate="MRN" ErrorMessage="*"></ asp:RequiredFieldValidator>
```

Figure 5.3: Code For Required Field

5.5.2 Testing for valid entry

Testing the valid entry values is to make sure that the data entered is in the right format.

Example: patient MRN number is in integer.

If the data entered is different from the format needed, the system will prompt message to the user and ask the user to re-enter the data in the correct format.

```
<asp:CompareValidator id="CompareValidator1" runat="server" Font-Size="XX-
Small" Display="Dynamic" ControlToValidate="MRN"
ErrorMessage="MRN is in Integer" Type="Integer"
Operator="DataTypeCheck"></asp:CompareValidator>
```

Figure 5.4: Code For Compare Validator

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5.5.3 Testing for Range

Sometimes there are also data that has range. In case a data that is entered is in a different range from the actual, then the system will prompt a message to the system user. This also helps in the proper flow of the system.

This phenomenon has been used in HMIS so that if a user of the system accidentally enters data that is out of range. HMIS also helps the users to improve on their mistakes.

5.5.4 Testing of Stored Data

Testing of this type is done to detect whether the data is already in the database or not. For example, each person will have different identification card number. Thus, if a system user enters a new data using identification card number that is already there in the database, then the system will prompt a message to the user to check the data entered again.

The example that is in HMIS is as following:

```
Sub Finish_Click(ByVal Src As Object, ByVal E As EventArgs)


        Try
                SqlHelper.ExecuteNonQuery(dbconn, "CarePlanInsert",
        MRN.Text, Session("UserID"), DateTimeOfPlan.Text, WardBedNo.Text,
        PerformedBy.Text, Convert.ToDateTime(DateTimeOfProblem.Text),
        PatientProblem.Text, ExpectedOutcome.Text, NursingIntervention.Text,
        NursingEvaluation.Text)
                Label1.Text = "Record added"
        Catch ex As Exception
                Label1.Text = "Update problem. Record not added."
        End Try

        End Sub
```

Figure 5.5: Code For Stored Data Test

CHAPTER 6

SYSTEM TESTING

6.1 Introduction

Testing is the process of exercising of evaluating a system by manual or automatic means to verify that it satisfied requirements or to identify differences expected and actual results. By the other words, testing is a verification and validation process.

Verification refers to the set of activities that ensures that the software correctly implements a specific function. On the other hand, validation refers to a different set of activities that ensuring the software have been built traceable to user requirements. Software testing is a critical element of software quality assurance and represents the ultimate of requirement specification, design and coding.

Rules that can serve well as testing objectives are:

- Testing is a process of executing a program with the intent of finding an error

- A good test case is one that has a high probability of finding an undiscovered error.

- A successful test is one that uncovers an as yet undiscovered error.

A good test must include the following features:

- A good test has a high probability of finding an error

- A good test is not redundant

- A good test should be "best of breed"

6.2 Unit Testing

Historically, quality software is relied on testing each function or module. This practice called unit testing, which is extremely time-consuming. Unit testing verify that the component functions properly with the types of input expected from studying the component design.

For HMIS, unit testing was done during the coding phase. The first step is to examine the program code by reading through it, trying to spot algorithm, data and syntax fault. Comparing the code with specification and with the design to make sure that all relevant cases have been considered followed. Finally, test cases are developed to show that the input is properly converted to desired output.

In the development of HMIS, unit testing is done concurrently with the prototyping phase. All the sub module and sub functions of HMIS are tested to ensure that it is error free.

Table 6.1 Patient Assessment Testing

System Name: **HMIS**		Programmer:	
Module Name: **Patient Assessment**		Test Done:	
		Test Date:	
Test Data	Expected Result	Actual Result	Remark
Next button	Next (page 1-11) patient assessment form is display		Done (No error)

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Finish Button	Data are send to the database		Done (No error)
Enter Patient MRN text Box	List name of performer (nurse) is display		Done (No error)
Selected Performer Name	List of Dates and time is display		Done (No error)
Selected Date and time	Patient Assessment information from selected date and performer is display		Done (No error)

Table 6.2 Care Plan Testing

System Name: **HMIS**		Programmer:	
Module Name: **Care Plan**		Test Done:	
		Test Date:	
Test Data	Expected Result	Actual Result	Remark
Next button	Next (page 1-3) care plan form is display		Done (No error)
Finish Button	Data are send to the database		Done (No error)

Enter Patient MRN text Box	List name of performer (nurse) is display		Done (No error)
Selected Performer Name	List of Dates and time is display		Done (No error)
Selected Date and time	Care Plan information from selected date and performer is display		Done (No error)
Enter Performer ID text Box	List name of patient is display		Done (No error)

Table 6.3 Rostering Testing

System Name: **HMIS**		Programmer:	
Module Name: **Roster**		Test Done:	
		Test Date:	
Test Data	Expected Result	Actual Result	Remark
Add Staff to Daily Schedule	Schedule from the selected date and location are display according to shift		Done (No error)

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Add New Button	New data is created. Data is inserted in the table and database		Done (No error)
Update Button	Data in the table and database is update based on the changes made		Done (No error)
Delete Button	Data in the selected row is deleted from the table and database		Done (No error)
Clear Button	Request is cancel, back to home		Done (No error)
Send Button (Relocation)	Data enter is send to the database	Data is not send to the database	Error on the declaration of time. Covert String to DateTime is not valid.

Table 6.4 My Profile Testing

System Name: **HMIS**	Programmer:
Module Name: **My Profile**	Test Done:

		Test Date:		
Test Data	Expected Result	Actual Result		Remark
Selected ID number (Inbox)	Display messages from the selected Number			Done (No error)
Send Button (Create New Massage)	Data enter is send to the database			Done (No error)

6.3 Integration Testing

Testing a specific feature together with other newly developed features is known as integrating testing. It is a systematic technique for constructing the program structure while conducting tests to uncover errors associated with interfacing. The objective is to take unit tested modules and built a program structure that has been dictated by design. This testing will ensure that the interfaces such as the module calling sequence in HMIS are arranged correctly.

In HMIS, an incremental strategy, the bottom-up integration and regression testing approach are used. In other words, when the individual components are working correctly and meet the objectives, these components are combined into a working system. Testing the interface of components explores how components interact with each other.

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The incremental integration is the antithesis of the big bang approach. HMIS program is constructed and tested in small segments, where errors are easier to isolate and correct; interfaces are more likely to be tested completely. Error will be corrected before processing to the next integration.

6.4 System Testing

The last procedure done is system testing. Testing the system is different from unit and integration testing. Its objective is to ensure that the system does what the users want it to do.

System testing ids designed to reveal bugs that cannot be attributed to individual component, or to the interaction among components and other objective. System test study all the concerning issue and behaviors that can only be explored by testing the entire integrated system or major part of it.

The HMIS is tested whether it meets the specific performance testing. Data integrity testing is used to verify that the data is stored in a manner where it is not compromised under updating restoration or retrieval processing in HMIS.

Table 6.5 Screen Testing

System Name: **HMIS**	Programmer:		
	Test Done:		
No.	Test Subject(Screen)	Remarks	Done	Date
1	Login		√	
2	Main Menu		√	
3	Patient Charting		√	
4	New Assessment		√	
5	View Assessment		√	
6	New Care Plan		√	
7	View Care Plan		√	
8	Swap Duties		√	

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9	Config Daily Scheduling		√	
10	Maintain Roster Location		√	
11	Change Staff Schedule		√	
12	My Schedule		√	
13	My Relocation		√	
14	My Messages		√	
15	Change Password		√	
16	Logout		√	
17	Access Denied		√	

6.5 User Acceptance Test

The system testing is not as tedious as it is for unit testing. Whereas the user acceptance test allows the hospital staff who are the client, to evaluate and to ensure that HMIS has meet all the user requirements. For user acceptance test, once the programmer has tested the system completely, it is ready for acceptance testing; testing the system in the environment where the people who will eventually be using it will use it. Acceptance refers to the fact that users typically sign off on the system and "accept" it once they are satisfied with it.

The purpose of acceptance testing is done to ensure that the system(HMIS) can fulfill the aspiration of users needs and meet their expectations or requirements

(Refer to Appendix)

CHAPTER 7

SYSTEM EVALUATION

AND CONCLUSION

7.1 System Evaluation

Through out the system development phase, problems were encountered and for the most part were resolved. The system was evaluated to identify its strength, limitations and possibilities for future enhancement

7.2 System Strength

The strength of HMIS is in the rostering module. Even thought there are still plenty of rooms to improve this module, currently this module has not been implemented in any of Hospital System in Malaysia.

The rostering module allowed the scheduling to be done digitally by the nursing sister and the staff can apply swap duties/changing duties online without filling in the form manually.

From the previous proposal, it had been state that scheduling can be done automatically (automatically generate) by the system, but it cannot be achieved due to the time constraint and the learning process.

7.3 Problems Faced During Development

7.3.1 Unfamiliarity with ASP.NET (VB.NET language) and SQL Server

Learning ASP.Net and SQL is not an easy task. I have to learn how to create even a tiny thing from the root. It takes lots of time to learn how to create functions, classes, store procedures for the database and lots of other task. Even a simple button needs its back coding and takes me a few days to make sure it functions well.

Learning how to manage state session, drill down and hierarchal takes a lot of energy for a beginner since it needs a very critical thinking and logic.

There are times when I don't even know how to correct the flaws and I have to change the method used.

But once I master all the basic task, the development of the system are quite simple and fun but there is time constraint that prevented the system to perfection since the time given are only 3 months.

7.3.3 Inserting Flash

There are lots of problems while inserting the flash movie in the system

1. The flash movie can only be inserted in a few web forms only.

2. Inserting the flash movie had to be done by back coding. The movie cannot be inserted like usual (using the insert flash facilities)

3. Some of the flash movie cannot be browse in the browser. It will return a black white page.

7.3.4 Setup Problems

1. The .Net framework and Visual Studio.net takes a long time to be installed in the computer. It takes more than 3 hours.

2. After installation, there are still a few problems with it where the Visual Studio.net cannot be open and it had to be reinstalled again.

7.4 Future Enhancement

Ideas for future enhancement cropped up during the development of HMIS. However time constraint prevented this idea from being explored any further. It would be beneficial to add the following features in the future:

- Automated Rostering
  - Provide facilities where the system will automatically change the roster if the nursing sister accept the swap duties changes
  - Automatically create monthly schedule and the nursing sister are allow to make changes.

- Library
  - Link to the Ministry Of health
  - Provide ability to access drug information index in on-line reference library.

- o Provide access to on-line reference from any clinical information system workstation.
- Recording down lab result
  - o Retrieve test results from hospital's lab information system (LIS) through interface for display in lab flow sheet.

7.5 Conclusion

It has been known for a long time ago, that the hospital system is managed manually is not that efficient. The users of electronic management system are estimated to bring a very drastic change in the medical field especially in the management of a hospital.

On the whole, HMIS has achieved most of its requirements, as determined during the analysis phase. It provides easy management of patient's treatment activities and other administration activities.

There was a lot knowledge gained through the development of the application. Knowledge was also gained in understanding how to translate a real world problem into computer-aided solution.

The developer was also able to understand all the details and concepts involved in planning and developing a system. The responsibility shouldered while developing this program will certainly prove useful upon entering the working environment.

Theories and knowledge gained through out the course of studies were applied in the development of HMIS. Although there is still room for improvement in HMIS, it is a fully functional system that will hopefully soon be implemented in the hospital.

Loggin In And Out

When you are not logged into Plone, you are not allowed to view any of the pages from the system. Logging in enables you to add, delete, or use content definition and edit content.

To log into Plone:

1. Go to the Plone icon on the desktop and double click the icon. You will be presented with this screen.

USER MANUAL

2. In the Login area enter your registered username and password in the fields.

   Your password is case-sensitive.

3. Click the

Loggin In And Out

When you are not logged into HMIS, you are not allowed to view any of the pages

from the system. Logging in enables you to add objects to the system collection and

edit content.

To log into HMIS:

1. Go to the HMIS icon on the desktop and double click the icon. You will be
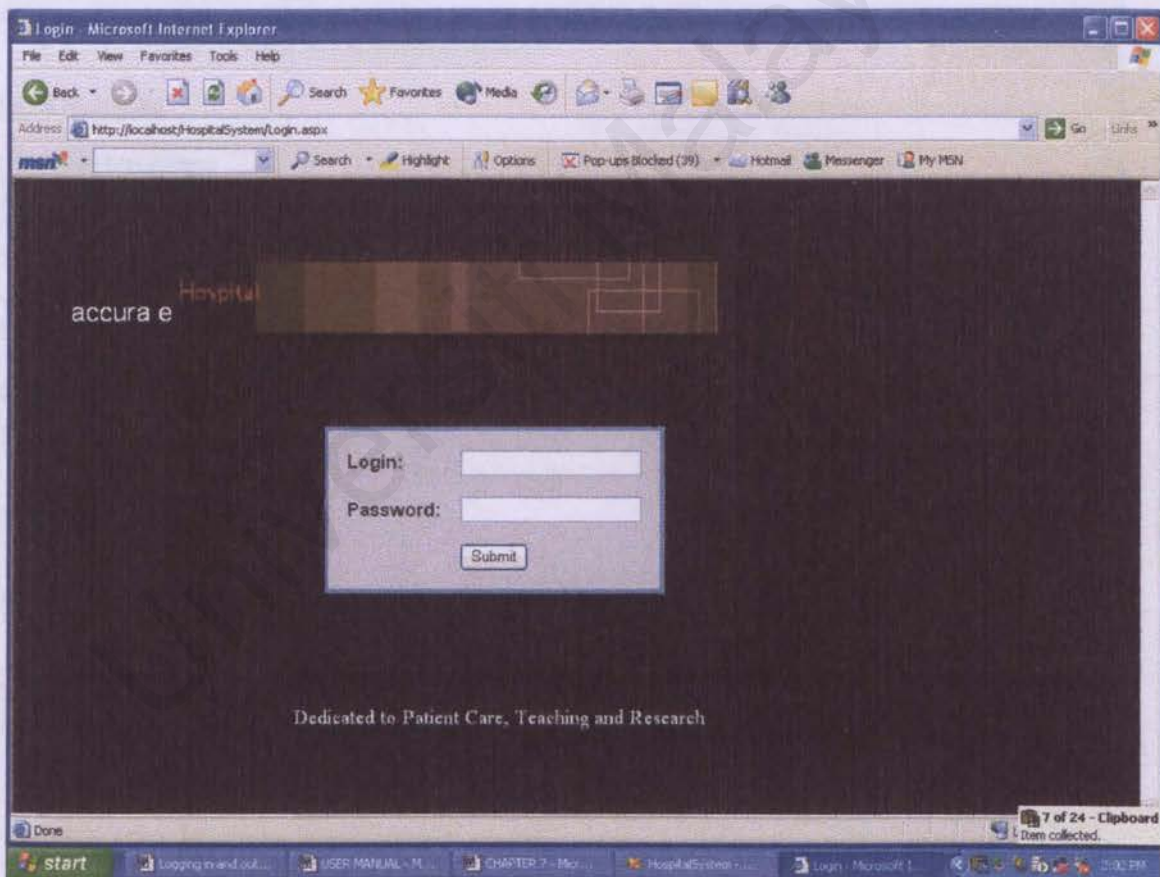
    presented with this screen.

2. In the Login area, enter your registered username and password in the
    fields.

    Your password is case-sensitive.

3. Click **Go**.

Your username appears on the navigation bar, indicating that you are logged in.

To log out of HMIS:

1. Do one of the following:

- close the browser window

- Click the **Logout** link on the navigation bar.
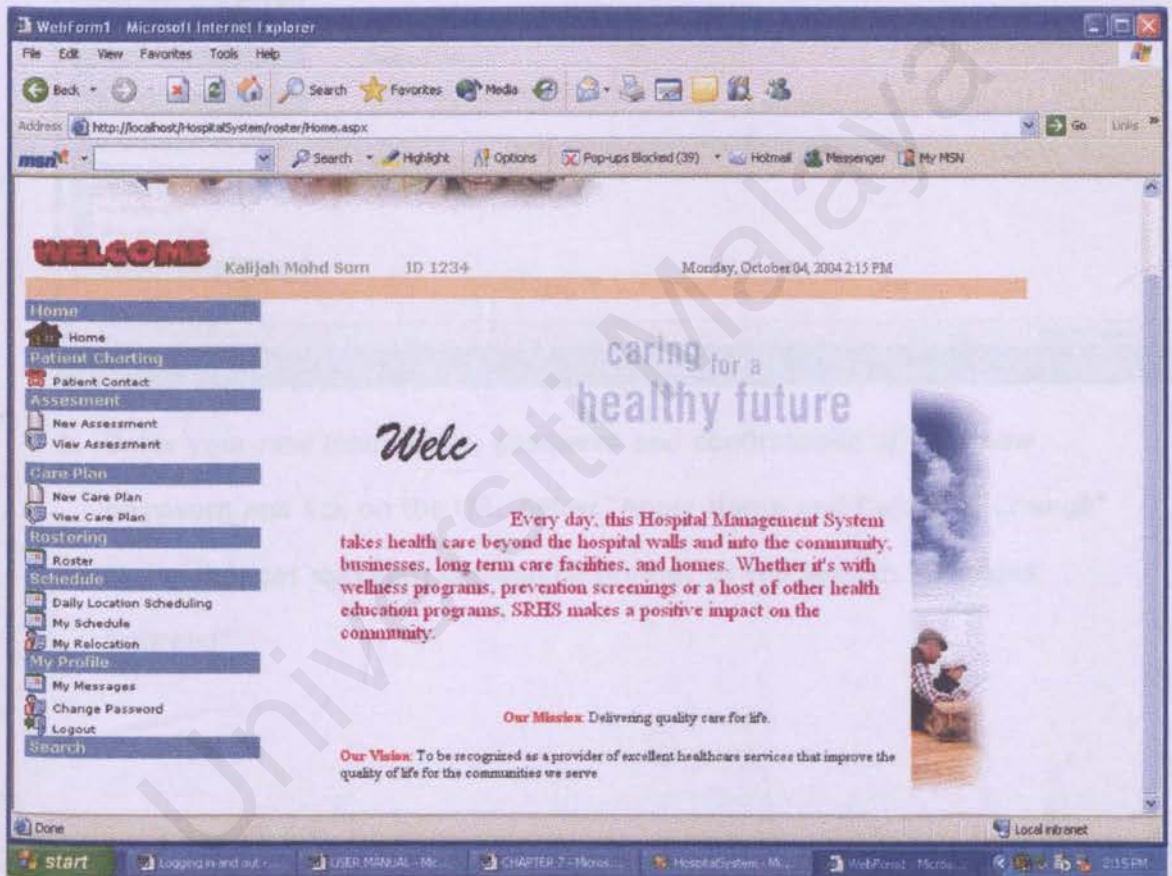
To change your login and password:

1. Click on "My Profile" on the navigation bar and choose "Change Password"
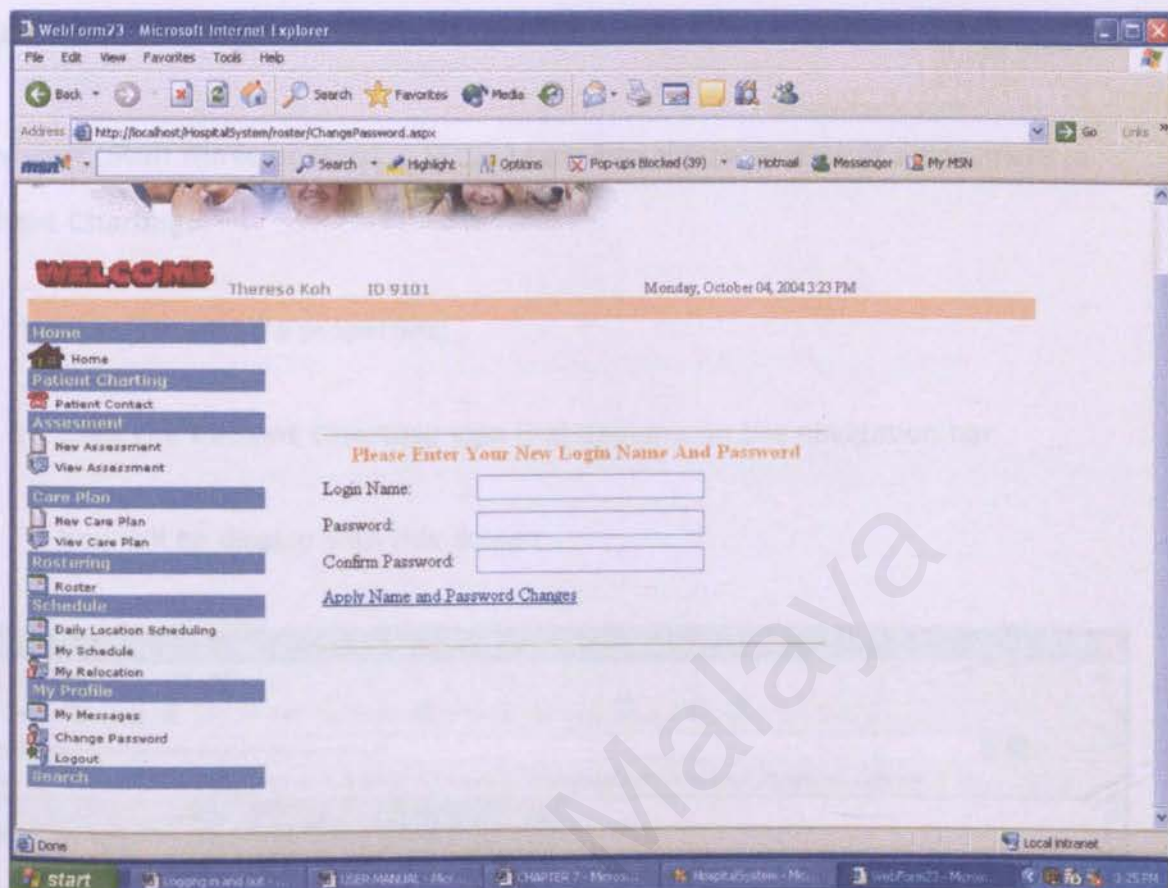
2. Enter your new login name, password and confirmation of your new
   password and lick on the URL below "Apply Name and Password Change"

3. If the changes succeed, you will be prompt by the system "Changes
   Succeed"

Patient Charting

Any user (Staff Nurse or Nursing Sister) can view the properties of a document in Patient Charting.

To view the document's properties:

1. Click the **Patient Charting** icon that appears on the navigation bar

    You will be display with this screen

Viewing and Creating New Patient Assessment

You can add a new patient assessment by selecting the assessment button on the navigation bar.

1. Click New Assessment, and you will be presented with this screen

2. Fill in all the details needed and click button next.

3. Once you finish filling in all the assessment, you will be presented with this screen.
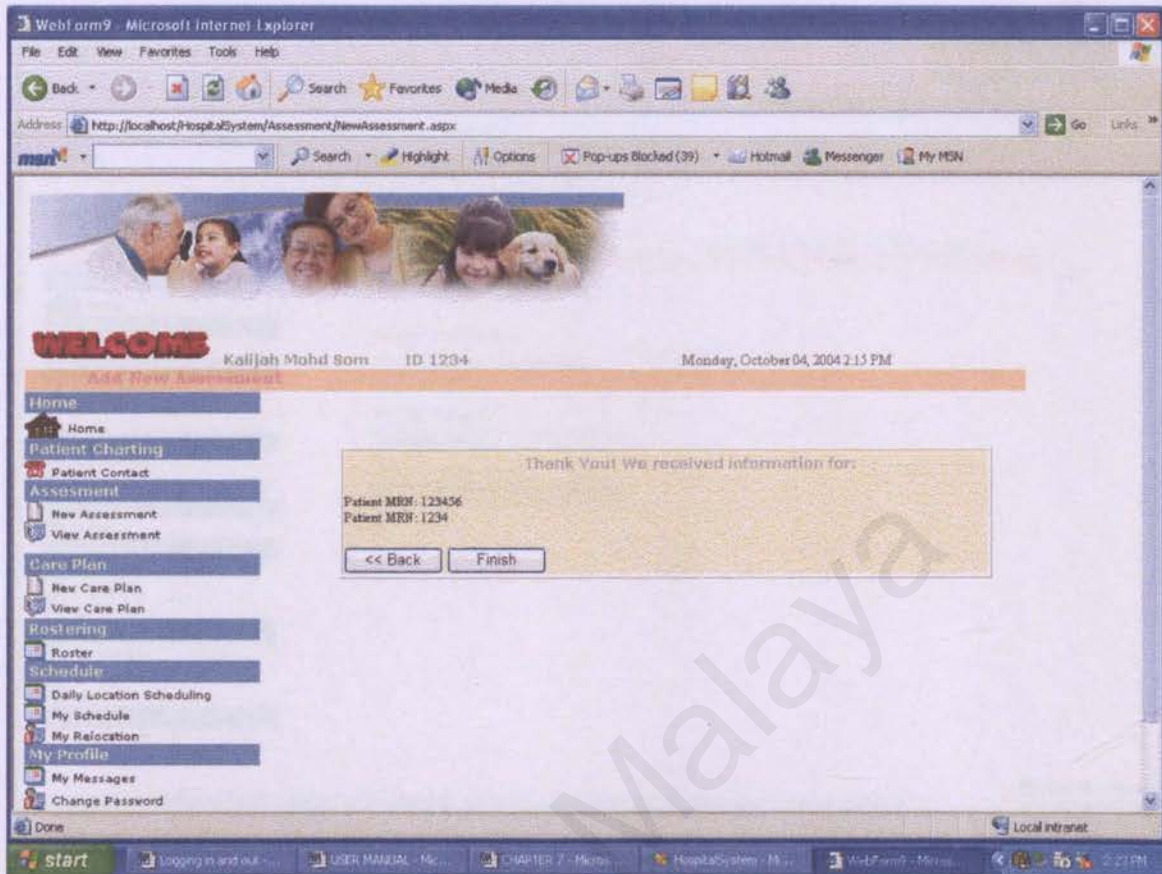
4. Click finish and all the information will be send to the database.

5. If the information is send, you will be prompt "Record Added". And if it fails, you will be prompt with "Update Problem. Record Not Added".

You do need to be logged into HMIS to view any collection's properties. The Assessment is sort by the Assessment categories.

To view Assessment properties:

1. Click the View Assessment Button and choose the categories you want to view.

2. Once you have choose a categories, this screen will appears
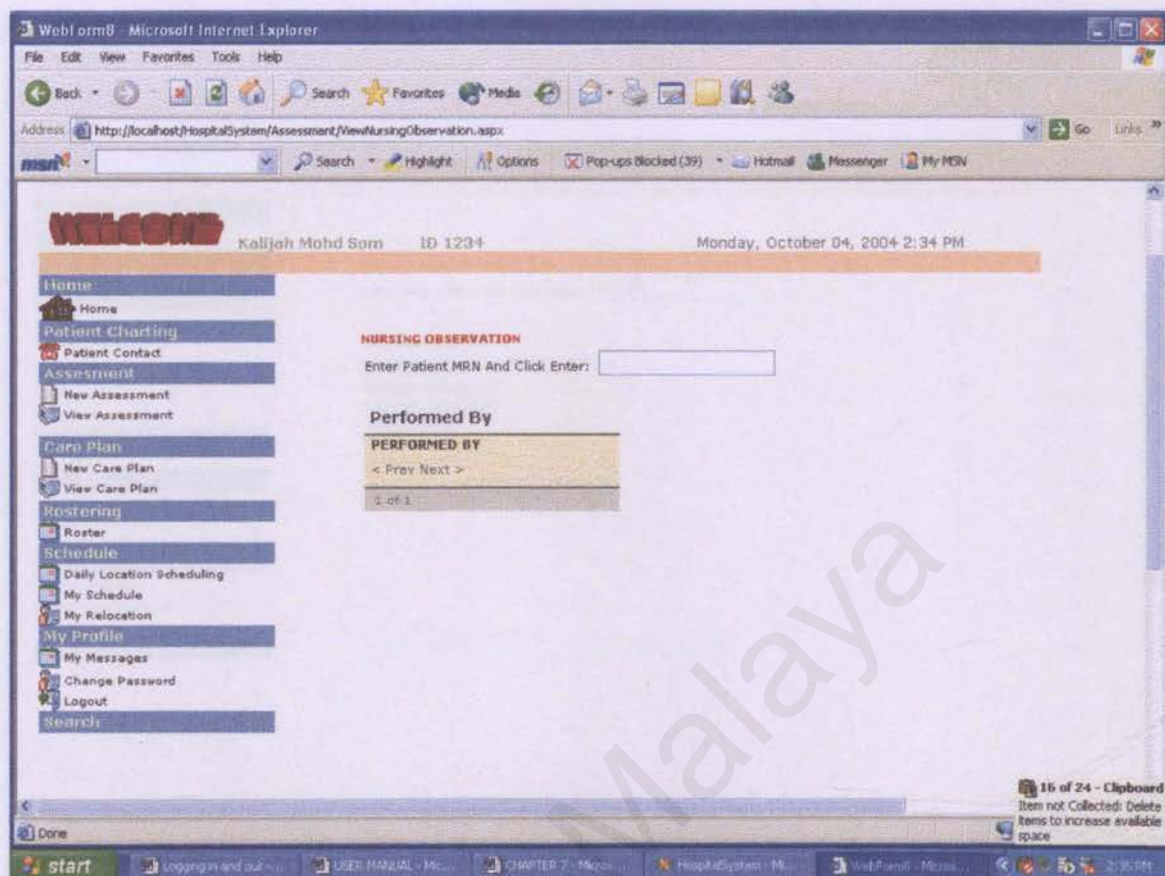
3. Enter the patient MRN Number and the list of the performer will be listed.
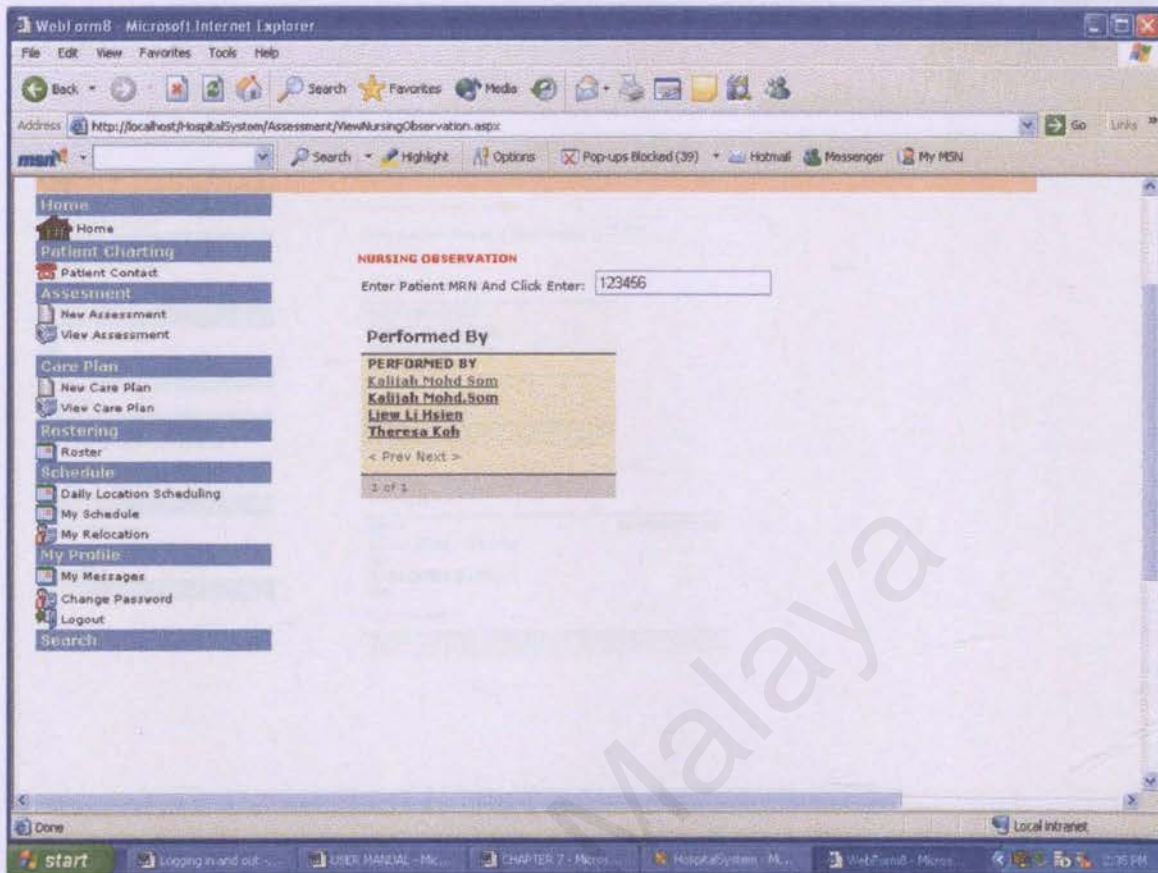
4. Click on the performer/Staff nurse name to view the assessment made by the particular person.

5. Once the name has been selected, you will see a list of dates and time of assessment made by the particular staff.

6. Double click the time and date of assessment that you want to view.

Theresa Koh
< Prev Next >
1 of 1

Nursing Observation By' Kalijah Mohd.Som'

DATE	REFERENCE ID
9/24/2004 12:14:53 AM	12
9/24/2004 12:51:41 AM	17

< Prev Next >
1 of 1

Patient Info On ' 9/24/2004 12:51:41 AM'

TEMPERATURE	RESPIRATION RATE	PULSE RATE	SBPSTANDING	SBPLYING	DBPSTANDING	DBPLYING
54564	64565	65464	564654	5665	5665	5656

7. The Information of the Assessment will be presented base on the performer
and the date and time.

You do.. Nursing Observation's properties. There are
two ways of viewing the assessment information, "by date/time" or "by performer"

To view care plan information:

1. Click the Care Plan button and select the categories you want to view.

2. "By performer"

   • If you choose "by date" you will need to key the performer ID number.

   • Use it one by one click, then you will be presented with the list of patients whose "......." you......

Viewing and Creating New Care Plan

You can add a new patient care plan by selecting the care plan button on the navigation bar. Basically, adding new care plan are the same as adding new assessment.

1. First you have to click on the new care plan button
2. Then you are required to fill in all the detail/information needed and click the button next.
3. Once you finish filling in all the details, click finish and all the information will be send to the database.
4. If the information is send, you will be prompt "Record Added". And if it fails, you will be prompt with "Update Problem. Record Not Added".

You do need to be logged into HMIS to view any collection's properties. There are two ways of viewing the care plan information, "By Patient" or "By Performer"

To view care plan properties:

1. Click the View Care Plan Button and choose the categories you want to view.
2. "By Performer"

   - If you choose "By Performer" you are required to give the performer ID number
   - Key in the ID and click enter, and you will be presented with a list of patients name

- Select the patient that you want to view and double click on the MRN number, and you will be given a list of dates and time of the care plan.

- Choose one of the date to which you want to view. Click on the date and the system will present you with the information of the care plan made by the particular staff on the selected date.

3. "By Patient"

- If you choose "By Patient" you are required to give the patient's MRN number

- Key in the MRN and click enter, and you will be presented with a list of performer/Staff Nurse name

- The next procedure or steps will be the same as viewing "By Performer". The only different is that, after the MRN is provided, you will be presented with Performer name list instead of Patient name list.

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Scheduling

To view your Monthly schedule

1. Click on the schedule button and choose "My Schedule"

2. You will be presented with this screen, detailing your shift and location of work
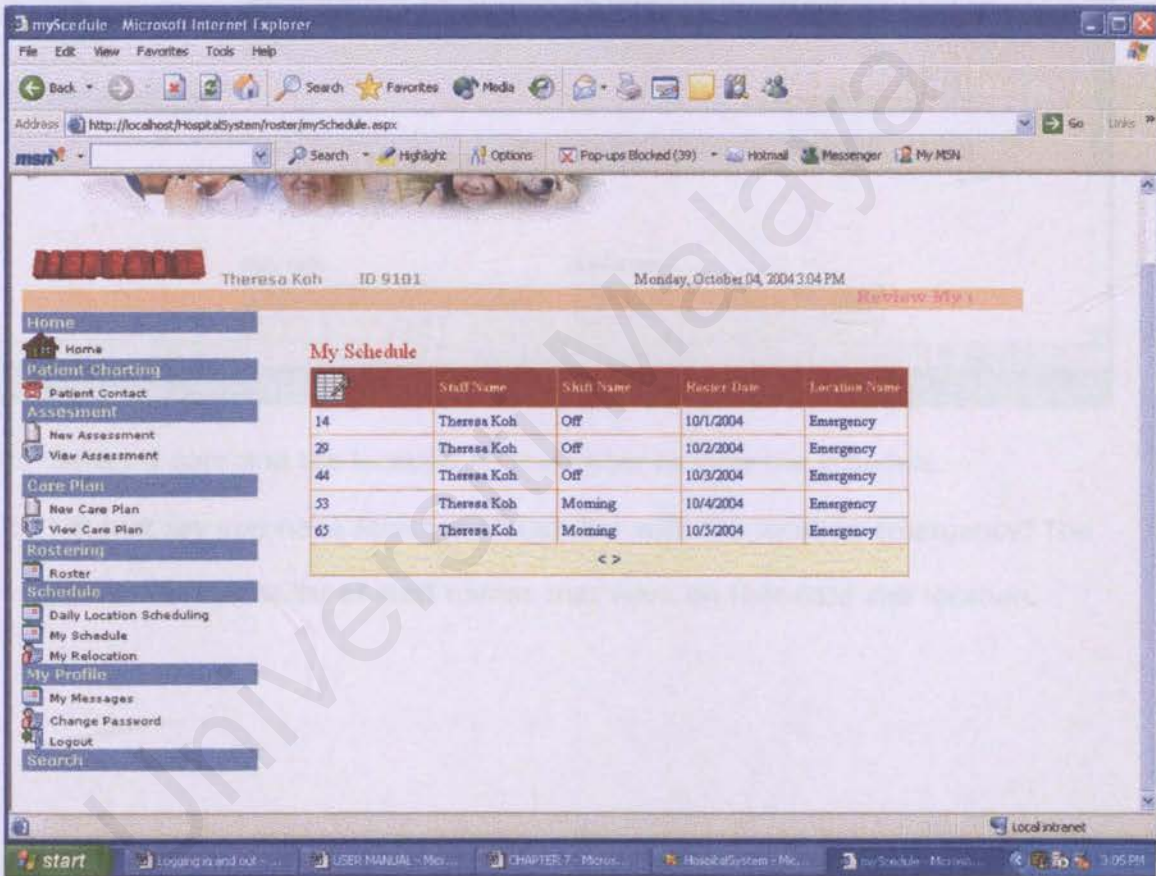
To view the daily roster or schedule, simply click on the scheduling button and choose "Daily Location Scheduling". You will see the screen as below
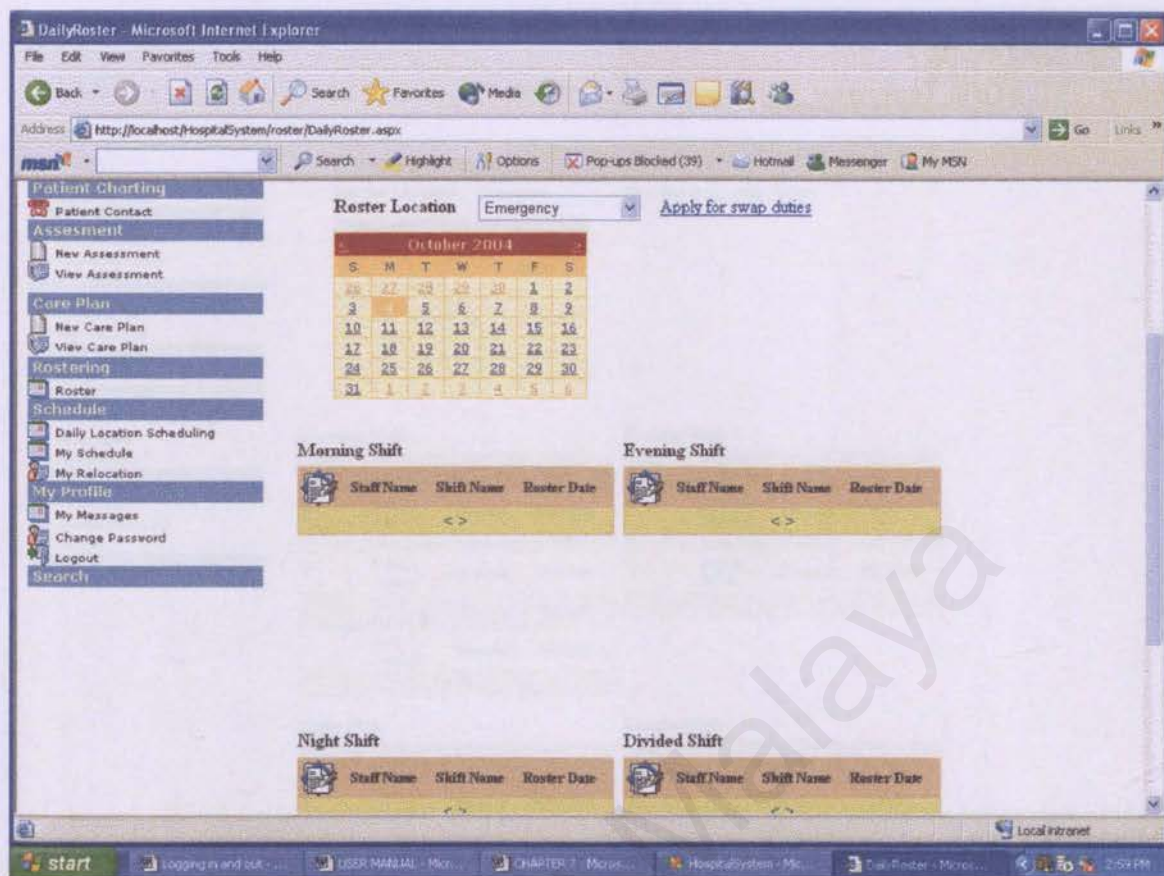
1. Select a date and the location on the roster to view the schedule.

2. Let just say you have selected 1st October with the location emergency. The
   system will show list of staff names that work on that date and location.

There are two ways of applying swap duties:

1. You can apply by clicking on the URL given on the "Daily Location Scheduling" or simply click on "My Relocation" on the navigation bar on the right.

2. Once you click either one of the choice, the system will present you with this screen
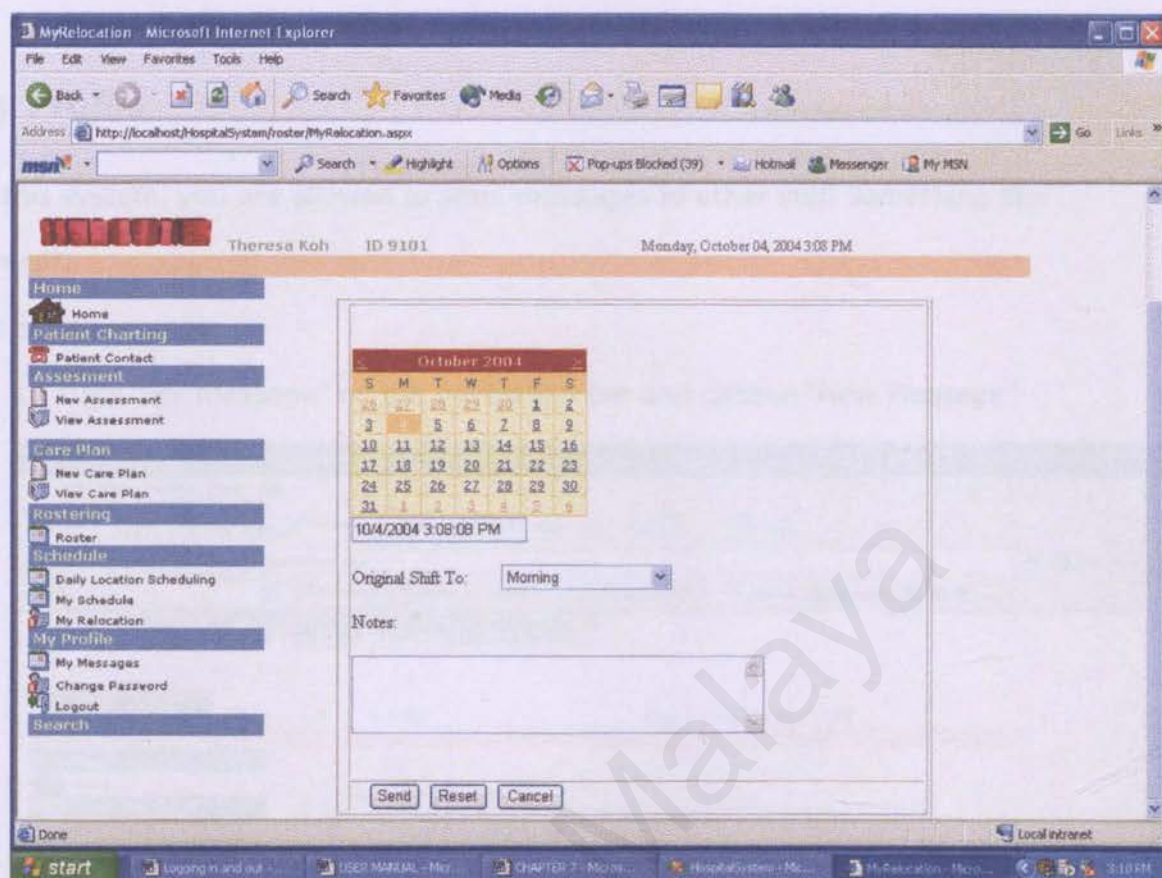
3. Choose a date from the calendar (swap duty date)

4. Choose the shift that you want to change to, and in addition, you can enter notes stating the reason why do you want to swap duty.

5. Click the button send once you are satisfied with the information or reset to re-enter all the information again or cancel to cancel the application

6. Once you hit the button send, your application will be send.

My Profile

In this system, you are allowed to send messages to other staff something like "email".

To send message:

1. Click "My message" on the navigation bar and choose "New Message"

2. Select the name of staff that you want to send the message to.

3. Type in the subject and your message and click enter to send, reset to re-enter all the information back and cancel to cancel the creation of message.

4. Once you click the button send you will see this screen
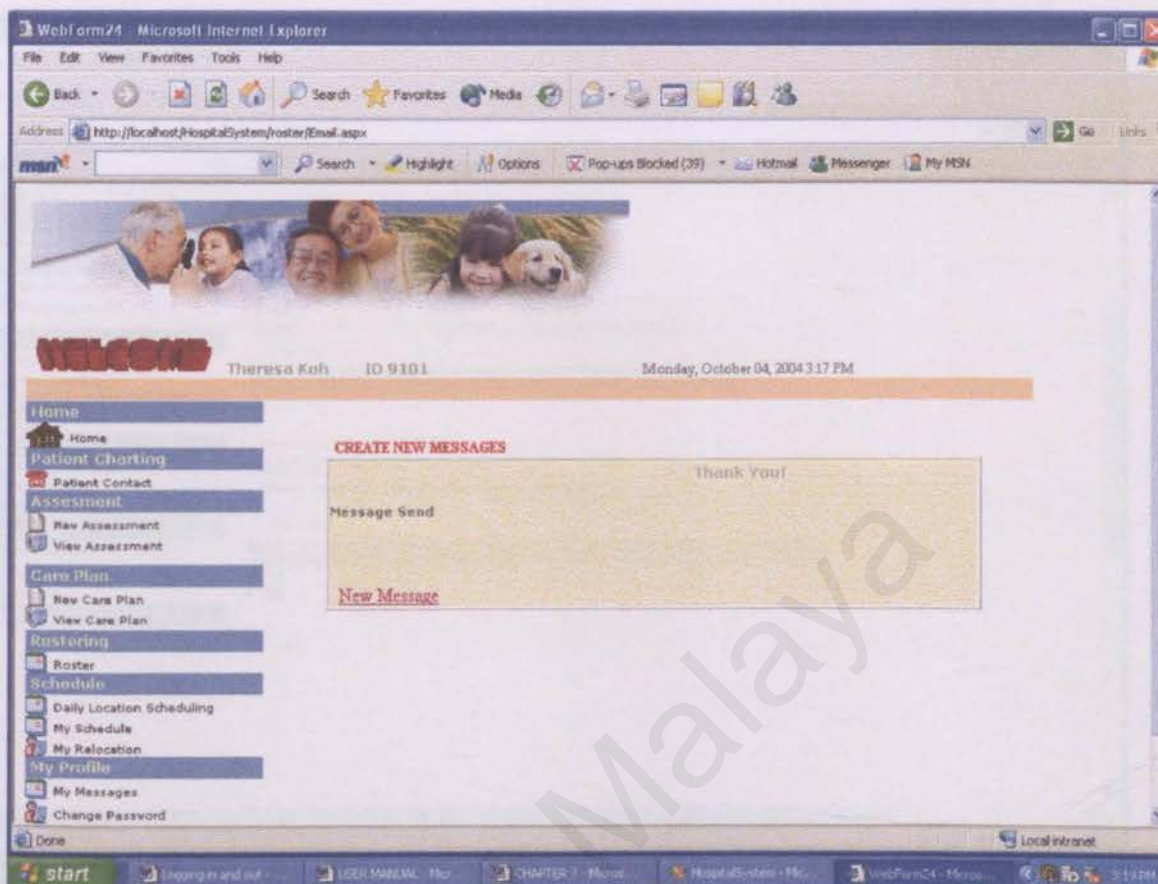
5. Double click on the URL "New Message" to send another message.

To view messages that has been send to you. Simply click on "My Message" on the right navigation bar and choose "Inbox"
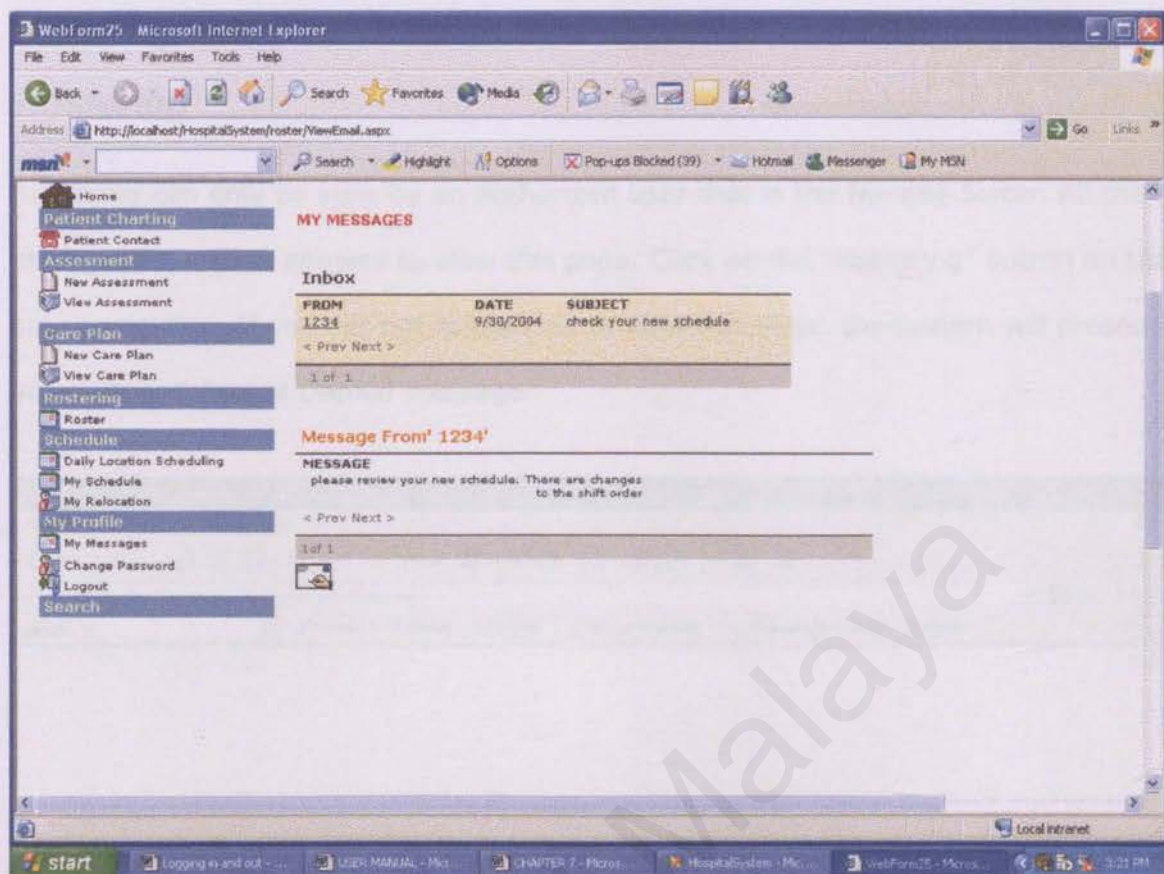
1. You will see the screen above.

2. Click on the "from" who, and you will see the message that has been send to you.

3. To replay the message, click on the envelope icon just below your message text.

Rostering

Rostering can only be view by an authorized user that is the Nursing Sister. All the other staffs are not allowed to view this page. Click on the "Rostering" button on the side navigation. If you are not authorized to view this page, the system will present you with and Access Denied message
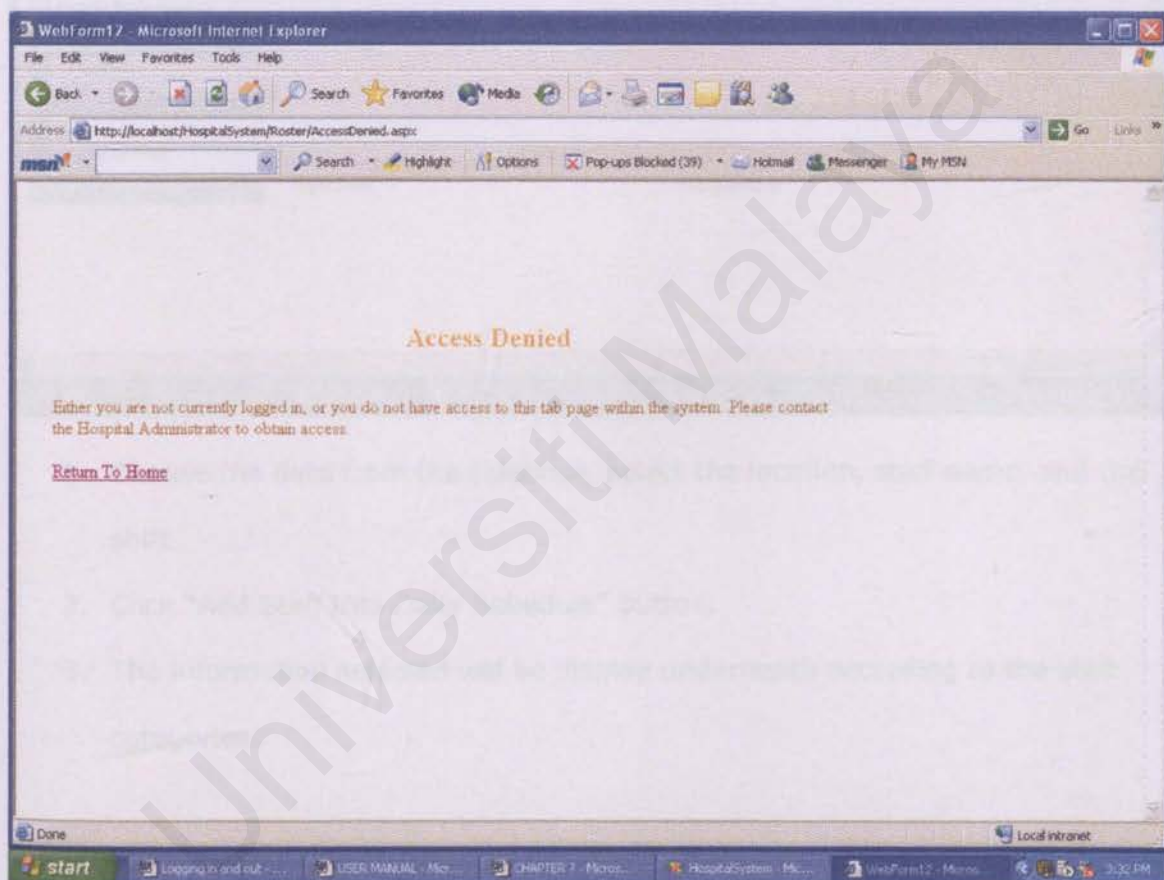
For authorized user

To create schedule, click on the "Config Daily Scheduling" on the navigation bar under "Rostering'
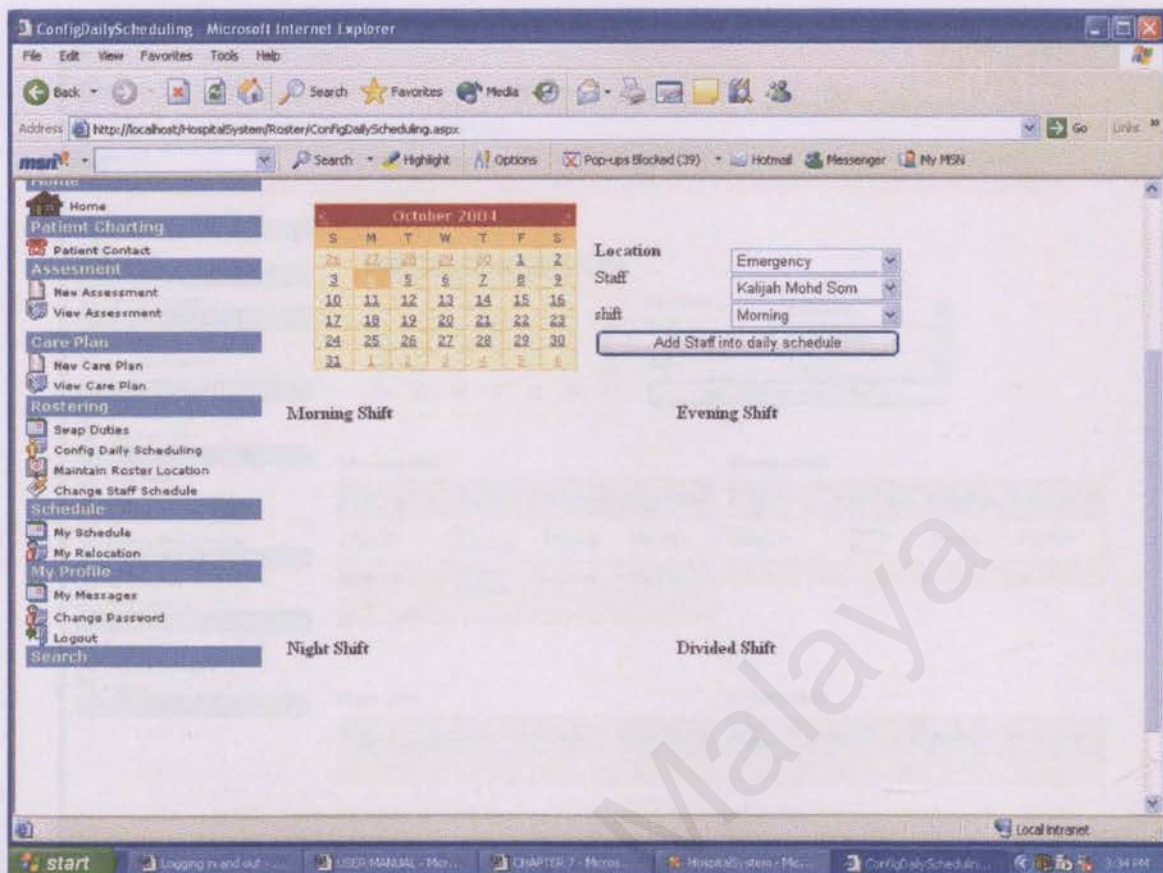
1. Choose the date from the calendar, select the location, staff name, and the shift

2. Click "Add Staff into Daily Schedule" button.

3. The information selected will be display underneath according to the shift categories.
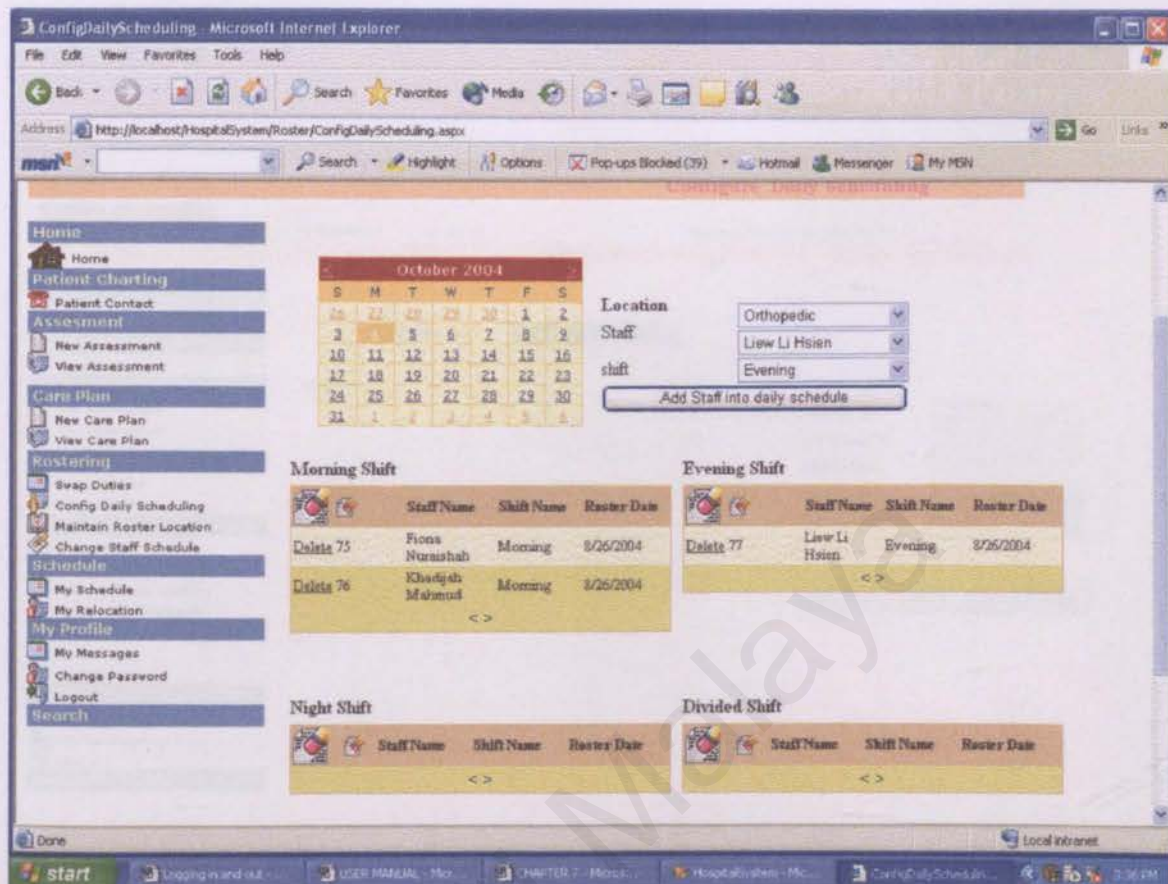
4. To delete the schedule that has just been created, simply click on the delete link at the side of each table.

The Nursing Sister have the authorization to change the roster or the schedule that have been created. To change staff schedule:

1. Click on "Change Staff Schedule" button on the navigation bar
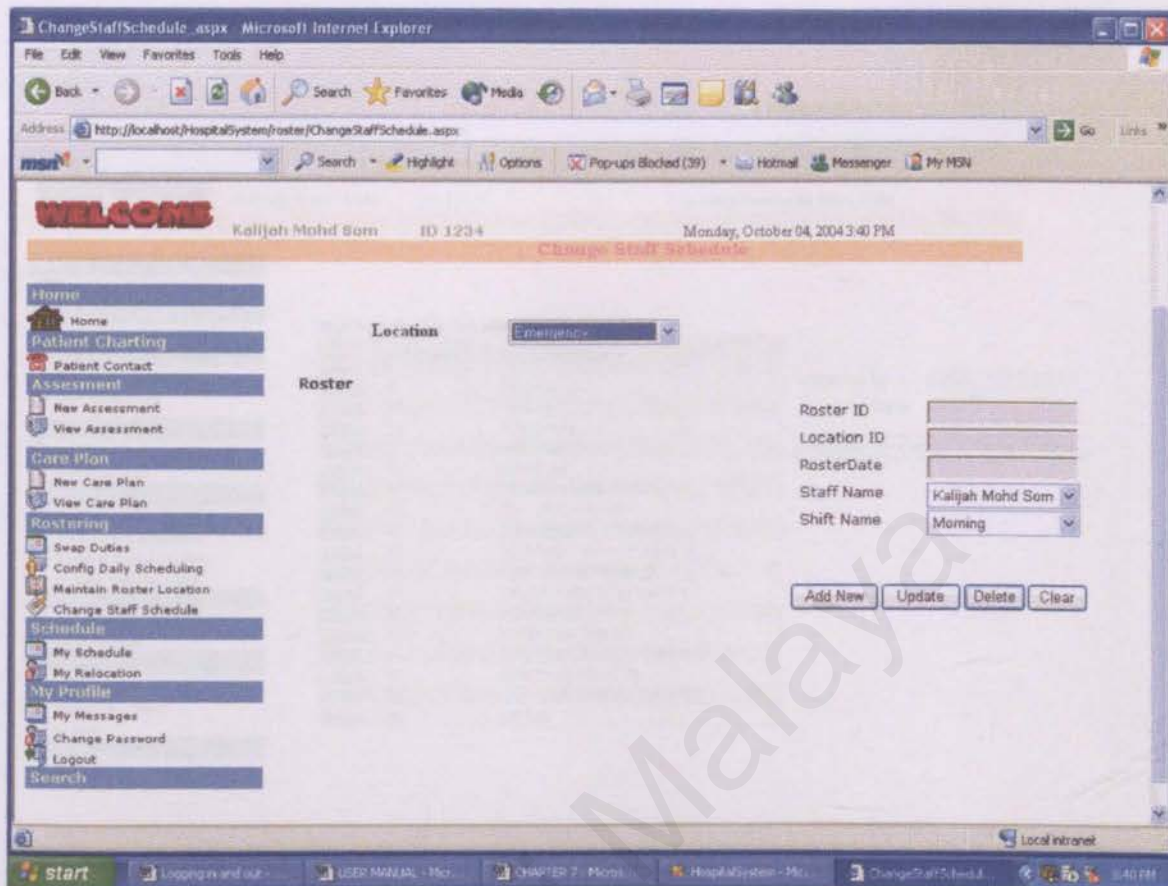
2. Select the location of work.

3. Select the staff by clicking on the select URL on the table

4. Change the Staff Name and the Shift Name and click update button.

5. You will see the changes that you have made at the table immediately

6. You can delete staff from the schedule, by selecting the staff name and click the delete button. The staff will be deleted from the schedule.

7. Click Add New button to add new staff to the schedule.

To maintain the roster location:

1. Click "Maintain Roster Location" on the navigation bar
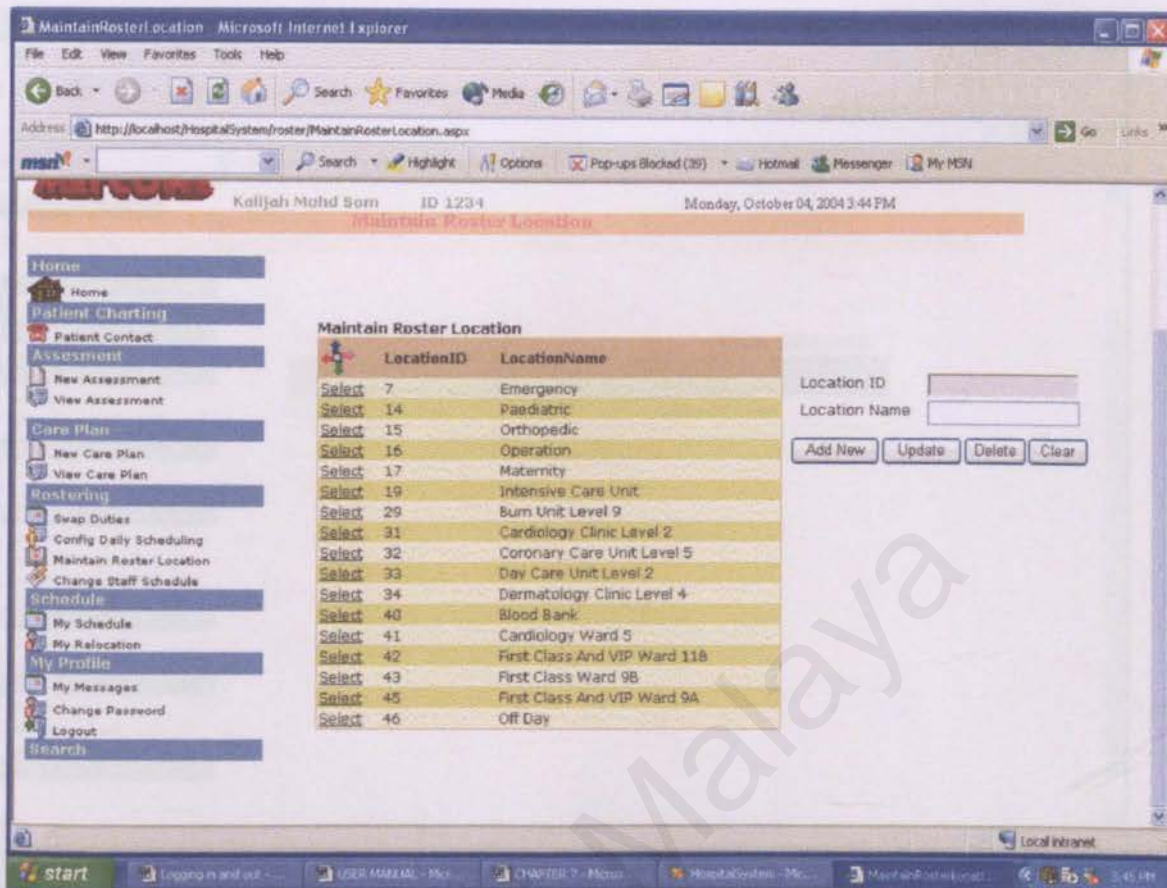
2. Select the location from the table by selecting the select URL

3. Change the Location Name and click the update button.

4. To add New location ,simply click the add new button after entering the new location name.

After the staff nurse have apply for swapping duties, it is the Nursing Sisters job to approve the request and change the schedule with the request is approve.

To view the staff nurse swap duties application:

1. Click on the "Swap Duties" under "Rostering" on the side navigation. You will be presented with the page below.
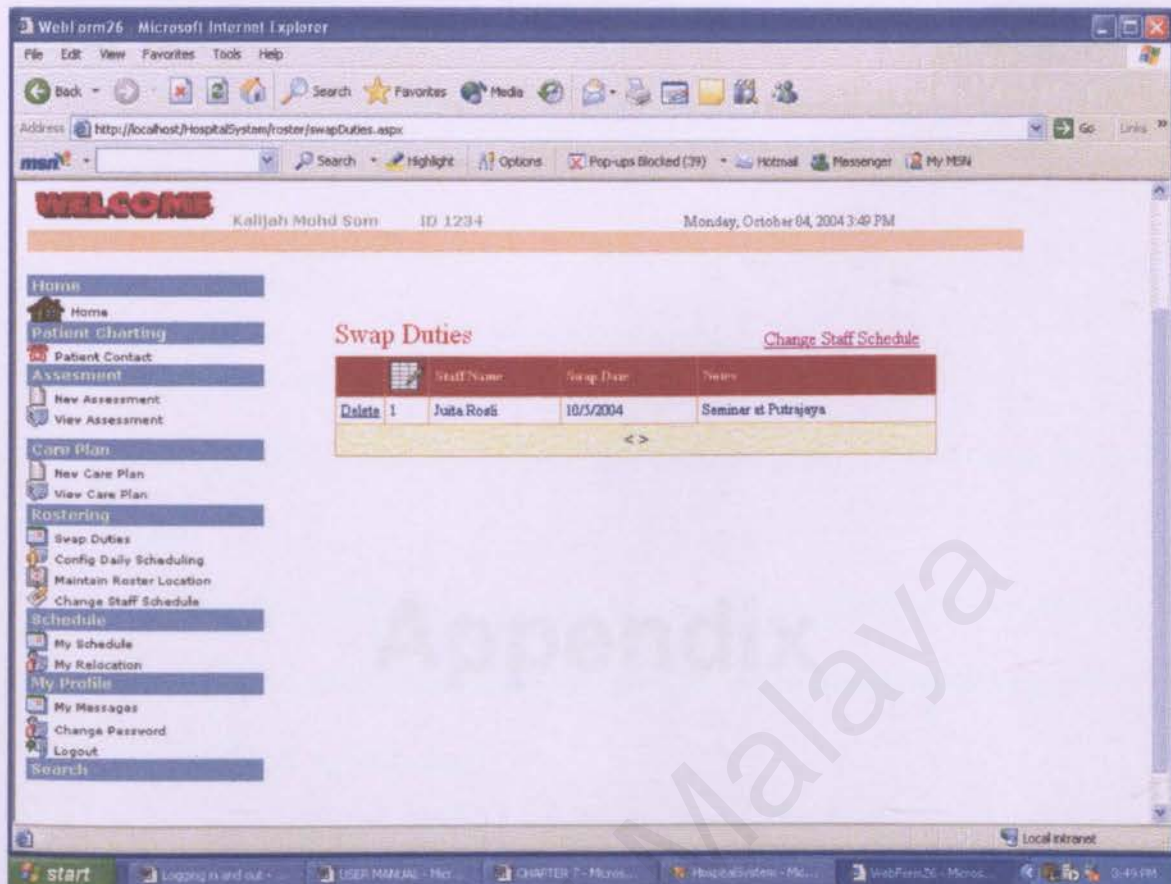
2. After viewing the application/request, you can change the schedule by clicking the "Change Staff Schedule" URL or by clicking "Change Staff Schedule" from the side navigation.

3. To delete the request from the table, click on the delete URL and the information will be deleted immediately.

Appendix

Interview Questions

Manual Based Hospital

1. Would you like to have a computer system to manage all the daily encounter and work?

2. If the files or record will contain their records, you have to open them and search for information? How can you print or search through all the records, wouldn't it take a long time?

3. Don't you think that data form manually are simpler? For example, if the records is change by any member and remove all the record content missed channel?

4. Is there any easy way than changing manually if any disappear?

5. Can you please explain about how the result any categorize, what field title and how these identify any separate?

6. Wouldn't you like a solution to send directly by the mail and not having you all the time and facing to explain the decisive of the previous patient treatment and show in the continuous way to record the patient and the history?

Computer Based Hospital

1. Are you satisfied with the current procedures of computer and data?

2. What are your action about the students retrieve?

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Manual Based Hospital

1. Would you like to have a computer system to mange all the documentation and work?

2. If the files or record cards are very thick, how are you going to access, store and search for information? How are you going to search through all the records, wouldn't it take a long time?

3. Don't you think that data kept manually are not safe? For examples, if the records is change by any unauthorized people or the record get lost (natural disaster?

4. Is there any backup or data recovery strategy if anything happen?

5. Can you please explain about how the nurses are categories, what their job, and how they carry out the jobs given?

6. Wouldn't you like a system to assist doctor by the side and not having you to all the time stand beside to update the doctor with the previous patient treatment, and observe the communication between the patient and the doctor?

Computer Based Hospital

1. Are you satisfied with the service given using computer currently?

2. What are your critics about the existing system?

3. Between manual and computer based system, which is better?

4. Have you ever experience using any rostering system (nursing sister)?

5. How long does it takes to manipulate the existing information from the patient's records to generate into report for higher management to analyzed and interpret the result?

6. How would you like to improve the existing system?

USER ACCEPTANCE

System Name:		Programmer:		
		Test Done By:		
		Hospital Name:		
No.	Test Subject(requirement specification)	Remarks	Done	Date
1	A transformation from the existing conventional hospital system to an improved and enhance support system in inventory decision making and better management system using advance technologies			
2	User-friendly field sensitive pop-up calendar expedite date time requirement. Flexible and unique reporting capabilities simplifies recalls which are able to select from many reports needed to make timely and accurate patient information tracking			
3	The retrieval of patient's information during consecutive visits are based on the MRN			
4	Information regarding patient records, treatment, and external provider are access faster and updated through the use of windows.			
5	To control access level of data by authorized hospital staffs, login information is prompted at the start of the system in order to increase security and integrity of the system			
6	To provide user control over the system whereby extra features such as user-friendly and attractive interface, links and additional interactive user guidance to ease hospital staffs to use the system			

P/S: These specifications above are the requirements that are wanted

OTHER COMMENTS:

_____
_____
_____
_____
_____
_____
_____
_____

Here with, I now agree/disagree that the system is according to the expresses requirements and certify that the system is at high standards and quality

_____

(signature of client tester)

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