AUTOMATED HOSPITAL MANAGEMENT SYSTEM

BY

OGBOBE NKECHI AGNES
(PG/M.ENG/08/49328)

In partial fulfillment of the requirement for the award of
Master of Engineering
In the
Department of Electronic Engineering,
University of Nigeria, Nsukka, Nigeria.

MAY 2011

APPROVAL PAGE

This is to certify that this project “AUTOMATED HOSPITAL MANAGEMENT SYSTEM” was carried out by Ogbobe Nkechi Agnes (PG/M.ENG/08/49328) of the Department of Electronic Engineering, Faculty of Engineering, University of Nigerian Nsukka in partial fulfillment of the requirements for the Award of Master of Engineering (M.Eng) degree in Electronic Engineering.

…….. ……..
Engr. Prof. C. C. Osuagwu Date
(Project Supervisor)

…… ……..
Prof. O.U. Oparaku Date
(Head of Department)

…….. ……
External Examiner Date

DEDICATION

This research work is dedicated to my children (Nneka, Ikenna , Ebube and Obinna)

ACKNOWLEDGMENT

I deeply appreciate the Almighty God and the Mother of Jesus Christ (The Queen of Holy Rosary) for the free gift of the Holy Spirit who gives me good sense of wisdom, peace, direction and sound health to carry out this work, I lack words to express my thanks, for your wonderful grace is enough for me.

My profound gratitude goes especially to diligent, hardworking and ever ready supervisor Engr. Prof. C.C. Osuagwu. I count it a special privilege to have him supervise my project. His prompt corrections, fatherly advice and timely suggestions in spite of his tight schedules and other commitments are responsible for the success of this work.

My deep and sincere gratitude goes to my beloved parents who thought it wise to send me to school. God bless you.

I am heavily indebted to my sweetheart, my dearly beloved husband Hon. Chief Ted Ogbobe for his untiring support in all aspects of my life. He is always by my side, encouraging and backing me up. His useful suggestions mean a lot to me. Darlyn, thank you, you are indeed a wonderful husband.

I also remember my lovely children, Nneka, Ikenna, Ebubechukwu and Obinna. They brought happiness to my life.

I acknowledge with deep gratitude the contributions of Dr C .I Ani, Sr Dr Angela Muobike, Dr Tom Ngwu ,Dr Sly Oputa and Dr Offiah ,their suggestions, assistance and care are commendable. They were always ready to assist me whenever I needed their assistance.

I must not forget my sisters; Mrs. Ijeoma Okwor, Mrs. Ugochukwu Eneh, Miss Amaka Ani amd my brothers Emma, Chidozie, Chika and Chima. May God richly bless you all.

I must not fail to mention some of my friends like Pricilla,Chioma, Amara, Kelechi,Fr Isaac, Rev Srs Janefrancis, Ifeoma, Helen, Eunice, Uche, and many others for their prayers and support in different ways.

NKECHI
MAY 2011

ABSTRACT

Every cooperate organization, institution or government agency requires data and good quality information to function effectively. It is not an over statement to say that many organizations, institutions or government agencies have become critically dependent on the use of database system for their successes especially in the hospital. Data collected from various sources for example telephone, fax, verbal messages, mails e.t.c. are used in decision making, planning and control of operations in management of clients, personnel and recourses. This project therefore aims at developing an improved hospital information management system using a function-oriented design. The poor efficiency of the present manual management system in hospitals today results from the inordinate length of time it takes to search for and locate patient folders and the ineffective filling system adopted. In this project the Oracle database is the database server where the data is sent to and retrieved from while Active Server Pages (**.net** programming language) is the client which provides the user interface design and the forms used by the doctors, staff and nurses during administration in the office, laboratory, wards, pharmacy, X-ray e.t.c.

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CHAPTER 1

1.0 BACKGROUND INFORMATION

A hospital is an institution for health care that provides patient treatment by specialized staff and equipment. Usually, hospitals are funded by the public sector, by health organizations (for profit or nonprofit), health insurance companies or charities, including funds by direct charitable donations. Historically, however, hospitals were often founded and funded by religious orders or charitable individuals and leaders. Modern-day hospitals are largely staffed by professional physicians, surgeons, and nurses.

1.1 CLASSIFICATION OF HOSPITAL.

Hospitals are distinguished by their ownership, scope of services, and whether they are teaching hospitals with academic affiliations. Hospitals may be operated as proprietary (for-profit) businesses, owned either by corporations or individuals such as the physicians or they may be voluntary-owned by non-profit corporations, religious organizations, or operated by federal, state, or city governments. Voluntary and non-profit hospitals are usually governed by a board of trustees, selected from among community business and civic leaders, who serve without pay to oversee hospital operations.

1.1.1 COMMUNITY HOSPITALS

Most community hospitals offer emergency services as well as a range of inpatient and outpatient medical and surgical services. Community hospitals, where most people receive care, are typically small, with fifty to five hundred beds. These hospitals normally provide quality care for routine medical and surgical problems.

Some community hospitals are nonprofit corporations, supported by local funding. These include hospitals supported by religious, cooperative, or osteopathic organizations. In the 1990s, increasing numbers of not-for-profit

community hospitals have converted their ownership status, becoming proprietary hospitals that are owned and operated on a for-profit basis by corporations. These hospitals have joined investor-owned corporations because they need additional financial resources to maintain their existence in an increasingly competitive industry. Investor-owned corporations acquire not for-profit hospitals to build market share, expand their provider networks, and penetrate new health care markets.

1.1.2 TEACHING HOSPITALS

Teaching hospitals are those community and tertiary hospitals affiliated with medical schools, nursing schools, or allied-health professions training programs. Teaching hospitals are the primary sites for training new physicians where interns and residents work under the supervision of experienced physicians. Non teaching hospitals also may maintain affiliations with medical schools and some also serve as sites for nursing and allied-health professions students as well as physicians-in-training.

Most teaching hospitals, which provide clinical training for medical students and other health care professionals, are affiliated with a medical school and may have several hundred beds. Many of the physicians on staff at the hospital also hold teaching positions at the university affiliated with the hospital, in addition to teaching physicians-in-training at the bedsides of the patients. Patients in teaching hospitals understand that they may be examined by medical students and residents in addition to their primary "attending" physicians.

One advantage of obtaining care at a university-affiliated teaching hospital is the opportunity to receive treatment from highly qualified physicians with access to the most advanced technology and equipment. A disadvantage is the inconvenience and invasion of privacy that may result from multiple examinations performed by residents and students. When compared with smaller community hospitals, some teaching hospitals have reputations for being very impersonal; however, patients with complex, unusual, or difficult diagnoses usually benefit

from the presence of acknowledged medical experts and more comprehensive resources available at these facilities. A teaching hospital combines assistance to patients with teaching to medical students and nurses and often is linked to a medical school, nursing school or university.

1.1.3 PUBLIC HOSPITALS

Public hospitals are owned and operated by federal, state, or city governments. Many have a continuing tradition of caring for the poor. They are usually located in the inner cities and are often in precarious financial situations because many of their patients are unable to pay for services. The federal government matches the states' contribution to provide a certain minimal level of available coverage, and the states may offer additional services at their own expense.

1.1.4 GENERAL HOSPITAL

This is the best type of hospital, it is set up to deal with many kinds of diseases and injuries, and normally has an emergency department to deal with immediate and urgent threats to health.

1.1.5 DISTRICT HOSPITAL

This is the major health care facility in its region, with large numbers of beds for intensive care and long-term care; and specialized facilities for surgery, plastic surgery, childbirth, and bioassay laboratories.

1.1.6 SPECIALIZED HOSPITAL

This is a special type of hospital meant for a particular case like trauma centers, rehabilitation hospitals, children's hospitals, seniors' (geriatric) hospitals, and hospitals for dealing with specific medical needs such as psychiatric problems, certain disease categories such as cardiac, intensive care unit, neurology, cancer center, and obstetrics and gynecology, oncology, or orthopedic problems.

1.1.7 CLINICS

A medical facility smaller than a hospital is generally called a clinic, and often is run by a government agency for health services or a private partnership of physicians (in nations where private practice is allowed). Clinics generally provide only outpatient services.

1.2 MANUAL WORKLOW OF THE HOSPITAL

In a hospital where patients are taken care of, when a patient visits the hospital, the patient is an inpatient if he/she is admitted while is an outpatient when he/she is not admitted. Or a patient is rushed in case of emergency. Some patients go to a hospital just for diagnosis, treatment, or therapy and then leave as outpatients without staying overnight; while others are admitted and stay overnight or for several days or weeks or months as inpatients. Hospitals usually are distinguished from other types of medical facilities by their ability to admit and care for inpatients whilst the others often are described as clinics. When a patient enters the hospital the following sequence of operation is carried out.

First and foremost, the patient is registered in the card/registration room, and then the patient goes to the nurses workbench for examination (vital signs), the nurses then carries the patient folder to the doctors workbench for diagnosis.
After the diagnosis, the patient is then sent to the laboratory for test or the patient is sent to the pharmacy for collection of drugs; the pharmacy section checks the patients prescribed drugs and cost them before the folder is sent to the bill office for billing.
After diagnosis the patient can also be referred to another clinic or to see a consultant in the same hospital. For example he/she may be referred for radiology services (CT scan, MRI, and ultrasound) or to special services like dental care. There may also be possibilities for surgical services. The inpatient may recover fully and be discharged or die and will be given a death report.

The purpose of the hospital management system is to automate the system for storage and easy retrieval of data, flow of information and management of hospital.

1.3 BRIEF DESCRIPTION OF HOSPITAL ACTIVITIES

A Hospital is a place where patients visit to for medical check up or diagnosis and treatment. Hospitals provide facilities like:-

- Consultation and diagnoses of diseases by doctors.
- Provision of treatment facilities.
- Facility for admitting Patients (providing beds, nursing, medicines etc.)
- Immunization of patients/children.

Various operational works are done in a hospital; all these works are done manually using papers as follows:

- Recording information about the patients that visit a hospital for treatment.
- Generating bills.
- Recording information related to diagnosis given to patients.
- Keeping record of the Immunization provided to children/patients.
- Keeping information about various diseases and medicines available to cure them.

These are the various jobs that are done in a hospital by the operational staff and doctors; information about patients is recorded manually by just writing the patients name, age and gender. Whenever the patient visits, his information is stored again;

- Bills are generated by recording price for each service provided to patient on a separate sheet and at last they all are summed up.

- Diagnosis information to patients is generally recorded on the document, which contains patient information. It is destroyed after some time to decrease the paper load in the office.
- Immunization records of children are maintained in pre-formatted sheets, which are kept in a file.
- Information about various diseases is not kept as any document.

Doctors themselves do this job by remembering various medicines.
All this work is done manually by the receptionist and other operational staff and lots of papers are needed to be handled and taken care of. Doctors have to remember various medicines available for diagnosis and sometimes miss better alternatives as they can't remember them at that time.

1.4 PROBLEMS OF THE MANUAL SYSTEM

Lack of immediate retrieval: -The information is very difficult to retrieve and to find particular information e.g. - To find out about the patient's history, the user has to go through various registers. This results in inconvenience and waste of time.

Lack of immediate information storage: - The information generated by various transactions takes time and efforts to store them.

Error prone manual calculation: - Manual calculations are error prone and takes a lot of time, this may result in incorrect information. For example, calculation of patient's bill based on various treatments.

Preparation of accurate and prompt reports: - This becomes a difficult task as business intelligence is difficult, this is due to lack of information collation (ability to put information together and analyze them).

1.5 NEED FOR AUTOMATED SYSTEM.

The need for an Automated Hospital Management System can be summarized as follows:-

Planned approach towards work: - The activities in the organization will be well planned and organized. The data will be stored properly in data stores, which will help in retrieval of information and in enforcing security.

Accuracy: - The level of accuracy in the proposed automated system will be higher. All operations would be done correctly and accurately. In practice, errors are not completely eliminated, they are reduced.

Reliability: - The reliability of the proposed system will be high as information is stored properly and securely.

No Redundancy: - In the proposed system utmost care would be taken to ensure that no information is repeated anywhere, in storage . This would assure economic use of storage space and consistency in the data stored.

Immediate retrieval of information: - The main objective of the proposed system is to provide for a quick and efficient retrieval of information. Any type of information would be available whenever users require them.

Immediate storage of information: - In manual system, lots of problems are encountered in trying to store large amount of information.

Easy to Operate: - The system should be easy to operate and should be such that it can be developed within a short period of time and fit the limited budget of

the user.

1.6 PROJECT OBJECTIVES

The main aim of this project is to design an automated system for controlling the flow of patient's data in the hospital. The aim is to solve most of the problems encountered in the hospital using the old and manual system of medical administration.

In the manual system, almost all the patient folders in the records have to be accessed by the staff for every folder request. The integrity and security of the data in database system are considered here from the point of view of freedom from risk. The risks are those events that threaten the data; threaten to destroy or corrupt it to prevent its use, threaten to access it illicitly or to steal it. The objectives of the project include:

- Systematic data collection.
- Efficient data storage
- Accurate data communication and manipulation
- Enhanced data security so that the hospital data and information are stored centrally in a secure fail safe database that has a secondary back-up database.
- Reduced system cost.

1.7 THE PROJECT SCOPE

The hospital management system is capable of supporting any number of staff of the hospital and each module of the package runs independently without

affecting other modules. This means that all departments of the hospital work independently.

SERVER EDITION (SE): This edition is Microsoft window based automated hospital management system server that will be running on the oracle database oracle database.

CLIENT EDITION (CE): This edition is a Microsoft window based Hospital Management System client, which must be developed and pre-installed in each of the client computers in the hospital before use. It provides the forms to be used.

INTRANET EDITION (WE): This edition is a web-based client and multi-platform system. It requires no modular installation and sits in any computer architecture.

1.8 PROJECT ORGANISATION

Hospital management system deals with using computer to enter and retrieve data for management of information in the hospital.
The project is made of seven chapters:

CHAPTER 1 introduces the project. It gives the background information of the project and discusses the problems, scope and objective of the project. It states the solution to the manual system of record keeping.
CHAPTER 2 is the literature review of the project. It reviews the manual system of keeping record in the hospital. It states all the effort that has been made so far to computerize the existing system. The existing manual system has a lot of problems that are facing it like data redundancy, data manipulation, data collection, and data storage and data security.
CHAPTER 3 reviews databases and database management systems.

CHAPTER 4 discusses requirement elicitation, analysis and specification

CHAPTER 5 is the project design. It shows the flow chart and design of different modules of the project. The project is made of different modules which ensure easy access to the database and ease maintainability.

CHAPTER 6 is the implementation and testing of the automated hospital management system. Active Server Pages .Net is the programming language while the Oracle database is the server. Each unit of the project will be tested to ensure correctness, robustness and maintainability.

CHAPTER 7 is project evaluation and conclusion.

CHAPTER 2

2.0 LITERATURE REVIEW

Automated Hospital Management System is a computerized medical information system that collects, stores and displays patient information. It deals with drug, equipment, human resources and other relevant information. They are a means to create legible and organized patient data and to access clinical information about individual patients. Automated hospital management systems are intended to compliment existing (often paper based) medical records which are already familiar to practitioners. Patient records have been stored in paper form for centuries and, over this period of time; they have consumed increasing space and notably delayed access to efficient medical care. In contrast, automated hospital management system store individual patient clinical information electronically and enable instant availability of this information to all providers in the healthcare chain and so assist in providing coherent and consistent care.

The advantages of automated hospital management system can be summarized according to (Yamamato 2006) as "optimizing the documentation of patient encounters, improving communication of information to physicians, improving access to patient medical information, reduction of errors, optimizing billing and improving reimbursement for services, forming a data repository for research and quality improvement, and reduction of paper".

The health care sector is an area of social and economic interest in several countries; therefore, there have been lots of efforts in the use of electronic health records. Nevertheless, there is evidence suggesting that these systems have not been adopted as expected, and although there are some proposals to support their adoption, the proposed support is not by means of information and

communication technology which can provide automatic tools of support.

2.1 EVALUATION OF HEALTH CARE

In 1995 van der Loo conducted a literature review to classify evaluation studies of information systems in health care (van der loo et al 1995). The primary objective was to get an insight into the variety of evaluation methods applied. In all, 76 studies published between 1974 and 1995 were included in the review. Many different performance measures or success factors were applied in the studies reviewed. The review's main conclusion was that the evaluation methods and effect measures depended on the characteristics of the information system under evaluation. However, the range of identified evaluation methods and effect variables was broad for every type of system. Among the effect variables were costs, changes in time spent by patients and health care personnel, changes in care process, database usage, performance of users of the system, patient outcomes, job satisfaction, and the number of medical tests ordered. Several authors have suggested approaches to evaluating information technology in health care (Anderson et al 1997). These approaches concerned assessment of technical, sociological, and organizational impacts. A literature review by Delone and McLean 1992 in the field of management information systems aimed at identifying determinants for system success. They presented a framework with six dimensions of success -:1) system quality, (2) information quality, (3) usage, (4) user satisfaction, (5) individual impact, and (6) organizational impact

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The purpose of their review was to analyze evaluation studies of inpatient patient care information systems requiring data entry and data retrieval by health care professionals, published between 1991 and May 2001, to determine the attributes that were used to assess the success of these systems and to categorize these attributes according to the Delone and McLean framework. They also examined how the attributes were measured and what methodologies

were used in the evaluation studies. Their review did not cover outpatient.

2.2 SYSTEM QUALITY

Delone and McLean 1992, proposed to subdivide success measures of management information systems into six distinct categories that define the five dimensions to measuring success of system deployment as follows: (1) system quality, (2) information quality, (3) usage, (4) user satisfaction, (5) individual impact, and (6) organizational impact. Within each category several attributes could contribute to success.

The information processing system itself is assessed with system quality attributes (e.g., usability, accessibility, ease of use). Information quality attributes (e.g., accuracy, completeness, legibility), concern the input and output of the system. Usage refers to system usage, information usage, or both. Examples of attributes of usage are number of entries and total data entry time. User satisfaction can concern the system itself or its information, although they are hard to disentangle. Delone and McLean included user satisfaction in addition to usage, because in cases of obligatory use, user satisfaction is an alternative measure of system value. Individual impact is a measure for the effects of the system or the information on users' behavior, and attributes can be information recall or frequency of data retrieval or data entry. Organizational impact, the last category, refers to the effects of the system on organizational performance. Thus, success measures vary from technical aspects of the system itself to effects of large-scale usage.

DeLone and McLean 1992– concluded that success was a multidimensional construct that should be measured as such. In addition, they argued that the focus of an evaluation depended on factors such as the objective of the study and the organizational context. Furthermore, they proposed an information system success model in which the interdependency—causal as well as temporal —of the six success factors was expressed. In their view, success was a dynamic process rather than a static state; a process in which the six different

dimensions relate temporally and causally. System quality and information quality individually and jointly affect usage and user satisfaction. They influence each other and have a joint influence on user behavior.

A study was conducted in 2004 by Healthcare Informatics in collaboration with American Health Information Management Association (AHIMA) to measure the level of readiness of health information management (HIM) professionals and the extent of(Electronic Health Record) EHR implementation in their organization. The findings showed the industry is continuing to see more movement toward EHR. For example, when organizations were asked to describe their progress toward an EHR, 17 percent of respondents indicated they were extensively implemented; 26 percent indicated they were partially implemented; 27 percent said they were selecting, planning, or minimally implemented, and 21 percent indicated they were considering implementation and gathering information about it (Minal Thakkar and Diane .Davic August 14 2006).

In a study conducted during the summer of 2004 by the American Academy of Family Physicians (AAFP), nearly 40 percent of respondents, who were members of AAFP, indicated they either had completely converted to EHRs or were in the process of doing so. Twenty-four percent had purchased the EHR system within the first half of the year. Findings showed that cost remained a major barrier for physicians in small and medium practices in the move to EHR systems.

Previous research on risks of EHR systems identified privacy and security as major concerns. Other risks identified were financial risk (billing errors in software), software systems becoming obsolete, software vendors going out of business, computer crashes, data capture anomalies, programming errors, automated process issues, and populating invalid information in the decision support systems module of EHR systems.

Some of the main benefits of EHR systems that have been identified include

reducing medical errors, improving quality of care, conserving physician time, sharing patient information among healthcare practitioners, and workflow efficiency.

2.3 RELIABILITY AND VALIDITY OF QUALITY MEASURES

Previous reviews of research on electronic health record (EHR) data quality have not focused on the needs of quality measurement. The authors Chan, Kitty S. et al, in 2010 reviewed empirical studies of EHR data quality, published from January 2004, with an emphasis on data attributes relevant to quality measurement. Many of the 35 studies reviewed examined multiple aspects of data quality. Sixty-six percent evaluated data accuracy, 57% data completeness, and 23% data comparability.

2.4 COST AND BENEFIT

The major barrier to adoption of an EHR system, as identified by some studies, was misalignment of cost and benefits or financial reimbursement (Bates, David 2005).. Brailer said that reimbursing physicians for using EHR systems and reducing their risk of investing in them should accelerate the adoption of EHR systems in physicians' offices.

Other barriers that have been identified are technical issues, system interoperability, concerns about privacy and confidentiality, lack of health information data standards, lack of a well-trained clinician informatics workforce to lead the process, the number of vendors in the marketplace, and the transience of vendors (Brailer david J et al 2003) .

These studies and other previous research conducted in the area of EHR systems determined the risks, benefits, and barriers as well as analyzed the relationship between the adoption of EHR systems and the size of the hospital or physician office. Moreno 2003 stated, "The evidence from our literature review suggests that large physician groups and hospitals are at the forefront of using EHRs; however, the extent to which small physician practices—those made up of eight or fewer physicians representing nearly 80 percent of all physicians in the

US—have adopted EHRs nationally remains unclear.

The American Hospital Association (AHA) conducted a survey of all community hospitals in 2005 to measure the extent of information technology (IT) used among hospitals and better understand the barriers to further adoption. CEOs from 900 community hospitals (19.2 percent) participated in the study. The study found that 92 percent of the respondents were actively considering, testing, or using IT for clinical purposes. The remaining 8 percent that were not considering IT were primarily small, rural, non teaching, and no system hospitals. The study reported that more than 50 percent of the respondents fully implemented the EHR functions results review—lab, order entry—lab, order entry—radiology, access to patient demographics, and results review—radiology report.

This study also reported that 50 percent of the rural hospitals specified they were just “getting started” on IT system implementation, whereas 48 percent of the urban hospitals indicated “moderate” or “high” levels of implementation of IT systems. Cost was the number one barrier to the adoption of EHR systems; 59 percent of the hospitals found that initial cost was a significant barrier; 58 percent found acceptance by clinical staff as somewhat of a barrier. Among the smaller hospitals with bed size less than 300, more than 50 percent saw cost as a significant barrier.

Historically, test results has been among the earliest components of the information system to be automated and it is possible that not-for-profit hospitals, which constitute the more traditional form of hospital organization, may have more experience developing this component of their information systems. Though there has been significant attention placed on the promise of computerized order entry systems to reduce medical errors, starting with the IOM reports in the 1990s, fewer hospitals have successfully installed such systems. We found that hospitals with older age of plant (i.e., building) scored 8 points

lower on the order entry sub-domain. One might suspect that newer hospital facilities would be more easily equipped with computerized order entry systems than hospitals with older physical facilities, as these results suggest. Perhaps more important than the age of the building is the newness of its technological infra-structure. The latter may not necessarily correlate with the building age, though it could be captured in the age of plant variable and may explain the findings we observe.

Historically, urban safety net hospitals in the United States are least able to meet the challenges associated with acquiring new medical technology. These hospitals balance multiple claims on their resources, perhaps reducing the capability to invest in the information technologies that support healthcare. Our analysis suggests, however, that urban safety net hospitals in Texas do not significantly trail their peers. Due to their size and scale, these hospitals may achieve IT parity because they can afford the fixed costs necessary for the IT infra-structure and have decided to pursue this course. In addition, all of the safety net hospitals in this sample are major teaching hospitals. Thus, it is difficult to differentiate between the effects of teaching status and safety net status.

According to recent estimates, adoption of clinical information technologies remains low but follows certain patterns. Our findings are consistent with these trends. Historically, the computerized display of lab results has been among the first aspects to be automated. In the last decade, digitization of radiological images has also increased. Both of these components fall under the test results sub-domain, which in our study showed the greatest degree of adoption. Though some hospitals may be experimenting with computerized order entry and decision support, these efforts have not yet translated into systems that physicians widely use, as indicated by the low scores in these areas. Electronic decision support is perhaps the most challenging component to implement since it requires all other components first. ,The nationwide health information network (NHIN) has been proposed to securely link community and state health information exchange (HIE) entities to create a national, interoperable network for sharing healthcare data in the USA. Dixon BE et al, J Am Med Inform Assoc

paper describes a framework for evaluating the costs, effort, and value of nationwide data exchange as the NHIN moves toward a production state. The paper further presents the results of an initial assessment of the framework by those engaged in HIE activities.

2.5 SERVICE PERFORMANCE

VIASANT, a leader in web-based service support systems for the healthcare industry, announced that Northwestern Memorial Hospital has deployed its Sentact service application to document and manage service requests for four of the organization's service departments including: Facilities Management, Environmental Services, Biomedical Engineering and Food & Nutrition. Utilizing Sentact, Northwestern Memorial has improved staff productivity, streamlined support operations and increased service performance.

Sentact has enabled Northwestern Memorial to manage services delivery with a detailed, real-time view into work activities. Escalation and alert procedures have been automated to meet service level objectives, reducing response and resolution times. Hospital employees can now submit requests and check on work status on-line. Also, by accessing a single system, hospital staff more easily locates the appropriate resource for service requests and resolution. Overall call volume into the support centers has been reduced by 32% with the use of Sentact's self-support channels.

"Northwestern Memorial is very effective at using technology to enhance or enable their business practices," says Shirley Escober of VIASANT.

Northwestern Memorial has also successfully integrated Sentact with other hospital support applications. By integrating Sentact with the billing platform for the accounting group in one department, and automating time-consuming functions, administrative tasks have been reduced by nearly 10 percent. Northwestern Memorial also integrated Sentact with their Biomedical Engineering preventative maintenance system, extending its features to capture online corrective maintenance requests from the hospital staff. This enabled the department to centralize and document all work orders for better tracking

management.

Recently the hospital launched a centralized call center to support multiple service department requests. More than 16,000 requests come through the system in a month and the Sentact personnel in the call center can enter and monitor work requests across different service teams.

“The Sentact system allows us to analyze trends and continually refine our methods of servicing the hospital and supporting our patients and staff,” says Brian Stepien, director, Support Services. “The data we collect enables our staff to benchmark and improve service delivery across the organization.”

2.6 TIME EFFICIENCY

Abu Dagga A et al, 6th October 2010 Telemedicine and e-Health, searched five databases (PubMed, CINAHL, PsycINFO, EMBASE, and ProQuest) from 1995 to September 2009 to collect evidence on the impact of blood pressure (BP) telemonitoring on BP control and other outcomes in telemonitoring studies targeting patients with hypertension as a primary diagnosis. Fifteen articles met their review criteria. They found that BP telemonitoring resulted in reduction of BP in all but two studies; systolic BP declined by 3.9 to 13.0 mm Hg and diastolic BP declined by 2.0 to 8.0 mm Hg across these studies. These magnitudes of effect are comparable to those observed in efficacy trials of some antihypertensive drugs.

Poissant et al, J Am Med Inform Assoc, 25th September 2010 made a systematic review to examine the impact of electronic health records (EHRs) on documentation time of physicians and nurses and to identify factors that may explain efficiency differences across studies. In total, 23 papers their criteria; five were randomized controlled trials, six were posttest control studies, and 12 were one-group pretest-posttest designs. Most studies (58%) collected data using a time and motion methodology in comparison to work sampling (33%) and self-report/survey methods (8%). A weighted average approach was used to combine results from the studies.

Verhoeven F et al, 2nd June 2010 Journal of Diabetes Science and Technology, 1994 to 2009, carried out a research to determine the effects of teleconsultation regarding clinical, behavioral, and care coordination outcomes of diabetes care compared to usual care. Two types of teleconsultation were distinguished: (1) asynchronous teleconsultation for monitoring and delivering feedback via email and cell phone, automated messaging systems, or other equipment without face-to-face contact; and (2) synchronous teleconsultation that involves real-time, face-to-face contact (image and voice) via videoconferencing equipment (television, digital camera, webcam, videophone, etc.) to connect caregivers and one or more patients simultaneously, e.g., for the purpose of education.

2.7 USABILITY

The Clinical Information Technology Assessment Tool (CITAT) examines information technology capabilities in the hospital within the context of the socio-technical environment of the organization (Wears RL and Berg M 2005).

In exploring which hospital characteristics are most associated with highly automated and usable clinical information systems as measured by the CITAT, we found that hospitals with larger information technology staff, budgets, and capital expenses had statistically significantly higher scores on automation, test results, and order entry scores. Spending on these factors alone appears to be more relevant than other structural factors, such as bed size, ownership status, and total margin, and persisted after adjustment for these factors. In a separate sensitivity analysis, however, after we normalized each of these factors for hospital size the association diminished or disappeared. Although bed size, by itself, was not related to higher automation scores, these results suggest that larger hospitals may enjoy an economy of scale with respect to the high fixed costs associated with large IT projects. Achieving this level of cost-effectiveness with respect to IT spending may be more challenging for smaller hospitals. Likewise, teaching hospitals, perhaps because of their history of innovation and experimentation, appear to embrace information technologies sooner than other

types of hospitals. These hospitals scored higher on the CIT score and on multiple automation and usability sub-domains. As with other innovations in medicine, it is possible that academic physicians advocate for newer information technologies, increasing the speed of its adoption in these organizations.

The CITAT assesses a system's automation and usability. Automation represents the degree to which clinical information processes in the hospital are fully computerized and is divided into four distinct sub-domains: test results, notes & records, order entry, and a set of other sub processes largely consisting of decision support. To score highly on a given automation sub-domain, the CITAT requires three factors of routine information practices:

1) The practice must be available as a fully computerized process;

2) The physician must know how to activate the computerized process;

3) He or she must routinely choose the computerized process over other alternatives, such as writing an order or making a telephone call.

Usability represents the degree to which information management is effective and well supported from a physician standpoint, regardless of whether a system is automated or manual. An overall measure, called the CIT score, represents an average of the automation and usability scores (the survey items can be obtained from the corresponding author).

Usability items in the CITAT do not presuppose the use of technology. The usability domain is constructed to measure the ease, effectiveness, and support of the information system regardless of the technologies in place (Amarasingham et al 2006). As an example of the types of questions in this domain, one of the survey items asks whether physicians are able to obtain adequate computer support in less than 2 minutes. As might be expected, we found that usability scores were generally higher than automation scores. It is feasible that thoughtfully planned paper-based systems could produce usability scores higher

than, or equal to, systems which employ poorly designed electronic processes. However, consistent with two previous studies, we found that a higher automation score correlated with higher usability scores, suggesting that digitization may be necessary to produce usable information systems. Alternatively, these results may indicate that physicians' expectations are changing; electronic processes may be perceived to be more usable than non-electronic processes, independent of overall merits, and therefore are rated more highly. Usability of the information system, an often elusive goal for hospital systems, was not specifically associated with any of the hospital characteristics we measured, with the exception of teaching status. In that case, hospitals with a teaching affiliation had higher user support scores than non-teaching hospitals. Our results suggest that usability may be more dependent on factors we did not measure as part of our set of hospital characteristics; these may include the quality and direction of leadership at the institution, the focus on quality improvement, and the concentration on human factors engineering in designing the information system. .

The analysis explores a number of hospital characteristics, raising issues of multiple testing and increasing the probability of some false-positive relationships. As with all cross-sectional studies, positive associations will need to be confirmed in repeated studies. A Bonferroni correction for the number of tests performed would have eliminated many of the significant relationships we report. However, the Bonferroni method of correction for multiple testing is itself controversial, and argued by some to be too severe a method for correction. The purpose of this study was to find potential relationships to explore further, given that the explanatory power of a cross-sectional study may be weak despite the construction of a well-validated instrument. Appropriate assessment of information technology requires multiple methods. Survey-based methods are one important method, but other methods such as electronic queries, time-motion studies, and qualitative analyses are needed to arrive at a complete portrait of an information system. Furthermore this study attaches importance to higher scores

on the CITAT, as a measure of the strength of the socio-technical environment at the hospital. However, we do not yet know whether, and to what degree, CITAT scores correlate with important clinical and financial outcomes. These relationships will need to be assessed in the future.

2.8 LEGAL ASPECT

Legal liability in all aspects of healthcare was an increasing problem in the 1990s and 2000s. The surge in the per capita number of attorneys and changes in the tort system caused an increase in the cost of every aspect of healthcare, and healthcare technology was no exception. Failure or damages caused during installation or utilization of an automated hospital management system has been feared as a threat in lawsuits.

Some smaller companies may be forced to abandon markets based on the regional liability climate. Larger EHR providers (or government-sponsored providers of EHRs) are better able to withstand legal assaults.

In some communities, hospitals attempt to standardize EHR systems by providing discounted versions of the hospital's software to local healthcare providers. A challenge to this practice has been raised as being a violation of Stark rules that prohibit hospitals from preferentially assisting community healthcare providers. In 2006, however, exceptions to the Stark rule were enacted to allow hospitals to furnish software and training to community providers, mostly removing this legal obstacle.

2.9 LEGAL INTEROPERABILITY

In cross-border use cases of EHR implementations, the additional issue of legal interoperability arises. Different countries may have diverging legal requirements for the content or usage of electronic health records, which can require radical changes of the technical makeup of the EHR implementation in question. (especially when fundamental legal incompatibilities are involved) Exploring

these issues is therefore often necessary when implementing cross-border EHR solutions.

2.10 IMPORTANCE

The literature review has helped me to see what people have done in the past, their finding and result, and it will help me improve on my work and also to do a project that is standard with new innovation.

2.11. DATABASE

A Database Management System (DBMS) is a system in which related data is stored in an efficient and compact manner. It is a set of computer programs that control the creation, maintenance, and the use of the database of an organization and its end users. It allows organizations to place control of organization wide database development in the hands of database administrators (DBAs) and other specialists. A Database Management System is a system software package that helps the use of integrated collection of data records and files known as databases. It allows different user application programs to easily access the same databases. Database Management System may use any of the variety of database models, such as the network model or relational model. In large systems, a Database Management System allows users and other software to store and retrieve data in a structured way.

2.12. THE NEED FOR A DATABASE SYSTEM

Most organizations in this information age are faced with the problem of managing information effectively. Information can only be an asset if it is accurate and available when needed. Accuracy and availability are achieved if an organization purposefully organizes and manages its data.

A database is the standard technique for structuring and managing data in most organizations today. This is because data is very useful for variety of purposes in organization. A database system is very important so as to avoid duplication of data, which introduces the problem of inconsistency in data.

2.13. TYPES OF DATABASE SYSTEM

INTEGRATED DATABASE SYSTEM

This is the kind of system whereby the database contains data for many users, not just one, which in turn connotes that any one user (batch or on-line) will be concerned with just a small portion of it. In addition, different user's portions may overlap in various ways (i.e. the data may be shared by several users).

An integrated system is based on the concept that there should be integration of data and processing. For an information processing system, this consists of all data that can be accessed by the system. In a computer-based Management Information System (MIS) the term database is usually reserved for data that can be readily accessed by the computer. Any application that uses a data item accesses the same data item, which is stored, and made available to all applications. Also, a single updating of a data updates it for all users.

The use of an integrated database system provides the following advantages:

i. Reduces cost of data collection and maintenance through sharing of data.
ii. Ensures enforcement of standard.
iii. Reduces data inconsistency
iv. Reduces data redundancy.
v. Assures maintenance of data integrity.
vi. Simplifies handling of data security since the Database Administrator (DBA) usually applies security restrictions to protect data and privacy.

2.14. NON-INTEGRATED DATABASE SYSTEM

This is the type of system in which data files support individual application in various units that are also developed independently. This type of database poses a number of problems that affect the efficient utilization of data available in an organization. These problems include; increased cost, data inconsistency, data redundancy, and lack of data integrity.

2.14.1. INCREASED COST:

There is duplication in the effort to create independent files. As a result, additional cost is incurred in unifying such independent applications in order to derive maximum benefit from the various data files.

2.14.2. STORED DATA INCONSSITENCY

There is frequent need to change some data in a file of one application system. Redundancy and duplicated data in other applications are often not up-dated simultaneously. This usually results in inconsistency of data.

2.14.3. REDUNDANCY OF DATA

Each independently developed application system duplicates some data that may be present in some other applications developed in other units of the organization. Identification codes, personal data etc are examples of such redundancy. This necessarily results in greater expenses to collect, prepare and store the duplicated data.

2.14.4. LACK OF DATA INTEGRITY

The problem facing integrity is that of ensuring that the data in the database is accurate. The creation of files necessarily needs personnel of different experiences and skills. When the control of data stored by various personnel lack integrity, the end result is that the public perceives the computer as unreliable. Inconsistency between two entries representing the same “fact” is an example of lack of data integrity (which of course can occur if redundancy exists in the stored data).

2.15 APPLICATION OF DATABASE

Information stored in integrated database systems help government in areas like planning, modeling and forecasting. Integrated database helps the government in the following areas:

I. **HEALTH CARE DELIVERY**

Accurate data got from census facilitate the provision of health facilities to the public. In hospitals, database systems can be used in recording data on patients, resource utilization and scheduling of medical personnel. These and other data recorded in other sections of the hospital (pharmacy, laboratory, and administration) help the hospital management in administration.

II. EDUCATION:

Here, stored data helps government in adequate planning and implementation of its educational programs.

III. FINANCE:

The availability of stored data on financial accounting makes good budgeting schemes possible.

IV. TRAFFIC CONTROL AND PLANNING

The provision of database for motor registration, analysis of road utilization and recording of accidents rates will make it possible for government to plan and provide emergency services in combating traffic offenders.

V. CENSUS

When accurate census data are stored, they help the government in policymaking, planning, projection and forecasting of development plans. Unreliable data frustrates the efforts of the government in making suitable projections for the plan of public utilities and facilities.

VI PUBLIC INFORMATION SERVICES

Library inquiry system, recording proceeding, status and laws enacted in senate and parliament can be provided by a database. These provide necessary information needed by the public to contribute their own quota towards the development of the society.

2.16. BASIC CONCEPT IN DATABASE MANAGEMENT SYSTEM

2.16.1 DATABASE ADMISNTRATOR (DBA)

A database administrator is the person (or group of persons) responsible for the overall control of the database system.

2.16.2 DATA MODEL

It simply means a single user's view of the database content. The data model represents the database structure in a manner, which allows the manipulation of the conceptual building block for the database. There are basically three well-known models for representing data storage structures namely: The Hierarchical, Network, and Relational Models.

a. HIERARCHICAL MODEL

In a hierarchical model, data items are grouped to form records, just as is done with traditional file systems. However, with a hierarchical model, each record forms a node that can be depicted on a tree. Fig. 2.1 shows how such a hierarchical, top-down structure might look.

PATIENT CATALOGUE

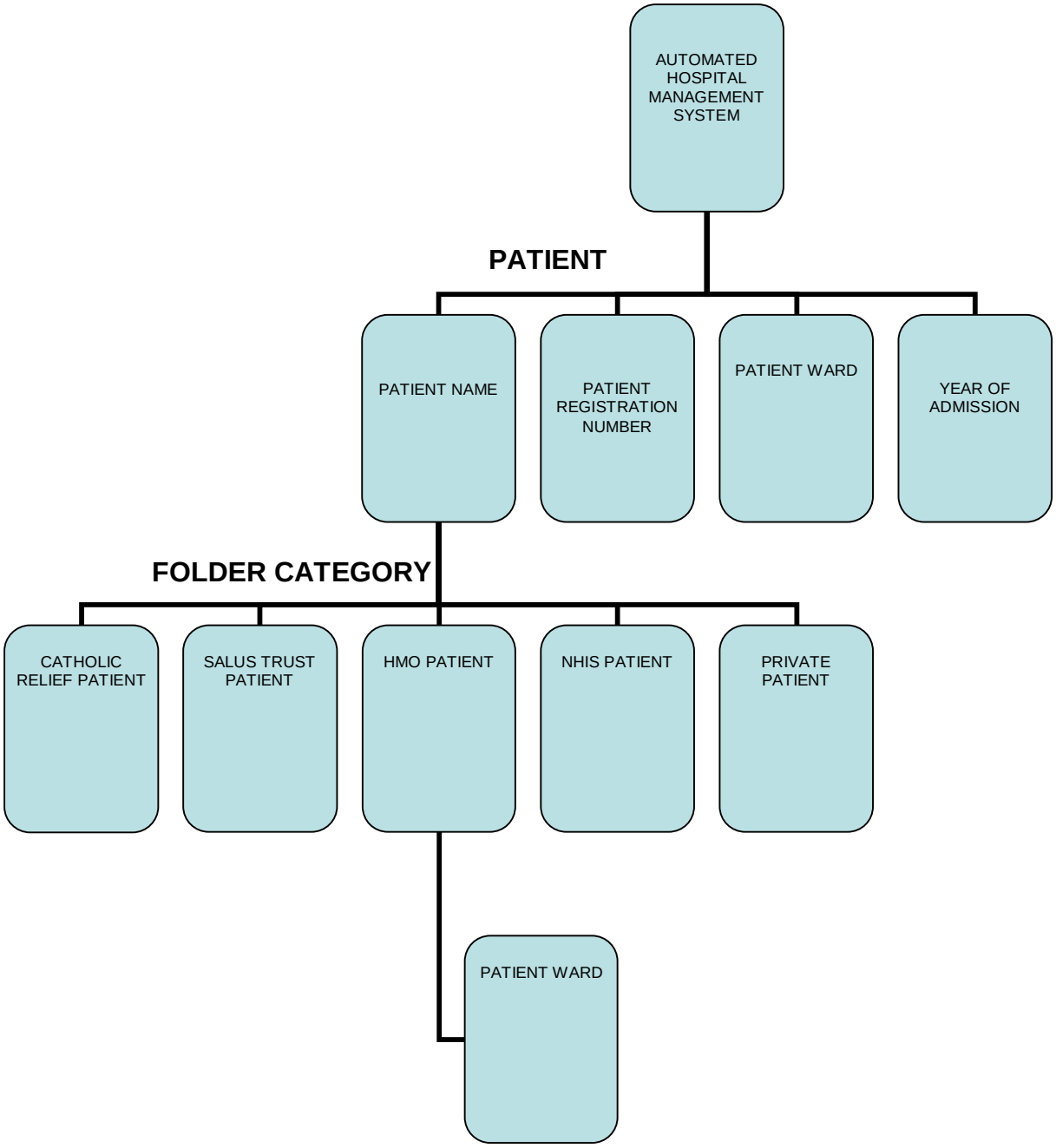


Fig 2.1 HIERARCHICAL MODEL

HMO - Health Management organization

NHIS - National Health Insurance Scheme

This diagram represents a hierarchical model for storage and access to a simplified hospital management system.

A hierarchical model supports rapid access to data through single entry points for elements that are organized within a top-down structure. As can be seen, the diagram resembles an inverted tree with the branches of the tree extending downward from the root. In fact, the top node of a tree diagram is referred to as the root node. Subordinate nodes are said to have parents-child relationships. That is, a given node is considered to be parent node of all nodes that extends from the parents to the next-lower level of the tree. In turn, the nodes on lower levels are said to be child nodes of the parents. An important characteristic of a tree diagram is that a parent node may have two or more children, but a child node may have only one parent. This characteristic helps to enforce the hierarchical, top-down relationships among nodes and to provide short, fast access paths to specific data items.

b. NETWORK MODEL

It consists of records and two or more connecting links. There is no defined dominant dependent relationship. Again record occurrence can have one or more dependent occurrences. It is a more general structure than the hierarchical model. The network model is a flexible way of representing objects and their relationships. Its distinguishing feature is that the schema, viewed as a graph in which object types are nodes and relationship types are arcs, is not restricted to being a hierarchy or lattice.

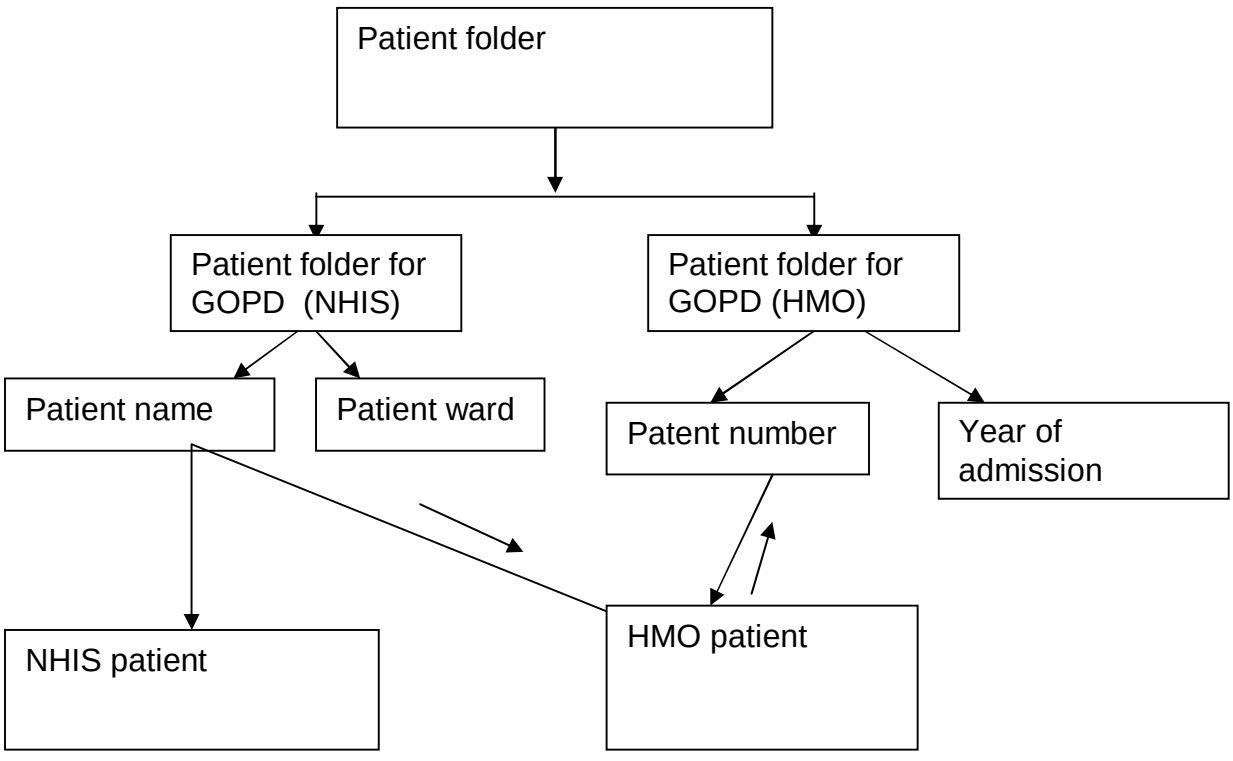
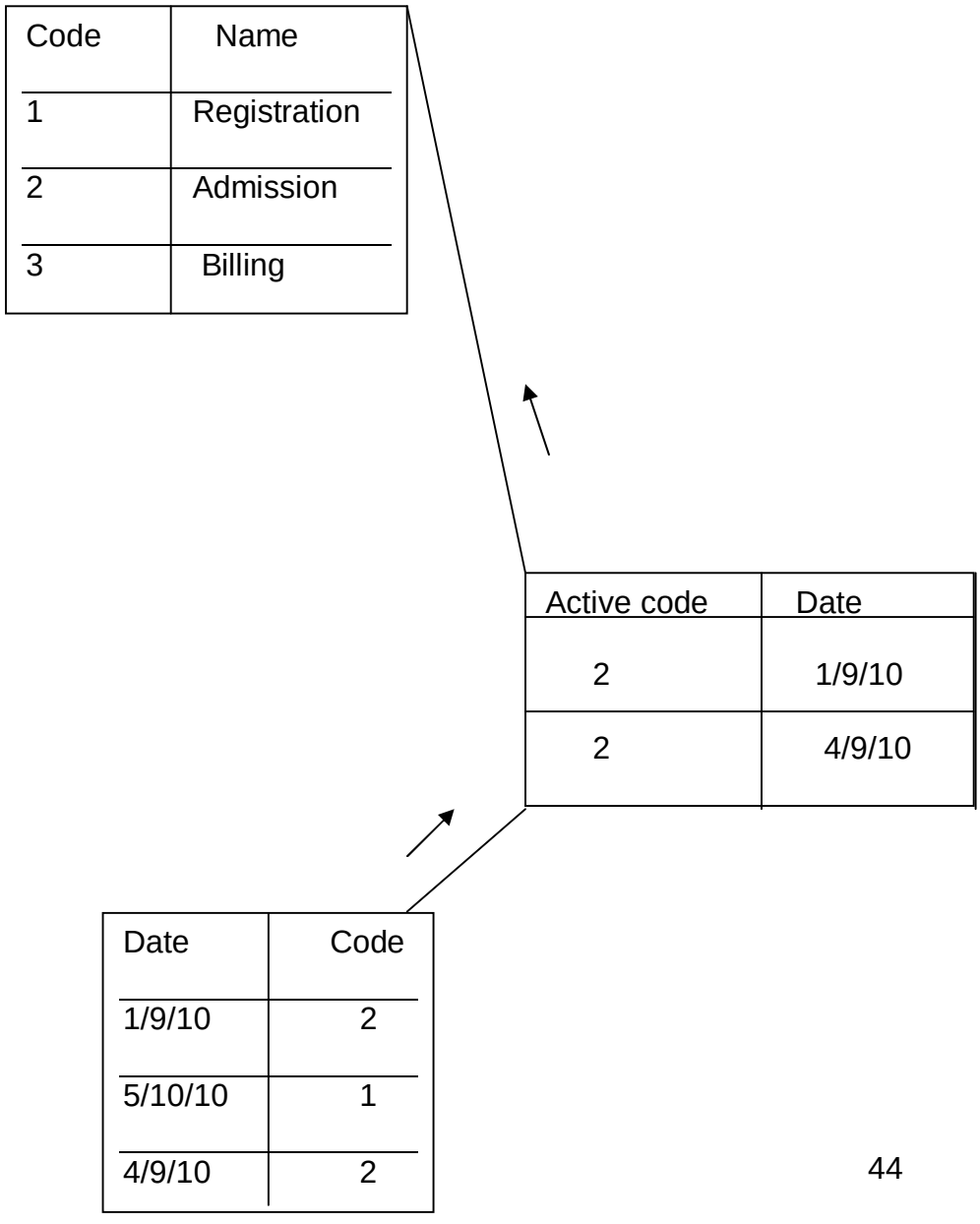


Fig 2.2 NETWORK MODEL.

c. RELATIONAL MODEL:

The relational model is represented using a table. It consists of records and connecting links. Rows of such a table are called tuples while the columns are called attributes. The purpose of the relational model is to provide a declarative method for specifying data and queries.



Code	Name
1	Registration
2	Admission
3	Billing

Active code	Date
2	1/9/10
2	4/9/10

Date	Code
1/9/10	2
5/10/10	1
4/9/10	2

Fig 2.3 RELATIONAL MODEL

2.16.3 RECORD

A record is a collection of related fields containing elemental data items.

2.16.4 STORE FIELD

It is the smallest unit of data in the database. In some systems, it is called the data item and in others attribute value.

FIELDS

NAME	FOLDER NO.	YEAR OF ADMISSION	FOLDER CATEGORY
UGWU. C	1234/09	2009	PATIENT REGISTERED UNDER CATHOLIC RELIEF SERVICES

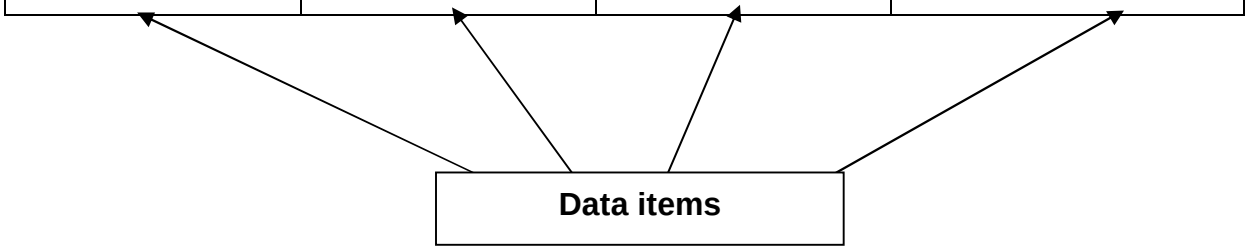


Fig. 2.4 Sample of patient folder showing the data items (store fields) corresponding to the four fields.

2.16.5 DATA ITEMS

Data Items are the smallest unit of data that have meaning to users. A data item represents a value, which is part of a description of an object or an event. For example, the patient folder with the following files will have the correspondent data items against each field as shown in figure 2.4

2.16.6 DATA COLLECTION

It is the process involved in getting the data from its point of origin to the computer in a form suitable for processing against master files.

2.17 COMPONENTS OF DATABASE MANAGEMENT SYSTEM

A database management system consists of five components as follows:

2.17.1 DATABASE MANAGEMENT SYSTEM ENGINE: Accepts logical request from the various Database Management System subsystems, converts them into physical equivalent, and actually accesses the database and data dictionary as they exist on a storage device.

2.17.2 DATA DEFINITON SUBSYSTEM: Helps user to create and maintain the data dictionary and define the structure of the files in a database.

2.17.3 DATA MANIPULATION SUBSYSTEM: Helps user to add, change and delete information in a database and query it for valuable information. Software tools within the data manipulation subsystem are most often the primary interface between user and the information contained in a database. It allows user to specify its logical information requirements.

2.17.4 APPLICATION GENERATION SUBSYSTEM: Contains facilities to help users to develop transactions-intensive applications. It usually requires that users perform detailed series of tasks to process a transaction. It facilities easy-to-use-data entry screens, programming languages, and interfaces.

2.17.5 DATA ADMINISTRATION SUBSYSTEM: Helps users to manage the overall database environment by providing facilities for backup and recovery,

security management, query optimization, concurrency control, and change management.

2.18 ORACLE DATABASE

Oracle database is a relational database management system that is used to store data logically in the form of table spaces and physically in the form of data files. These table spaces contain various types of memory segments such as data segment, index segment e.t.c. the segments in turn comprise one more segments.

These segments comprise groups of contiguous data blocks which form the basic units of data storage.

The server-side memory structure of the oracle database is referred as the System Global Area (SGA). The SGA holds cache information such data buffers, SQL commands and user information. More so, the database consists of online redo logs or (logs) that hold transactional history processes. Processes can in turn archive the online redo logs into archive logs which will provide the bases for data recovery and data replication. The oracle DBMS can store and execute stored procedures and functions within itself.

Each oracle instance allocates itself an SGA when it starts and de-allocates it at shut-down time. The information in the SGA consists of the following elements, each of which has a fixed size, established at instance startup:

A. **DATA BASE BUFFE CACHE**: stores the most recently used data blocks. These blocks normally consist of modified data that are not yet written to disk; unmodified blocks or blocks written to disk since modification. The most active buffer stay in memory to reduce I/O and to improve performance because the buffer cache keeps blocks based on a most recently used algorithm.

B. **READ LOG BUFFER**: these stores redo entries i.e. a log of changes made to the database. The instance writes redo log buffers to redo as quickly and efficiently as possible. The redo log aids in instance recovery in the event of a system failure.

C. SHARED POOL: This is the area of the SGA that stores shared memory structures such as shared SQL areas in the library cache and internal information in the data dictionary.

Performance degradation can occur as a result of insufficient amount of memory allocated to the shared pool.

2.18.1 COMPONENT OF ORACLE DATABASE

A, QUERIES: QUERIES IS a collection of programming languages and functions that performs the request/response operation and also serves as a means of communication between the server (oracle database) and a client (form)

B, SERVER(TABLE):- the tables are schematic organization of data in a data database also know as table schema. It provides the format for the records stored in the database.

C, LIBRARY CACHE:- This stores the shared SQL, caching the parse tree and the execution plan for every unique SQL statement. If multiple applications issue the same SQL statement, each application can access the shared SQL area. This reduces the amount of memory needed and reduces the processing time used for parsing and execution planning.

D, DATA DICTIONARY CACHE: Oracle database store information in data dictionary cache which comprises of a set of tables and views that map the structures of the database.

Oracle database stores the logical and physical structure of the database in data dictionary cache. The data dictionary contains information such as :

- Names and data types of all columns in database tables.
- Information on space allocated and used for schema objects.
- Users' information, such as user privileges.
- Integrity constraints defray for tables in the database

To avoid performance degradation, the data dictionary should have sufficient capacity to cache the data. The operation of the oracle depends on ready access to the data dictionary because the oracle frequently accesses the data dictionary in order to parse SQL statements.

2.19 HOSPITAL MANAGEMENT

Health Care services delivery especially in developing nations such as Nigeria are continually hampered by very weak information infrastructure to support data collection, collation, analysis and interpretation. This has led to a myriad of problems such as poor and inadequate information for clinical care of patients, education, research, and planning, budgeting and report generation amongst others. The burdens of poor information infrastructure are missing and misfiled patients records which are gradually becoming a norm while data reporting are either absent or delayed to the point of un-usefulness. Hospitals are still groaning with the burden of manual health records, absence of good health library and long patient waiting time for documentation. They are still struggling to benefit from the gains of information and communication technology, hence the need for Hospital Management System.

Having considered the above and other problems besetting information management in our hospitals, this project aims at developing software for hospital management using oracle database system(see section 6.3).

The goal is to satisfactorily integrate all efforts to ensure successful design and implementation of the hospital management system, which must result to precision, cost cutting and efficient management. The product (Hospital Management System) must be very accurate and suit all environments including large, medium or small-scale hospitals.

By implementing the hospital management system, hospitals will enjoy the following benefits:

1. Hospital management system will provide not only an opportunity to the hospital to enhance their patient care but also can increase the

profitability of the organization.

2. The hospital will require smaller staff to cater for more patients in the same time or even less.
3. Hospital Management System would enable the hospital to serve the rapidly growing number of health care consumers in a cost-effective manner.
4. This software system will allow for development of additional modules including automation of more services as the resources and job tasks of the hospital grow in time.
5. Upgrading of the software does not and will not require taking down of the existing running application modules.
6. Hospital administrators would be able to significantly improve the operational control and thus streamline operations.
7. Hospital Management System would enable the hospital to improve the response time to the demands of patients care because it automates the process of collecting, collating and retrieving patient information.
8. The hospital management system software interface would also save a lot of time for doctors.
9. Accounting sometimes becomes awfully pathetic and complex. This product will eliminate such complexity since the retrieval of information through its management information system will come virtually to their fingertips.

These advantages will justify the decisions of hospitals to invest or purchase this cost saving and life saving management system. But practical limitations exist for example (1) Proper adoption strategy (2) ability to absorb the cost of training and finally following the appropriate change management life cycle.

CHAPTER 3

3.0 SYSTEM ANALYSIS AND SPECIFICATION

The requirement analysis encompasses those tasks that determine the needs or conditions to be met for a new product, taking into account the possible conflicting requirements of the various stakeholders such as beneficiaries or users.

Software requirement specification is a complete description of the behavior of the system to be developed. It includes a set of used cases that describe all the interactions that the users will have with the software.

Requirement analysis is the first stage in systems engineering process and software development process.

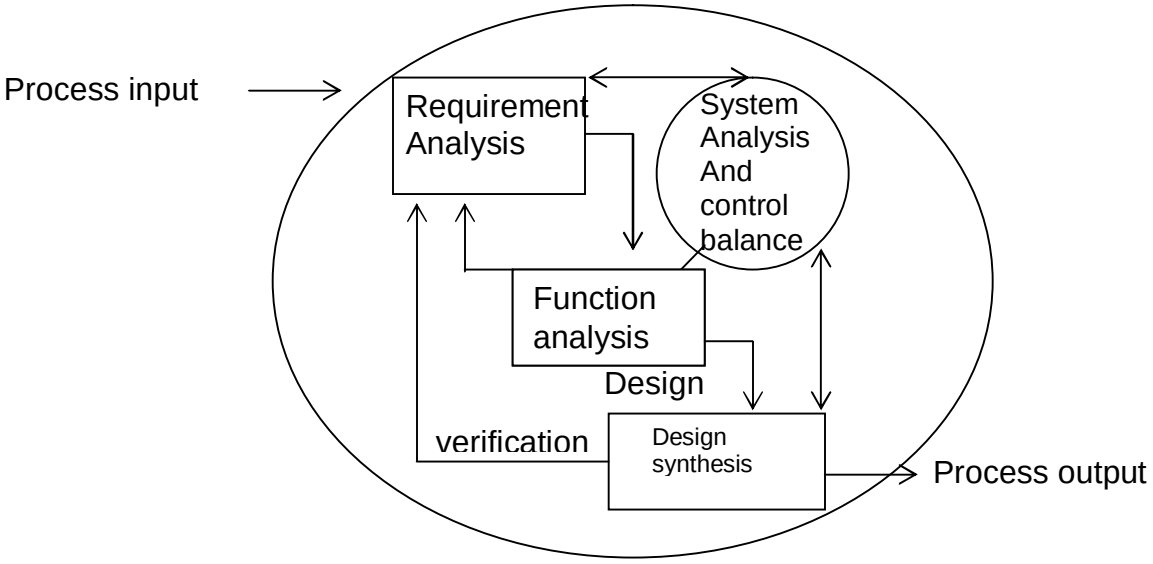


Fig. 3.1: System Analysis Control Flow Diagram

System analysis as shown in fig 4.1 encompasses those tasks that go into determining the needs or conditions to be met for a new or altered product, taking account of the possibly conflicting requirements of the various

stakeholders, such as beneficiaries or users.

Requirements analysis is critical to the success of a development project. Requirements must be documented, actionable, measurable, testable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design. Requirements can be architectural, structural, behavioral, functional, and non-functional.

An analysis and full description of the existing system should lead to a full specification of the users' requirement. This requirement specification can be examined and approved before the system design is embarked upon. In recent times, greater emphasis has been placed upon this stage because of former experience of designers who failed to meet requirements. The earlier in a system life cycle that a mistake is discovered, the less costly it is to correct. Hence, the need for requirement specification is very clear.

3.1 REQUIREMENT ANALYSIS

Since the design of a new or revised system cannot begin until the analyst fully understands the existing system, this stage cannot be omitted in software development. Hence we are going to start with the analysis of the existing manual system under the following heading: data collection, data storage, data communication and manipulation, data security and system cost.

3.2. DATA COLLECTION:

In hospital management system, the type of data that we require to collect are:

1. Patient' Bio-data
2. Patient's Registration Data
3. Patient's Admission Information
4. Patient's next of kin data

In the manual system used by most hospitals in Nigeria, the patients' folders are packed into shelves in the patient record department. These folders are grouped into shelves according to year of admission.

A patient in need of any of these folders will make a request at the records department where the staff in charge of this folders will now choose from the shelve which one belongs to the patient. In the shelves, the names are repeated because two or three persons may bear the same name. As a result the patient folder number is preferably used to look for the folder. It takes a lot of time to look for these folders and it may be impossible to retrieve a folder if the patient forgets his or her card where the folder number is written.

Inspecting the existing manual system very closely reveals a lot of loopholes like data duplication, data redundancy, data manipulation and data inconsistency which make the system inefficient and hence calls for urgent improvement to the existing manual system. The improvement envisaged is the proposed electronic records management system or data base management system.

3.3. DATA STORAGE:

Hospitals using the manual record system require large space for storing records in shelves or alternatively dumping them on the ground if the shelves overflow.

3.4. DATA COMMUNICATION AND MANIPULATION

If the original forms of data were suitable for all purposes, less processing would be necessary. Seldom, can the real objective of a transaction or situation be attained without converting data into a more useful forms-manipulation. This conversion is accompanied by one or more of the following procedures – sorting, comparing, analysis and calculation.

Difficulties arise when it actually comes to manipulation of data before communication. Processing data manually consumes a lot of time; for instance, sorting of folders into years of admission. This takes a lot of time. Hence the access time or process time of the present system is extremely high and results in patients spending more time in hospitals than is necessary.

Now, with the availability of high speed modern electronic information processing machines, this need for improved speed of transaction processing could easily be accomplished.

3.5. DATA SECURITY.

In the manual system, almost all the patient folders in the records have to be accessed by a staff for every folder request. The patients' record in a manual system is not secure and confidential information may be accessed by unauthorized persons. The manual system are subjects to risks and threats : for example events that may destroy or corrupt records, prevent them from use, or steal them.

The risk may be physical loss or damage to storage devices holding the data including natural disaster, accident fire, and dust.

Theoretically, a folder last the length of a patient's life. This means that in say twenty years the number of folders accumulated by a hospital may be so large that it may be impossible to manage them securely manually. Containment strategies, for example, to archive folders may be adopted on the assumption that such folders may be inactive. Such actions though pragmatic may be unwise and show clearly why electronic means for managing hospital records may now be mandatory.

3.6. SYSTEM COST

The cost of the system determines whether it should be feasible. If the cost of the system designed is too costly for the people to afford then it is practically a failure. In order to make the system economical the cost per unit of storage data must be low enough hence the need for cost analysis in the design of automated management system in very important.

3.7. REQUIREMENT SPECIFICATION

In the course of the requirement elicitation, it was observed that some hospitals already have the automated system. ANNUNCIATION HOSPITAL, ENUGU has an automated system while UNTH, ORTHOPEDIC, UNN MEDICAL CENTER AND SHANAHAN HOSPITAL does not have automated system. Of the hospitals that are not yet automated, Orthopedic hospitals, Enugu has the network and is computerized but it has not installed the software. UNTH, UNN Medical centre and Shanahan hospital have similar status: no network, no installed computers and no software. Table 3.1 shows the computerized status of major hospitals and medical centers in Enugu state.

TABLE 2

3.1 STATUS TABLE

HOSPITAL	LEVEL OF COMPUTERIZATION
Annunciation Specialist Hospital Emene Enugu	• Has Network • Has software • Is computerized
University of Nigeria Teaching Hospital Enugu	• No Network • No software • No installed computer
University of Nigeria Nsukka Medical Centre	• No Network • No software • No installed computer
National Orthopedics Hospital Enugu	• Has Network • No software • Is computerized
Bishop Shanahan Hospital Nsukka	• No Network • No software • No installed computer

3.8. UNIT REQUIREMENT DEFINITION

1 INPUT

1) All inputs that are not of standard ASCII code / format, HLT codes or byte stream will be rejected and treated as invalid inputs.
2) In response to invalid inputs, the system shall produce an error message or help message so that the input shall not cause the database application to crash or fail. For instance, if a user makes an invalid entry, the system will respond with an error massage relevant to the error generating input in this case, the system will not crash in operation.
3) The system should be interactive.

Fig 2.2 shows the work flow diagram which specifies the working principle of a standard hospital.

3.9 FUNCTION SPECIFICATION: -

A function specification explains what has to be done by identifying the necessary tasks, action or activities that must be accomplished in the design. Automated hospital management is a system, which is conceived, designed and developed to increase clinical outcomes, operational efficiency, improve financial outcome, and manage all hospital records on computers. Automated Hospital Management System (AHMS) addresses all major functional areas of a hospital. It keeps track of a patient record from registration to discharge. This software helps to maintain the data of each individual patient with a unique identification for a life time.

The development environment ensures that AHMS has the portable and connectivity features to run on virtually all-standard hardware platforms, with stringent data security and easy recovery in case of system failure. The software provides the benefits of streamlining operations, enhancing administration and control, improving response to patient care, cost control and profitability.

AHMS provides effective information across the continuum of patient care for inpatient, outpatient, accounting, pharmacy, laboratory, referral and death report.

3.10 HOSPITAL OPERATION FLOW SYSTEM

The diagram in fig 3.2 shows the basics flow of operation in a standard hospital, from this diagram, a patient falls under three categories thus;

1, General out patient
2, Accident/Emergency patient
3, General in Patient

During attendance at a hospital, a patient can switch from one patient category to another depending on the circumstances. For instance, General Out Patient Department (GOPD) patients come from their residences to consult with the doctors in a hospital after which they go back to their homes.

All In-patients are admitted in the hospital for example, a patient who came as an out patient may be admitted if the patient has a serious health condition in which case he becomes an in-patient. If the patient is rushed to a hospital in an emergency state or after an accident, he or she is first managed in an emergency unit. If the patient is subsequently admitted he /she becomes an in-patient else he/she is an out-patient.

In the flow diagram, a newly visiting patient proceeds to the carding room to obtain a card where he/she is assigned a hospital unique identification number after registration. The patient enters a queue system (waiting list) until he/she is pre-examined by a nurse. The patient then proceeds to see a medical specialist by referral. This stage repeats at both the GIPD and GOPD but data in both cases are pulled from the initial registration data from the carding system.

At the doctors' workbench, diagnosis takes place. The result of the doctors diagnosis determines the medical flow of the patient if the patient will be an in-patient or out-patient.

Finally, other systems find attachment from the doctor workbench. This includes Diagnosis, Drug prescription, Pharmacy, Treatment, laboratory test, Referral, Billing, Death report.

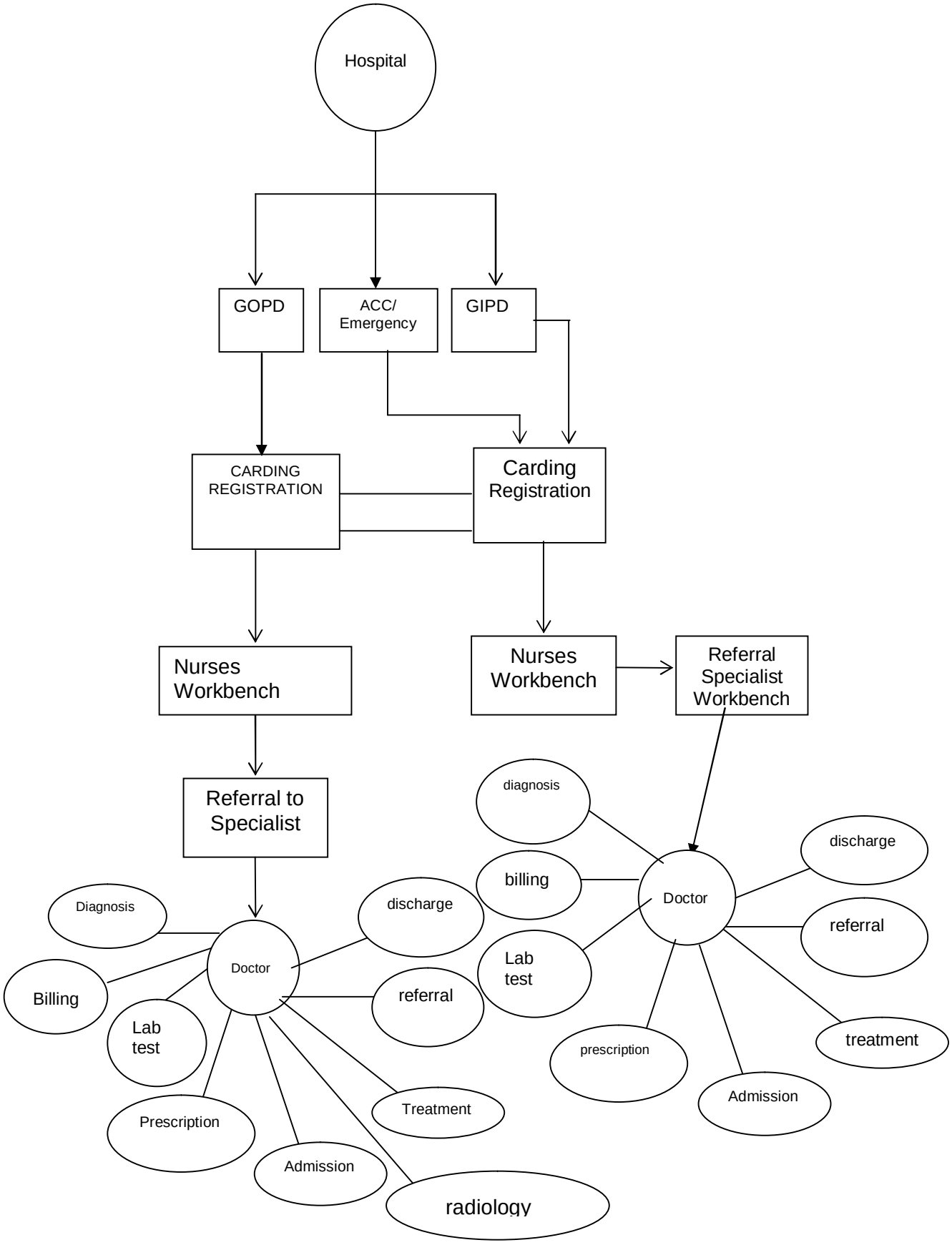


FIG 3.2 : WORKING PRINCIPLE OF A STANDARD HOSPITAL

3.11 THE MODULES OF AUTOMATED HOSPITAL MANAGEMENT SYSTEM

3.11.1 PATIENT REGISTRATION / CARDING SYSTEM:-

This module deals with registering of new patients, for either OPD (Out-patient department) or IPD (In-patient department) and issuing unique identification numbers to the patients. These numbers are unique throughout the system. A patient is first registered at the OPD front office. If eventually the patient is admitted, the same number is used. The IPD / OPD identification number is used for tracking the medical records of the patient for any OPD visit or IPD admission. All medical records of this patient are identified by this number. The number helps in a flexible search in finding the patient records. This number is assigned to the patient together with a patient card. The number will be used to track the patient record and medical history throughout the life cycle of the patent medical section.

PATIENT REGISTRATION FLOW DIAGRAM

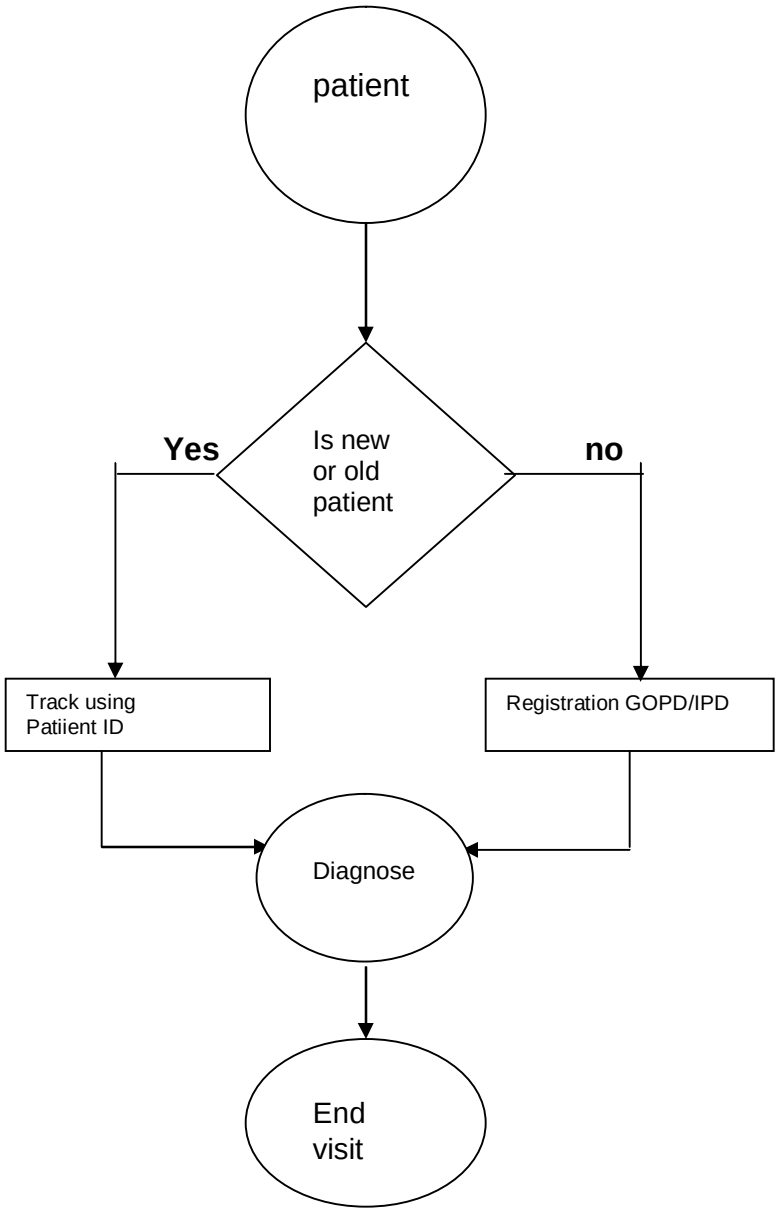


Fig3.3 Patient Registration Flow Diagram

3.11.2 PATIENT HISTORY AND RECORD SYSTEM:-

This module is provided for use in generating or queuing existing patients' information. It is more of a reporting system than an output system or data entry system.

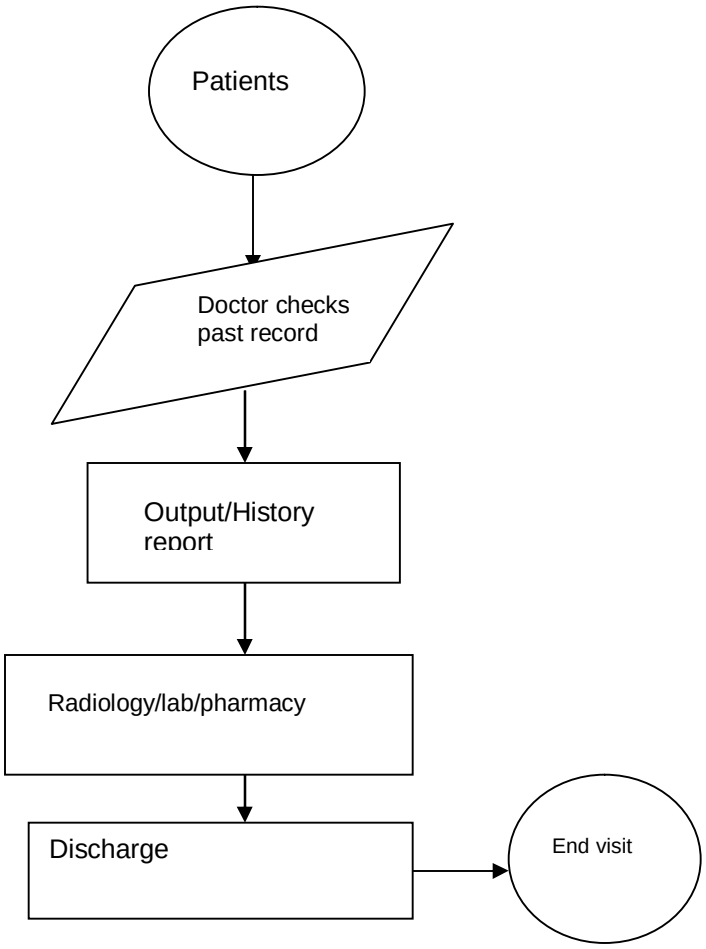


Fig 3.3 **Patient History and Record Flow Diagram**

The patient history and record system generate the following records:

- Bio data records
- Patient's Medical record
- Patient's Diagnostic record
- Patient's Appointment record
- Patient's billing record.

3.11.3 NURSES WORK BENCH:

A nurse's work bench is a work platform provided for use by intermediate nurses (auxiliary nurses) to assist in taking patients preliminary examination, accessing current health condition, managing appointment queue and waiting list. Preliminary examination involves taking temperature reading, blood pressure, height and weight of the patient.

The features are:-

- Waiting list
- Referrals
- Pre – examination
- Bill payment

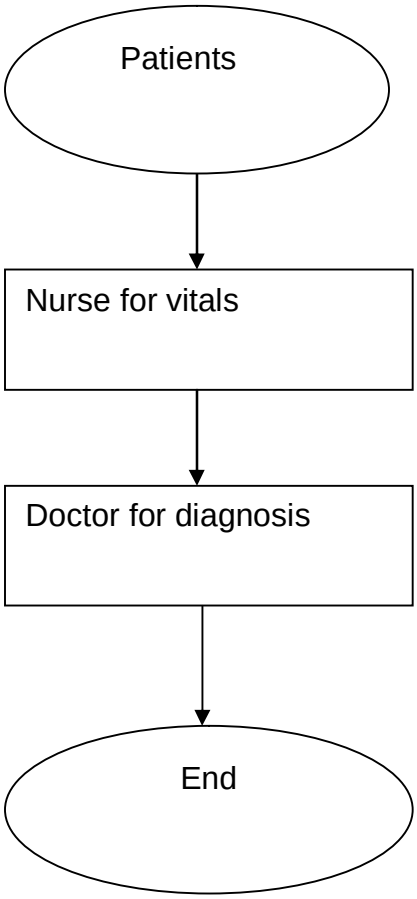


Fig 3.4 Preliminary Examination Flow Diagram

3.11.4 DOCTORS WORK BENCH

This is a special diagnostic plat-form for doctors. Through the doctor's workbench, doctors can perform various tasks such as:

- Viewing and editing patient's registration data
- Requesting and viewing laboratory test and result
- Performing diagnosis
- Referring patients to specialist / clinics
- Managing beds / wards
- Issuing admission and discharge orders
- Scheduling appointments

3.11.5 APPOINTMENT / WAITING LIST MODULE: -

This module assists in the management and control of appointments waiting lists and queuing. The module integrates a special patient reporting system. This makes it possible for doctors to view and monitor their appointments any time in the system.

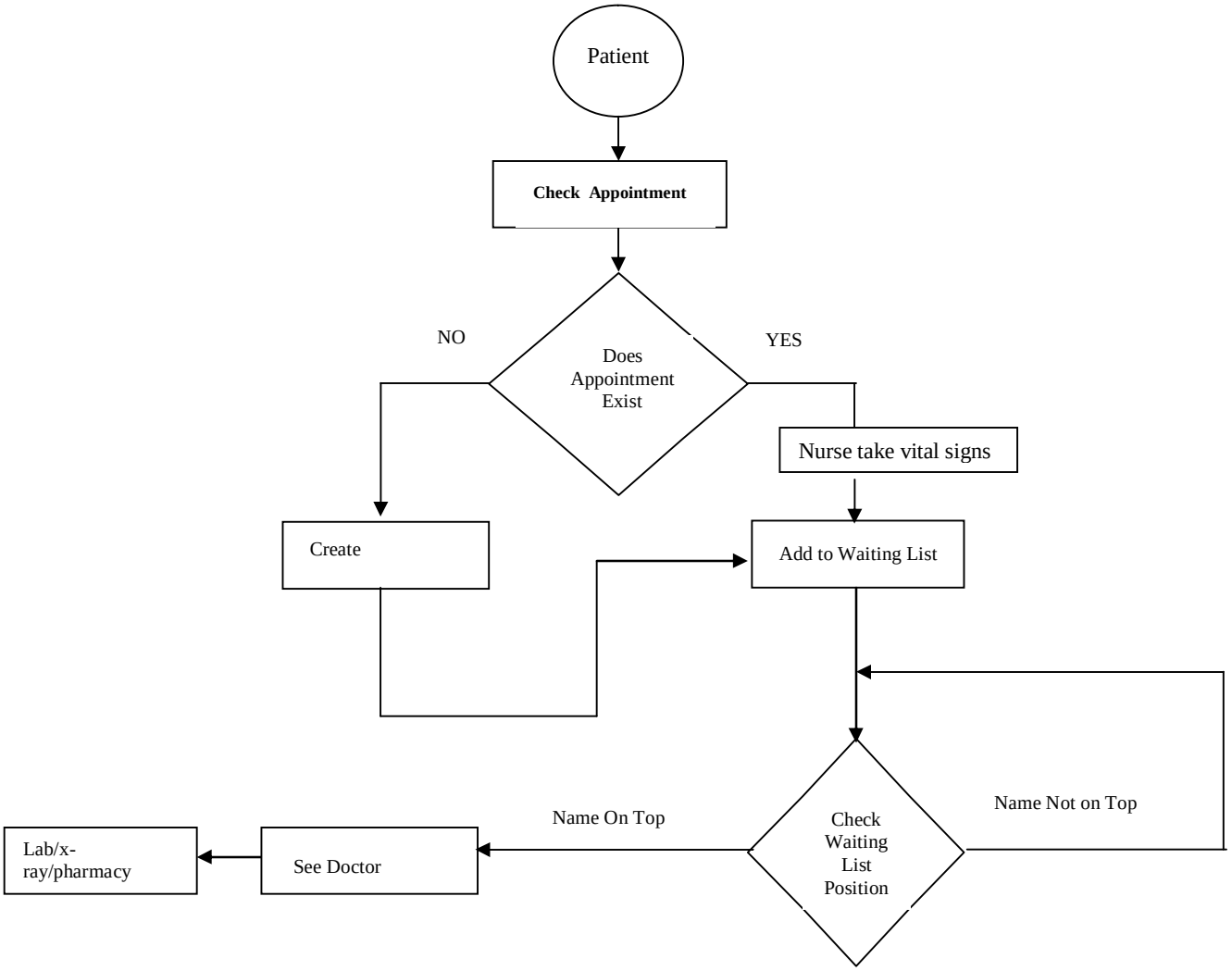


Fig 3.5 Appointment and Waiting List

3.11.6 DOCTOR'S DIAGNOSTIC SYSTEM

This is a data Entry system used by doctors to document and follow up patient's diagnosis and treatment.

The follow up system is also used by the nurses to augment the activities of doctors.

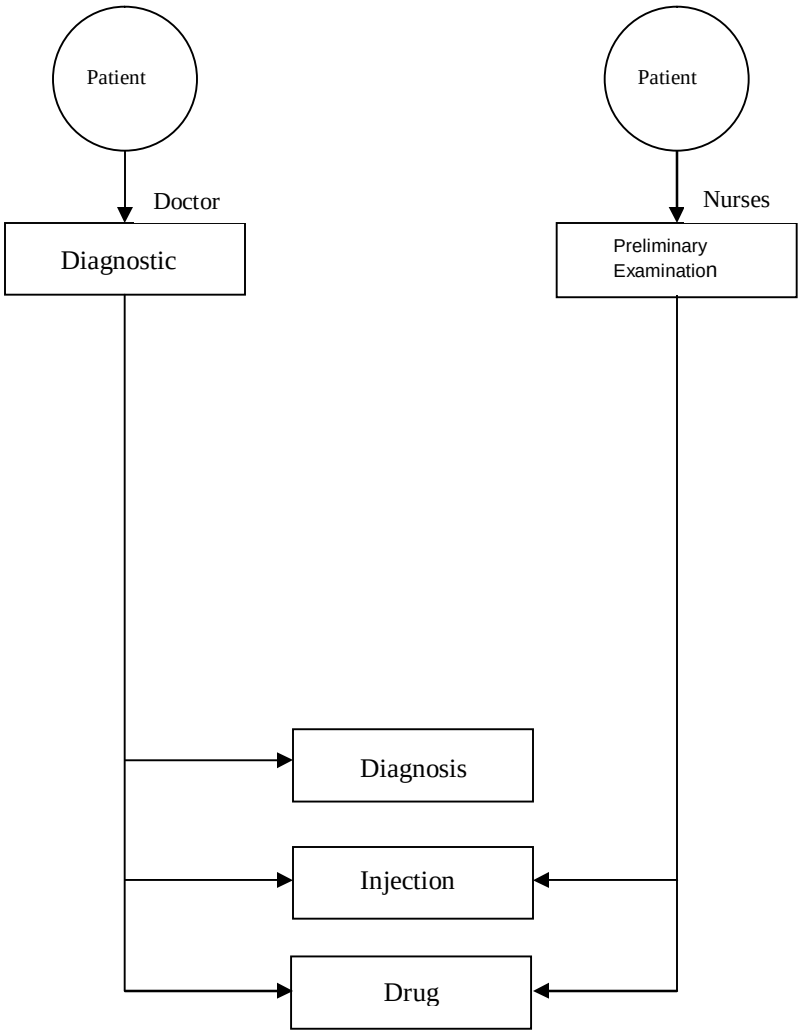


Fig 3.6 **Doctors Diagnostic System**

3.11.7 LABORATORY SYSTEM / X – RAY

This is used to perform data entry of lab test performed on a patient. Tests are grouped under various sections and sample types. Results are based on the type of sample. These results are entered for either one, or multiple tests. These test results are available to concerned doctors. The results of the test are confidential

and secured. Most tests are done after the billing is done although this rule is violated in an emergency case. For the X – RAY system, the system stores all the result details of various test results.

3.11.8 PHARMACY: This module maintains the data related to the servicing of the in-patient and out-patient of the pharmacy department. It is more of drug order dispensary administration, billing and reporting system.

3.11.9 ADMINISTRATIVE SYSTEM: This is the main administration platform used by the Chief Medical Director (CMD), hospital admin, hospital secretary, account and any other authorized personnel in the hospital to monitor overall activities of all the modules.

3.12 ACCOUNTING / BILLING SYSTEM: - This module is for monitoring payments and billing. The entire billing system for the patient will automatically be created. It includes all kinds of expenses made by the patient. When the patient is discharged, the entire bill will be generated automatically. The bill will contain all the expenses, which should be charged to the patient for the period for which he / she were admitted in the hospital.

3.12.1 REFERRAL SYSTEM:

This is the module that enables the referral of patient to specialist clinics and accepting of referrals from other clinics.

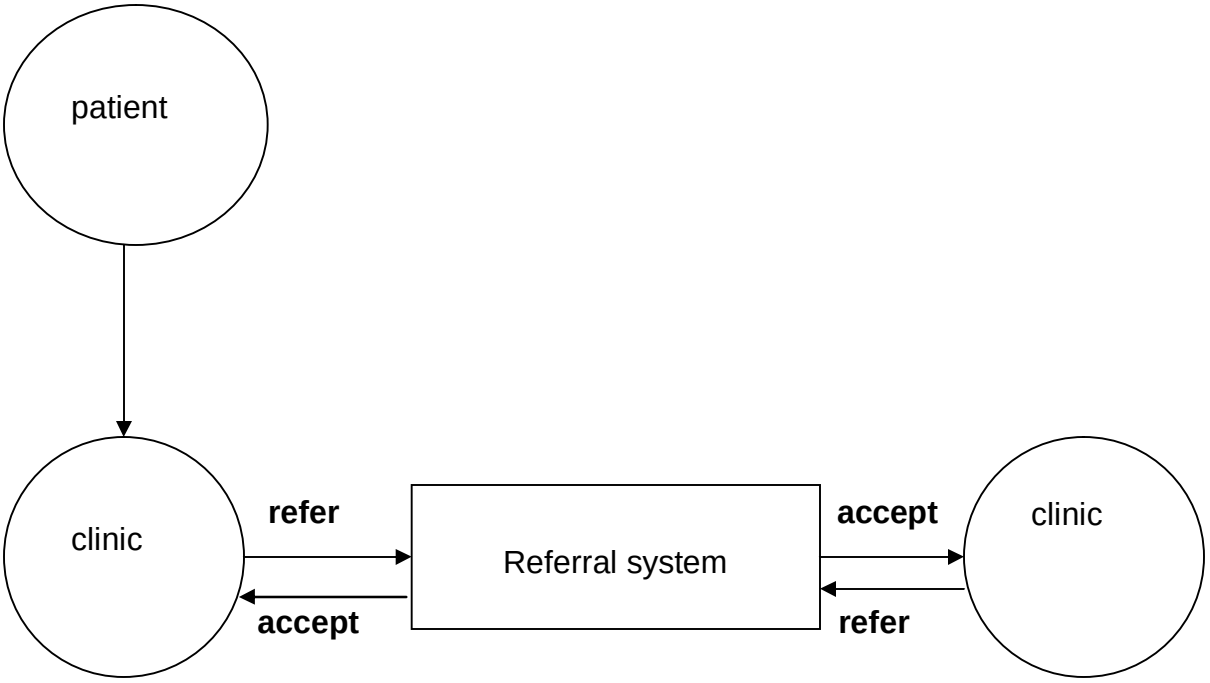


fig 3.7 Referral flow system

CHAPTER FOUR

4.0 SOFTWARE DESIGN

A software design is a model of a real world system that has many participating entities and relationships. This design is used in different ways. It acts as a basis for detailed implementation; it serves as a communication medium between the designers of subsystems; it provides information to system maintainers about original intentions of the system designer. Database design is the process of creating structure from user requirement. It is a complex and demanding process that requires both creativity and experience.

In this work, a function – oriented design was chosen. This is because of its widespread popularity and they are concerned with record processing where the processing of one record is not dependent on any previous processing. A function-oriented design relies on decomposing the system into a set of interacting functions with a centralized system state shared by these functions. Database design is the process of producing a detailed data model of a database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language which can be used to create a database. A fully attributed data model contains detailed attributes for each entity.

Database design has some parallels to more classic code or software design processes. It goes through two stages namely: the logical design and physical design. The logical model is concerned with transforming the database specification and normalized database schemas respectively. The physical design process is concerned with how the database system will be implemented. It specifies the physical configuration of the database on the storage media. It includes the detailed specification of data element, data types, indexing options and other parameters

residing in the database management system. It is the detailed design of a system that includes modules, database's hardware and software specification of the system.

4.1 STRUCTURED DESIGN

Structured design is a design process by which a program is partitioned into independent modules, each with a unique task (i.e. functional decomposition) in order to make the program easier to implement and maintain. This design procedure places emphasis on steady progression from overview to detail, providing guidelines for achieving the successive partitioning.

A structured design is obtained by transforming a data flow diagram into a structured chart. Each process on the data flow diagram will be transformed into one module. It may no longer be a single module when the process is completed. The transition from data- flow to structure chart involves the construction of a first cut structured design for the system. In this process, a 'MONITOR' module must be identified and this module will be the central transform.

The data flow diagram fig 3.2 in Chapter 3 encompasses all the functions proposed for the new system. Each unit in the system with its files contains basic services in the diagram. From the data flow diagram it seems that the centre of attraction is the data store; but the data store cannot be used as a central transform since it is not a process. At the same time, there seems to be no other central process that controls the other processes.

The first – cut design shown in fig 4.1 is the starting point for the structured design.

Three processes are identified for the transformation process from the data – flow diagram.

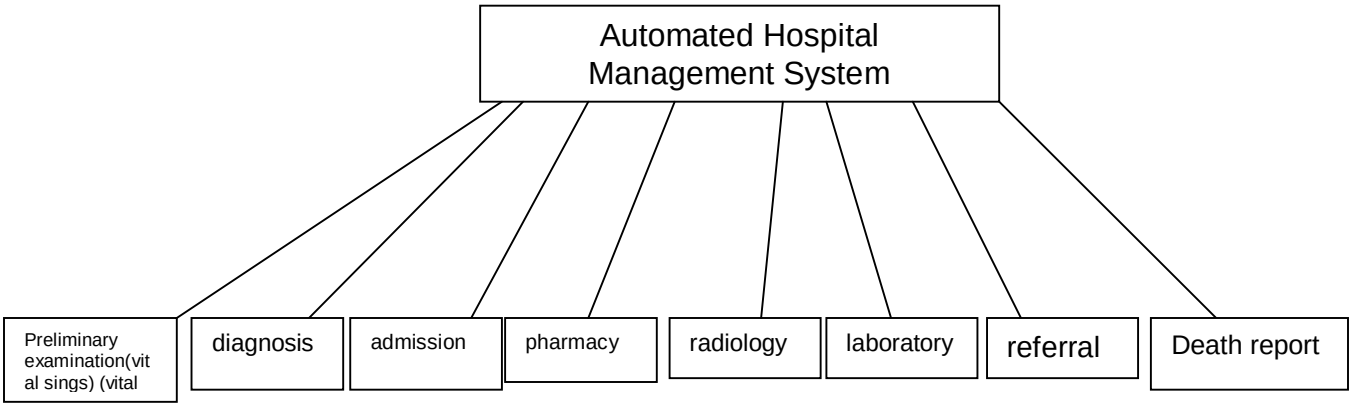


Fig 4.1 ILLUSTRATION OF THE FIRST CUT STRUCTURED DESIGN FOR FUNCTIONAL UTILITIES

4.2. SYSTEM PROCESSING TRANSFORMATION

This type of transformation is responsible for central processing functions. They are not concerned with any input or output function such as reading or writing data, data validation or filtering or output formatting.

4.3. INPUT TRANSFORMATION: These are concerned with reading data, checking data, removing duplicates and so no.

4.4. OUTPUT TRANSFORMATION: These are transformation which prepare and format output or write it to the users screen or other device.

4.5. ENTITY RELATIONSHIP MODEL (ERM) OF THE DESIGN

Entity relationship model is the conceptual representation of data; it is a database modeling method that is used for producing semantic data model of a system. Diagrams created by this process are called entity relationship diagrams. The entity relationship of the design shows how two or more entities are related to one another. Each entity must have a minimal set of uniquely identifying attributes which is called the entity's primary key.

The entity relationship diagram of fig 4.2 shows the entity sets and relationship sets.

To identify a particular record in a unique manner there must be a key.

There are three types of key

1. **PRIMARY KEY (pk):** The primary key is like a field name which can be used to uniquely identify a given record in a database table.
2. **FOREIGN KEY (fk):** Is a key in a table ‘’schema’’ that is a primary key in another table schema of a database.
3. **UNIQUE KEY (uk):** Is a key in a table schema which is not a primary key but can uniquely identify a record in table schema.

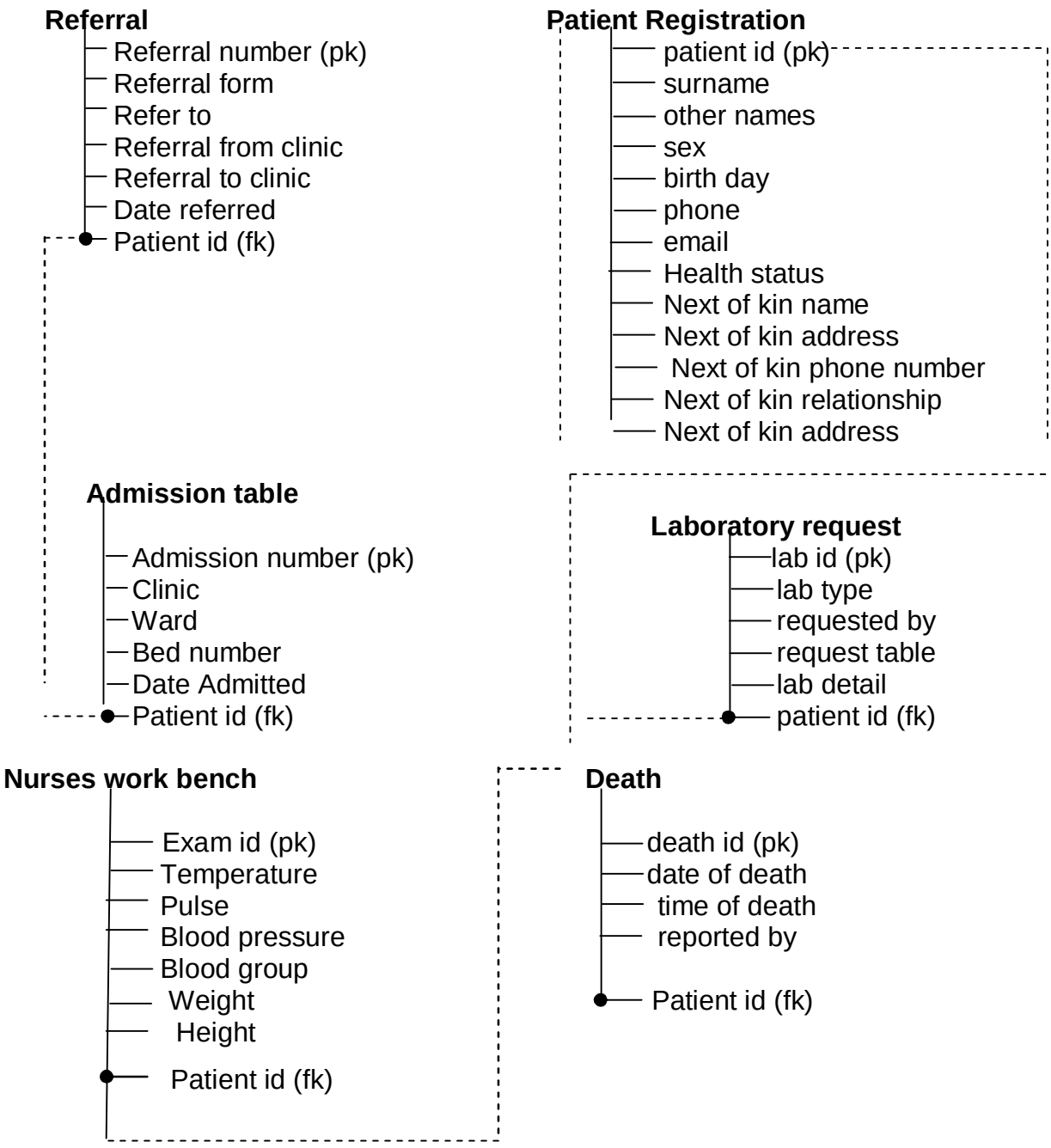


Fig 4.2. Entity Relationship model.

In fig 4.2 the primary key in patient registration module is the patient identity number and this module is related to all the other modules like admission, laboratory, death, referral etc, in the sense that the same patient with patient identity can be admitted, referred, sent to laboratory or examined by the nurse but the primary key in the patient registration of this patient now becomes a foreign key in other modules because the primary key of each module is that key with which the patient is primarily identified there. For example, in Admission table, the admission number is the primary key while the patient identity number is the foreign key, in laboratory; the laboratory identity is the primary key while the patient identity number is the foreign key and so on.

4.6. DESIGN DATABASE SCHEMA

Database schema is the structure of the database that defines the objects in the database. A schema is a collection of logical structures of data, or schema objects. A schema is owned by a database user and has the same name as that user. Each user owns a single schema. Schema objects can be created and manipulated with SQL and include the following types of objects:

- Clusters
- Database links
- Database triggers
- Dimensions
- External procedure libraries
- Indexes and index types
- Java classes, Java resources, and Java sources
- Materialized views and materialized view logs
- Object tables, object types, and object views
- Operators
- Sequences
- Stored functions, procedures, and packages
- Synonyms

- Tables and index-organized tables
- Views

Other types of objects are also stored in the database and can be created and manipulated with SQL but are not contained in a schema:

- Contexts
- Directories
- Profiles
- Roles
- Tables paces
- Users
- Rollback segments -

There are **four levels** of database schema thus:

1. Conceptual schema: is a map of concepts and their relationships. This describes the semantics of an organization and represents a series of assertions about its nature. Specifically, it describes the things of significance to an organization (entity classes), about which it is inclined to collect information, and characteristics of (attributes) and associations between pairs of those things of significance (relationships).

2. Logical schema: is a map of entities and their attributes and relations. The logical schema was the way data were represented to conform to the constraints of a particular approach to database management. Logical Schema is a data model of a specific problem domain expressed in terms of a particular data management technology.

3. **Physical schema**: is a particular implementation of a logical schema. It describes how physically data would be stored on disk drives.

4. **Schema object:** is an Oracle database object. Schema objects are logical data storage structures. Schema objects do not have a one-to-one correspondence to physical files on disk that store their information. However, Oracle stores a schema object logically within a table space of the database. The data of each object is physically contained in one or more of the table space's data files. For some objects, such as tables, indexes, and clusters, you can specify how much disk space Oracle allocates for the object within the table space's data files.

There is no relationship between schemas and table spaces: a table space can contain objects from different schemas, and the objects for a schema can be contained in different table spaces. Examples of schema are shown in fig 4.3

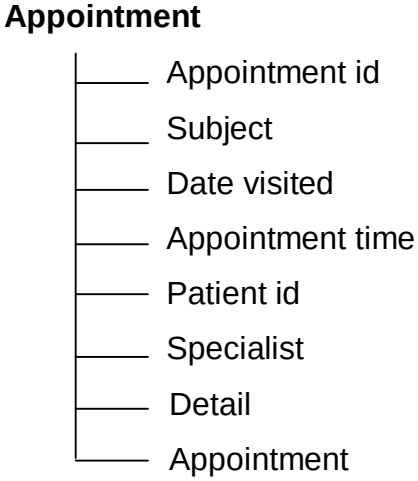


Fig 4.3a database schema

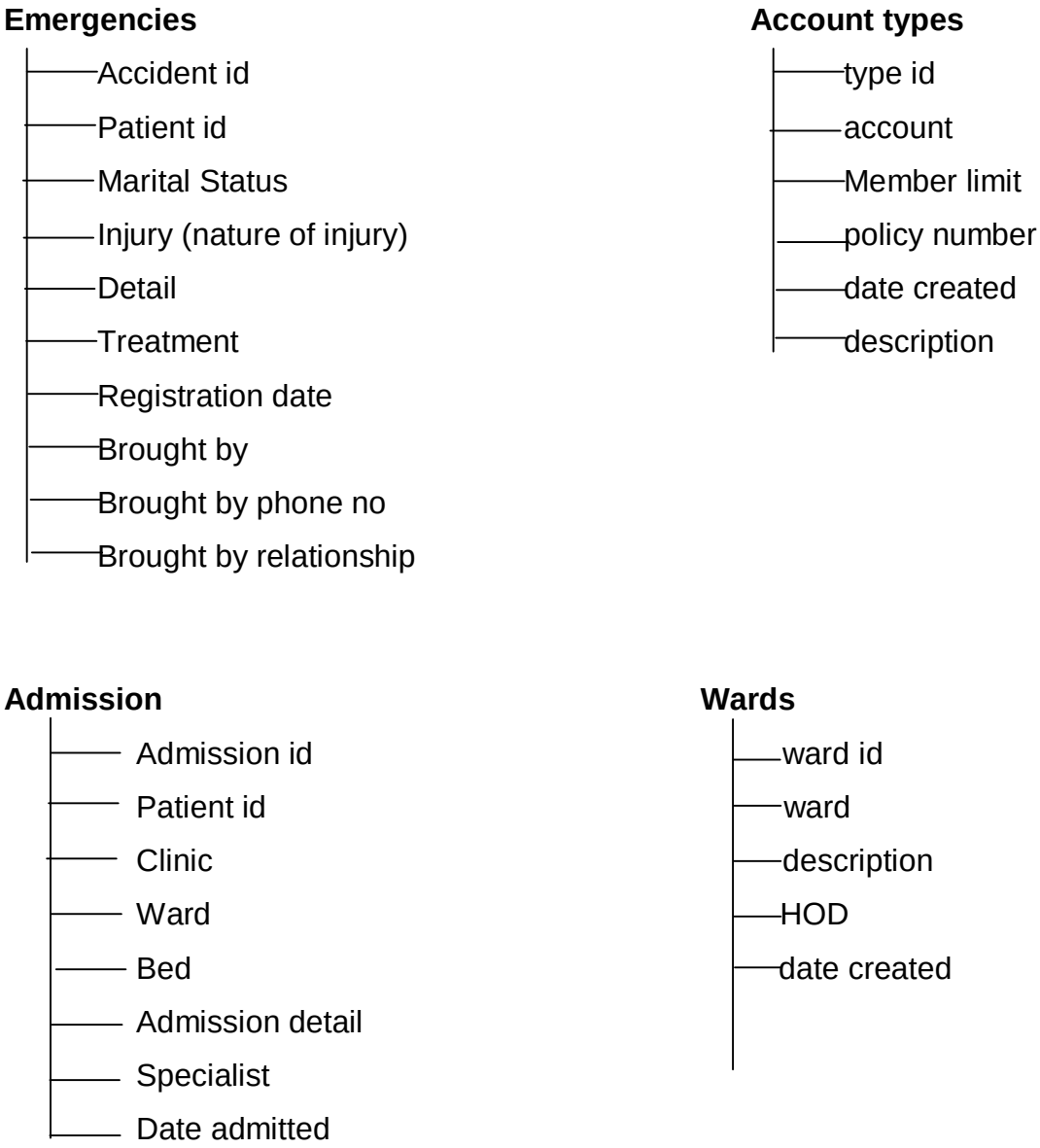


Fig 4.3b DATABASE SCHEMA

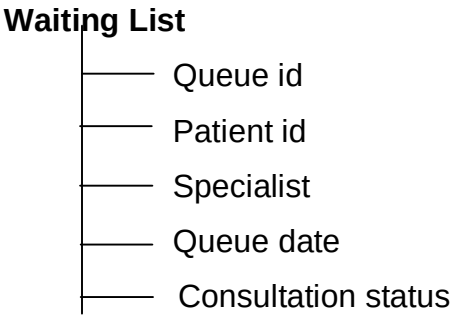


Fig 4.3c Database schema

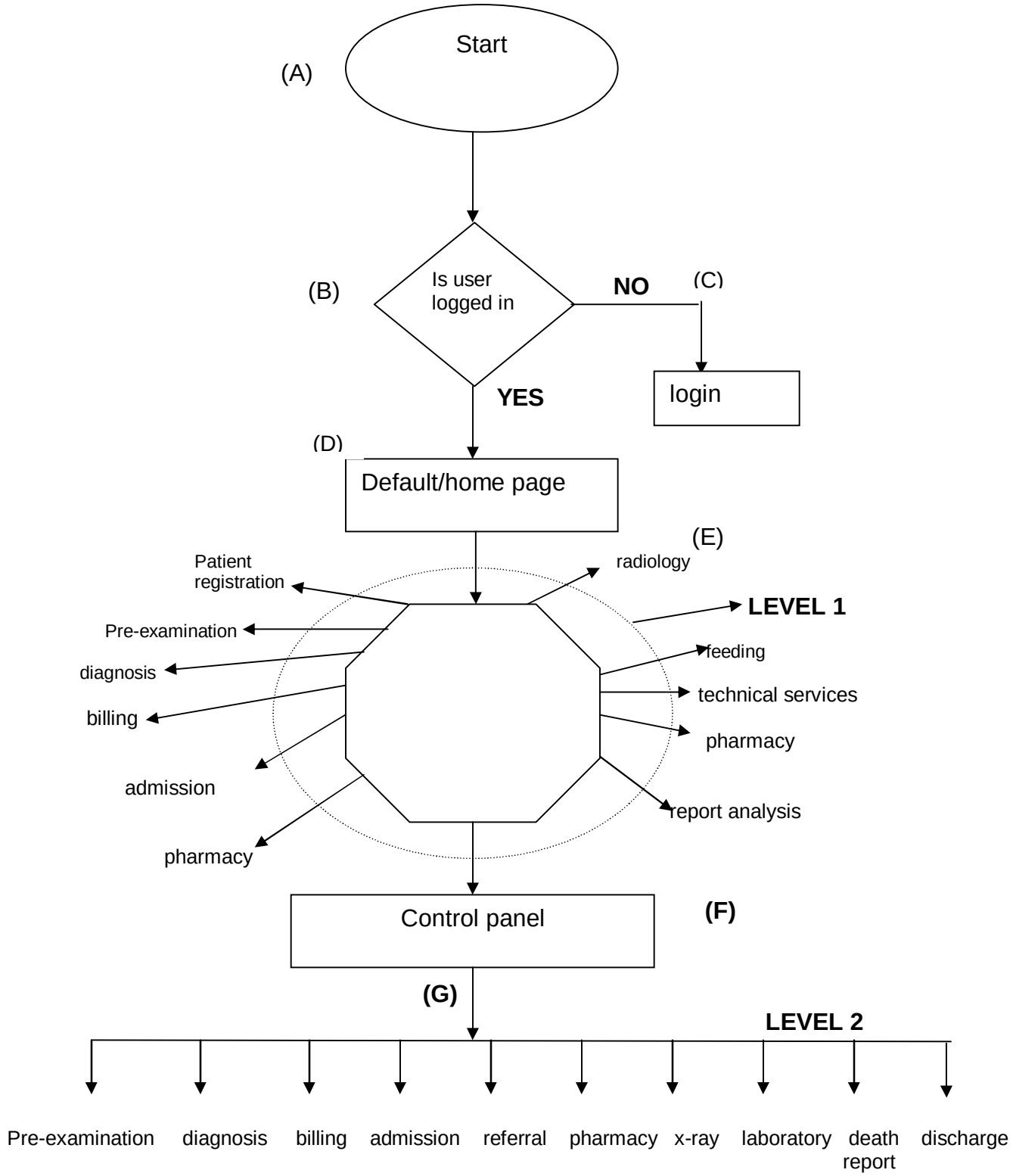
Patients

- Hospital number
- Registration type
- Registration number
- Registration date
- Surname
- First name
- Other names
- Sex
- Day of birth
- Home address
- Religion
- Occupation
- Civil status
- Insurance
- Place of origin
- Nationality
- Phone number

Fig 4.3d: DATABASE SCHEMA

4.7 PROGRAM DESIGN

The program design Fig 4.4 reflects how the new computerized system looks like. The user (doctors or nurse) is expected to log in with username and password.


Start
(A)
(B)
Is user logged in
NO
(C)
login
YES
(D)
Default/home page
(E)
Patient registration
radiology
LEVEL 1
Pre-examination
feeding
diagnosis
technical services
billing
pharmacy
admission
report analysis
pharmacy
Control panel
(F)
(G)
LEVEL 2
Pre-examination
diagnosis
billing
admission
referral
pharmacy
x-ray
laboratory
death report
discharge

There are two levels in the software of fig4.4 :- namely LEVEL 1- which is the patient general level and LEVEL 2- which is the patient specific level. In fig 4.4, LEVEL 1 is the point where the general diagnosis takes place while in LEVEL 2 only one patient can be attended to. From these fields the user can choose a particular option. Menu items may be selected by pointing with a mouse and clicking.

The flow diagram of fig 4.4 explains the working flow of the application from the time the user starts it to the control panel where a patient can be handled for diagnosis and treatment. When the software starts the user is presented with a log in page where he /she can enter login information (user name and password) as in fig 4.5

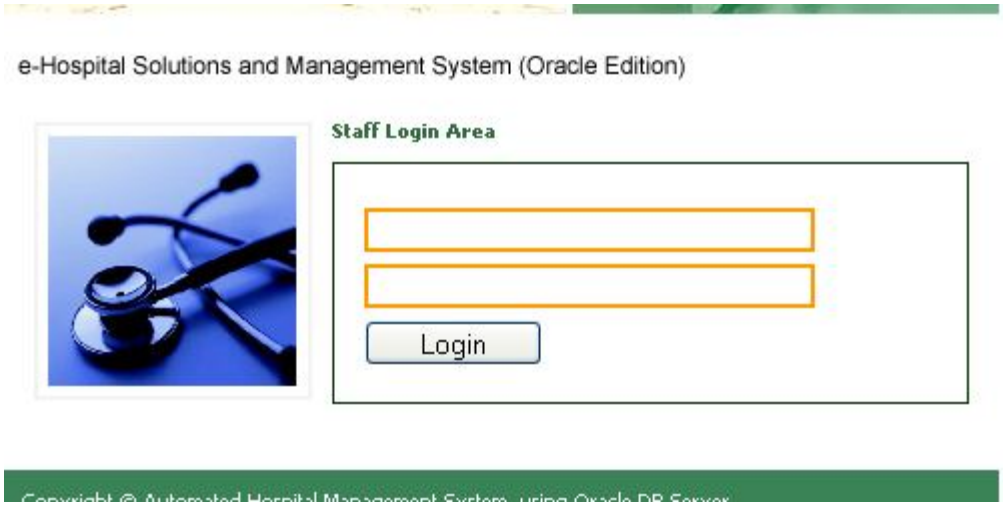


Fig 4.5 Login form

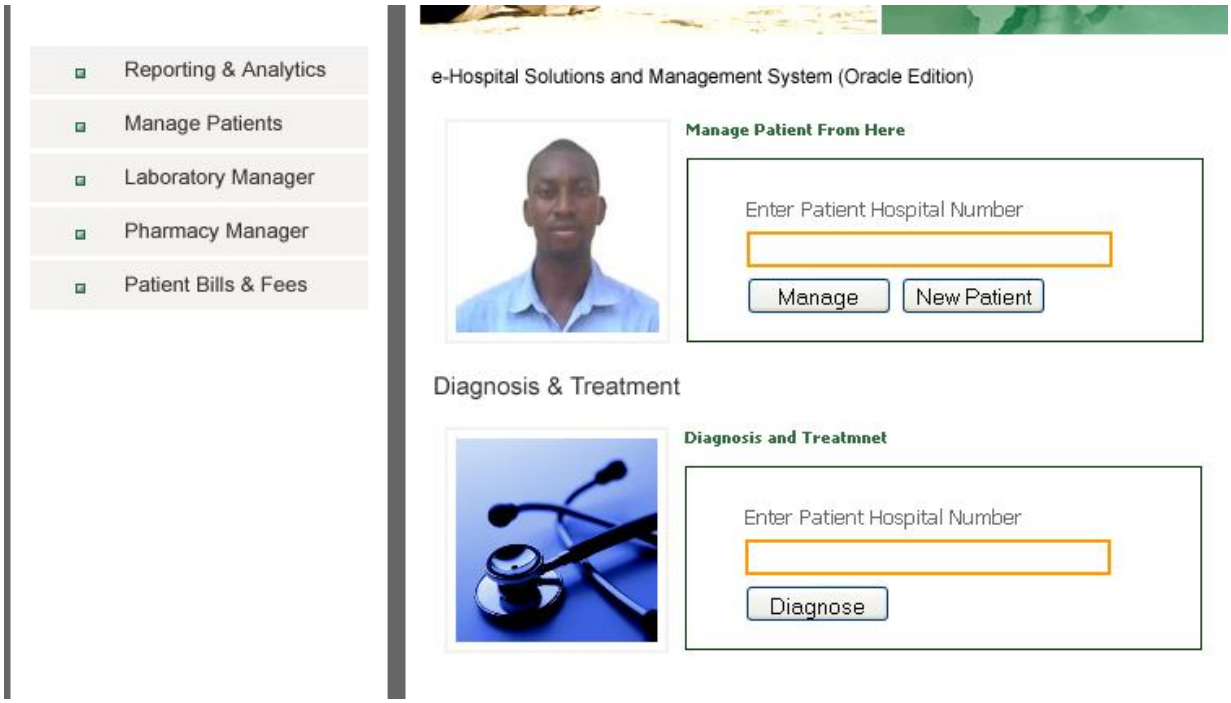


FIG 4.6 LEVEL 1 FORM

- In (A), the user enters the Universal resource language address of the application and continues to login.

- In (B) the software checks to see if the user has the necessary login authentication (Username and password).

- In (B) if the authentication is correct, the software continues to (D) else the user is redirected to the error page in (C) and back to (B) again

- In (D) if the authentication is correct the user is directed to the general page or home page.

From the home page shown in fig 4.6 patient administration can start. The home page contains various services which include:

1) Laboratory System
2) Report And Analysis
3) Patient Registration System
4) Billing System
5) Pharmacy System
6) Admission System

In (F): CONTROL PANEL, from the control panel, a patient can be explicitly managed as shown in fig 4.7. Here several clinical functions can be performed on the patient.

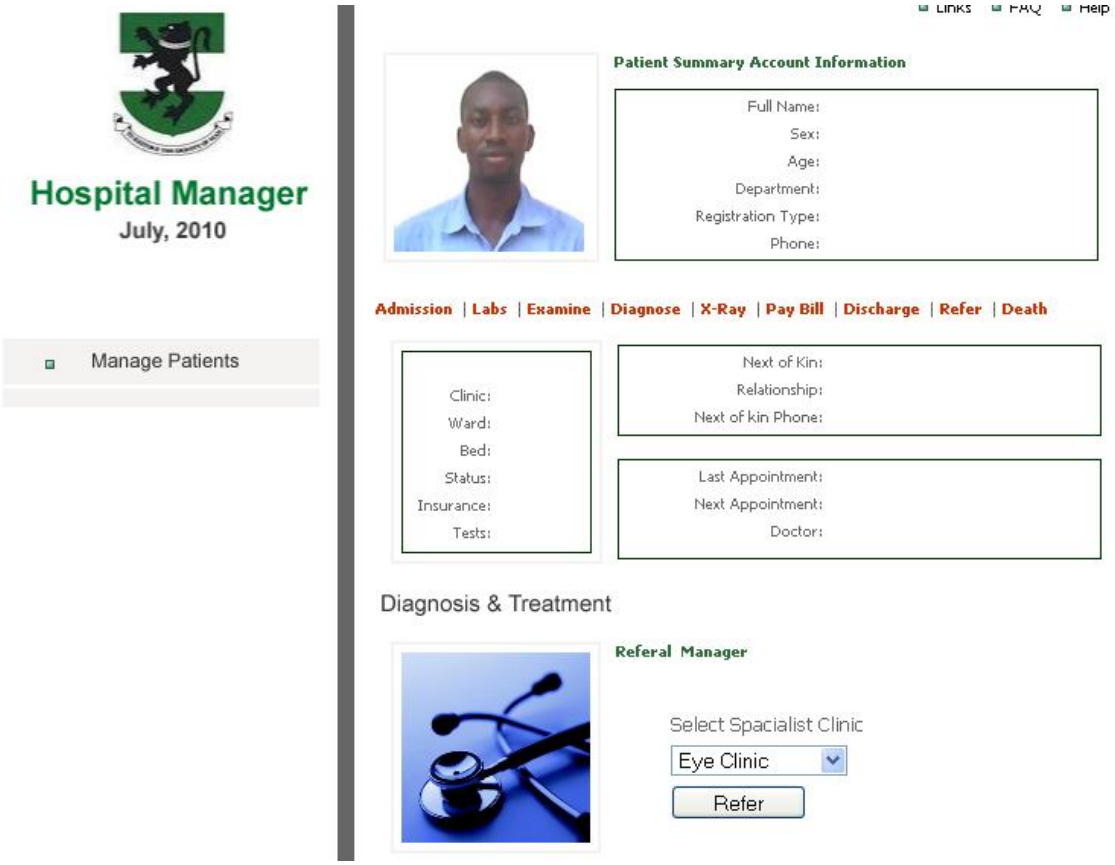


FIG 4.7 LEVEL 2 FORM

These clinical functions include;

1) X- Ray Services
2) Billing Services
3) Referral
4) Death Report
5) Laboratory Service
6) Discharge
7) Diagnosis
8) Examination.

From the fields of the home page the user can choose a particular option. Menu items like admission, diagnosis, examination, billing, laboratory, discharge, referral and death are selected by pointing with a mouse and clicking.

The main menu consist of the following main options

- Nurses Workbench
- Doctors Workbench

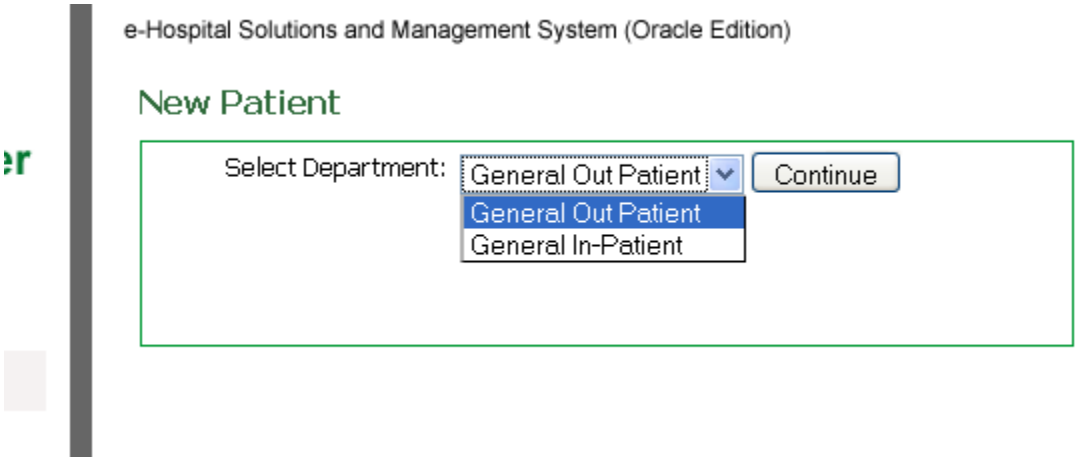


FIG 4.8 NURSES AND DOCTOR'S FORM

This is the pre-examination form used by the nurses to examine and take basic health information of the patient before the patient sees the doctor. Such data include height, weight, blood pressure, and temperature,

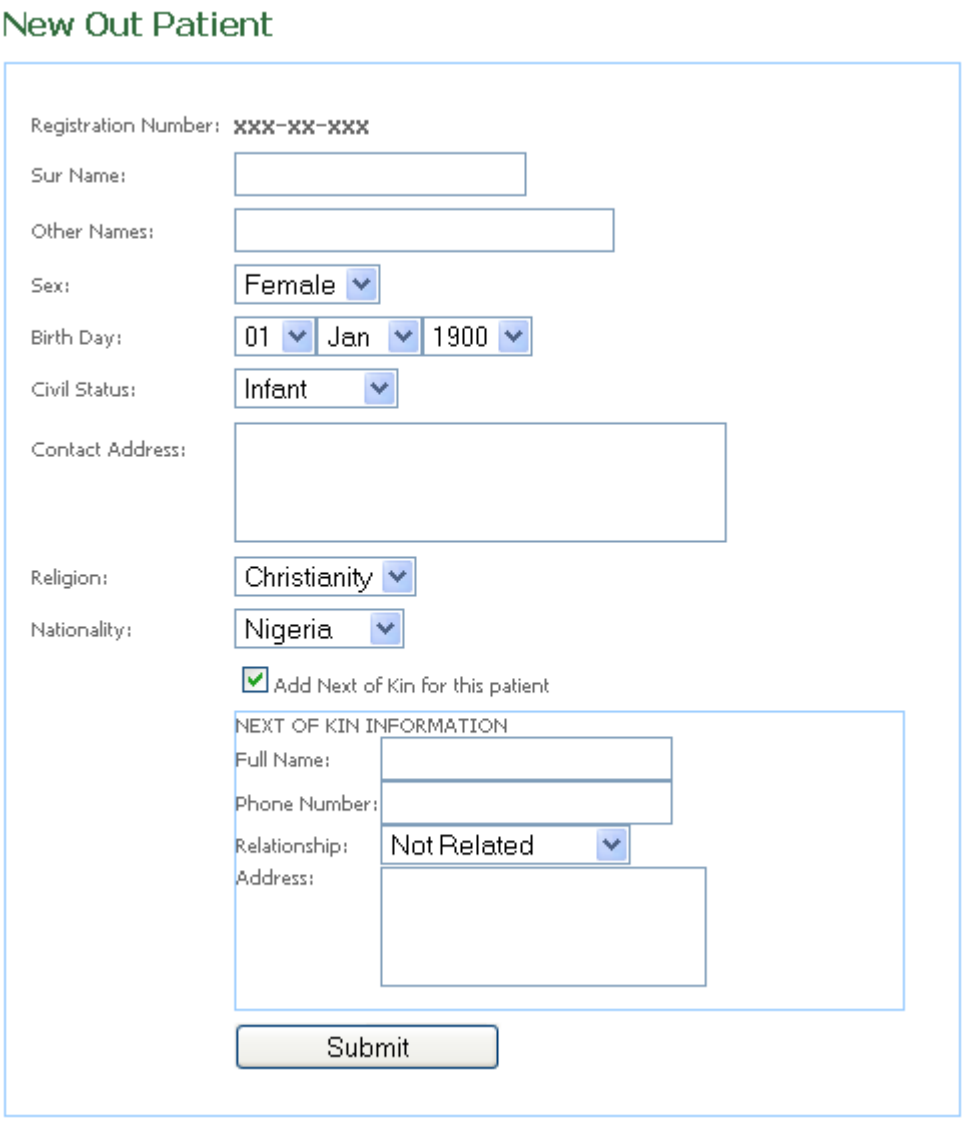


FIG 4.9 NURSES AND DOCTOR'S FORM

4.8 LABORATORY MANAGER:

This form is the laboratory request form used by doctors' order for laboratory test. These requests must be accepted by laboratory technician, carried out and the results feedback into the system for further follow up.

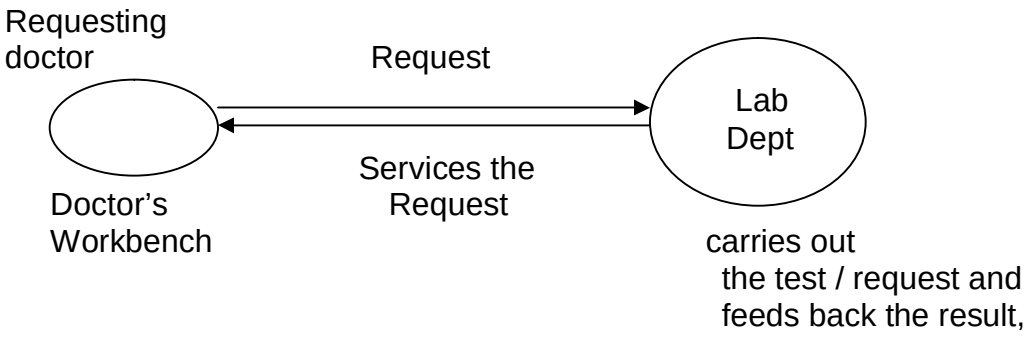


Fig 4.10: Laboratory Flow diagram

4.9 REPORT AND ANALYSIS:

ADMISSION: The admission is for the in-patient. It provides comprehensive data pertaining admission of patient and ward management as shown in fig 4.11. The option displays a submenu which consists of the following options:

Ward type

- General ward
- Male ward
- Female ward
- Children ward
- Private ward
- Medical ward
- Surgical ward
- Maternity ward

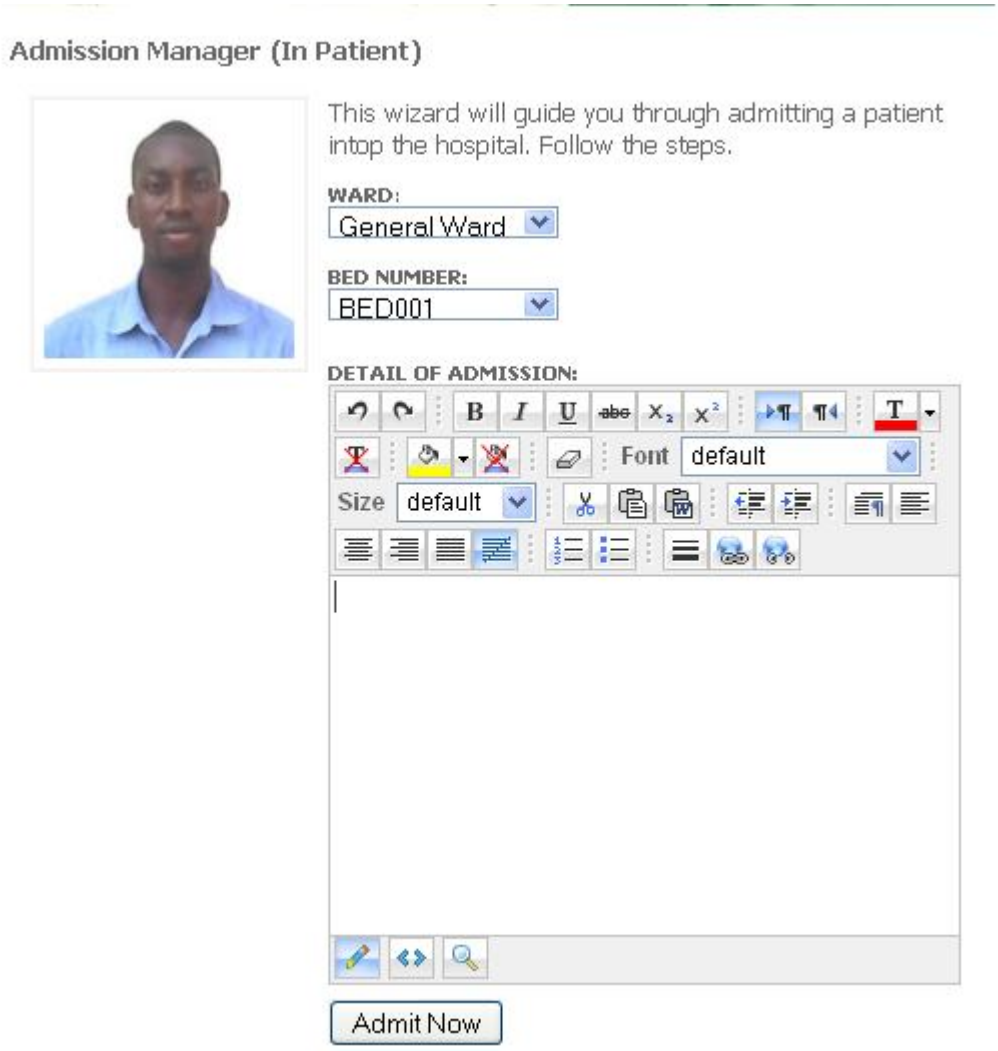


FIG 4.11 ADMISSION FORM

The admission operation follows the following sequence: click the cursor at the combo box of the general ward, choose ward, type click on the ward

Enter the bed number to fully admit the patient. Enter the additional detail like the patient's ailment for admission of the patient in question, click admits now.

4.10 LABORATORY

The laboratory request form is shown in fig 4.12

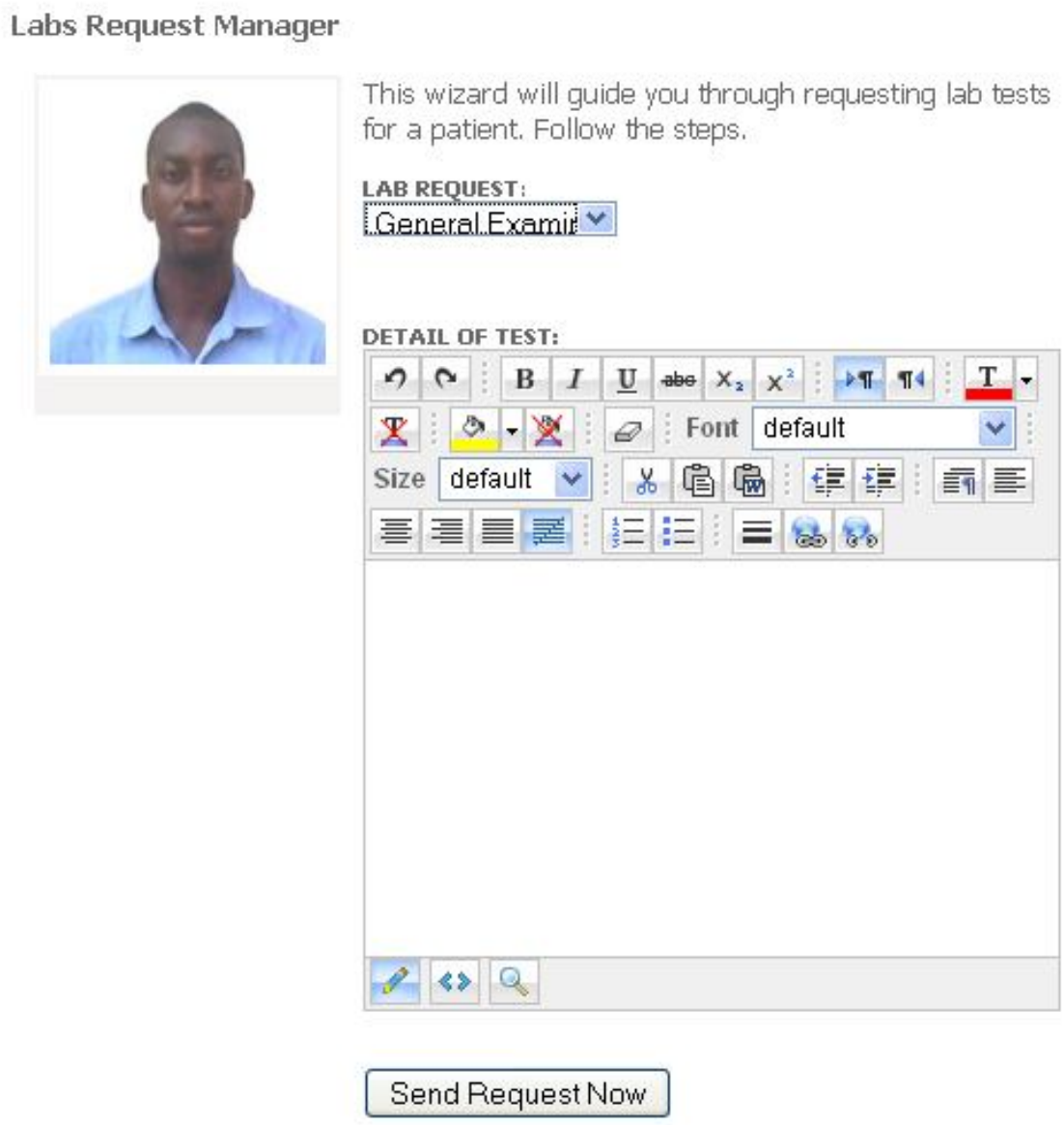


FIG 4.12 LABORATORY FORM

Click the cursor on the combo box of the general examination, chose the type of examination to be done on the patient; Click on it. Type the details of the test click the combo box request now.

4.11 EXAMINATION (NURSES WORKBENCH)

This is the pre-examination form used by nurses to examine and take basic

health information from the patient before the patient sees the doctor as in shown fig 4.13

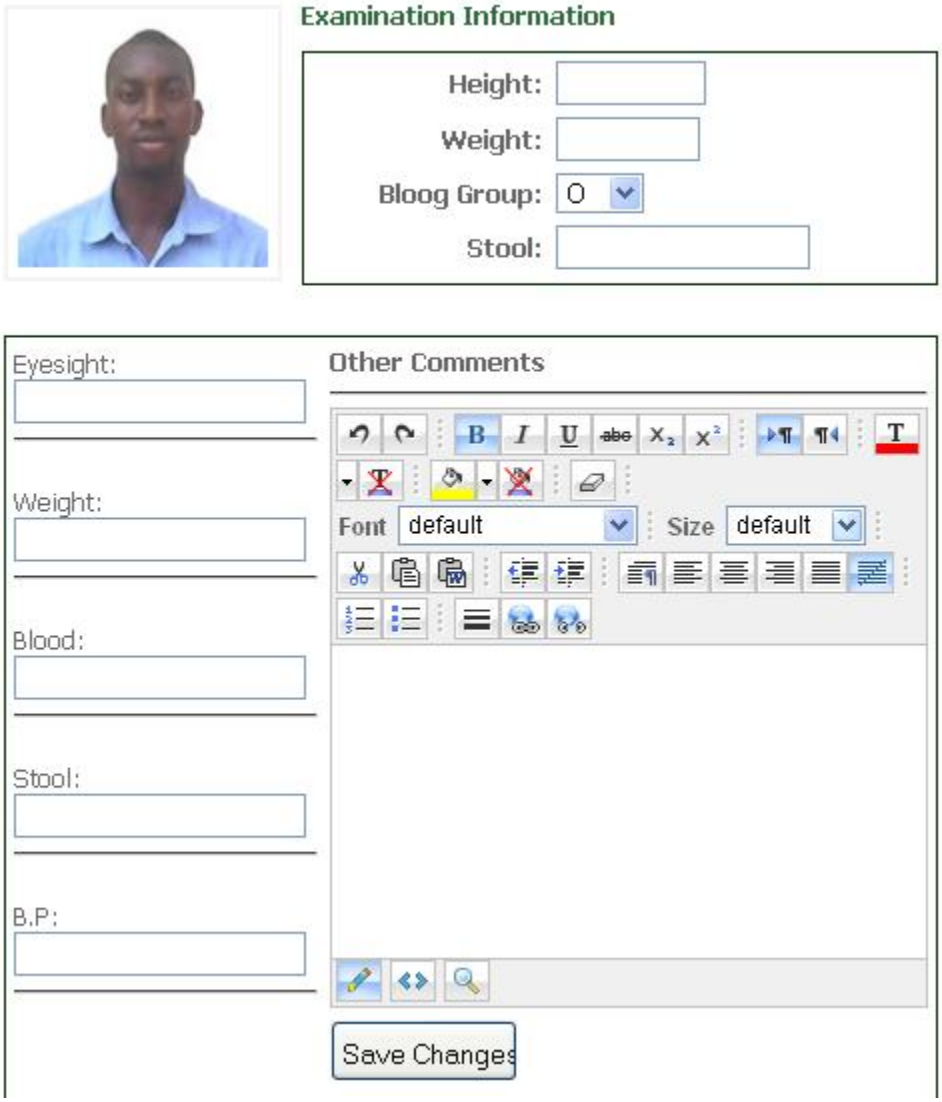


FIG 4.13 EXAMINATION FORM

Such data include height, weight, blood pressure and eyesight. The details of the examination may be added,

4.12 DIAGNOSIS (DOCTOR WORKBENCH)

The diagnosis form (fig 4.14) is the main doctors work bench area, handling diagnosis and doctor to doctor, doctor to nurse, nurse to doctor and nurses to

nurses follow up activities.

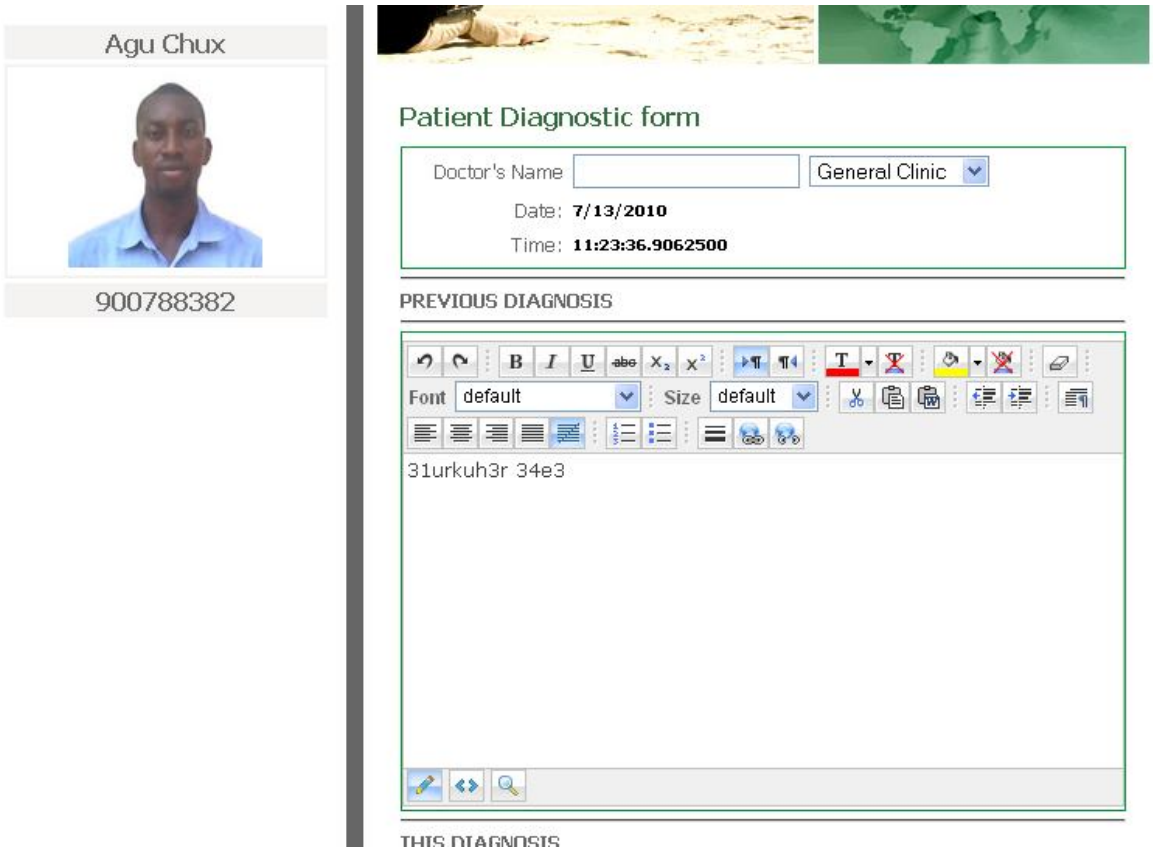
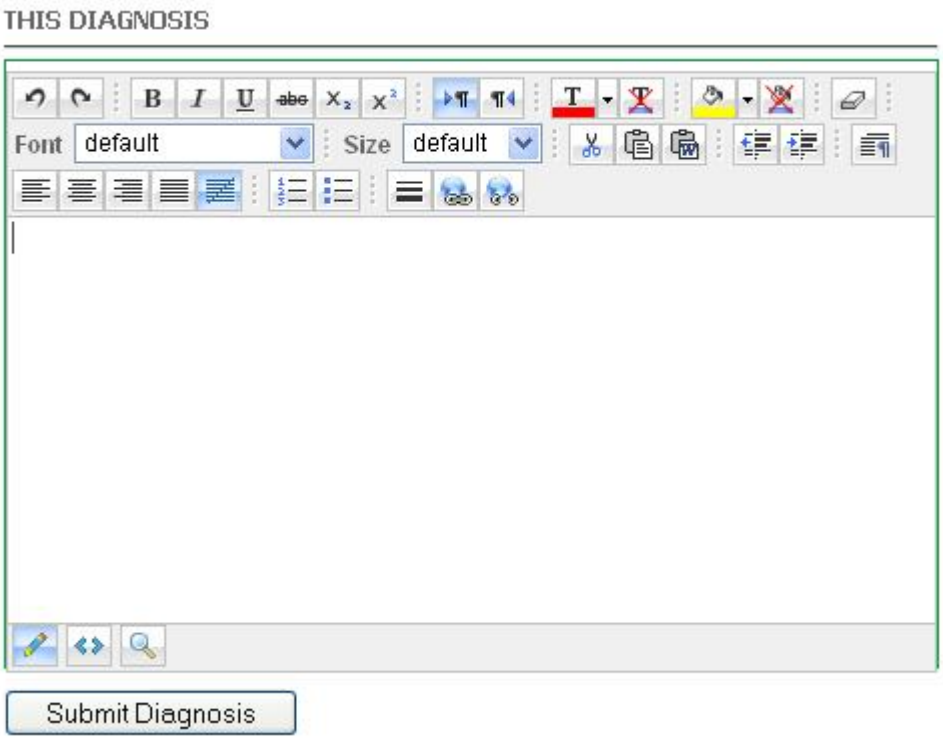


FIG 4.14 DIAGNOSTIC FORM

Here all diagnosis is logged into the database serially according to the date and time. The doctor carrying out the diagnosis will have to provide his name, clinic or department, go through the previous diagnosis and then enter details of the new diagnosis.



DIAGNOSTIC FORM

Submenu option displays the doctors name combo box, type of clinic, Automatic update and time.

Enter diagnosis detail and submit diagnose box to finish the process.

4.13. X - RAY.

This form is used by doctors to make an x-ray request for a particular patient at the patient specific level.

4.14. BILLING / ACCOUNTING SYSTEM.

This is part of the accounting module but this area is used to pay patient's bills or lodge money into the patients account.

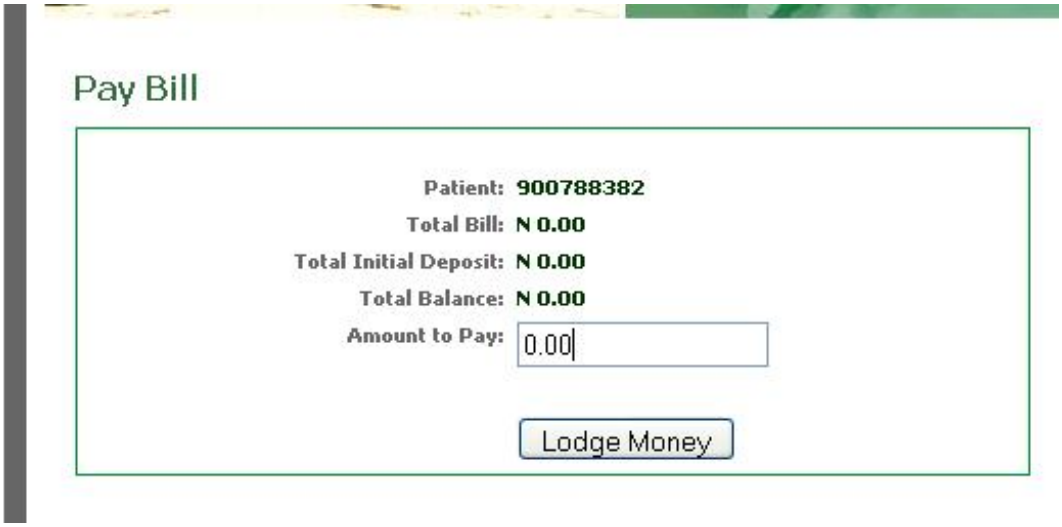


FIG 4.15 BILLING FORM

Data includes the following:-

1) Total Bill
2) Total Initial deposit
3) Total Balance
4) Amount to pay.

But only, the amount to be paid is entered.

4.15. DISCHARGE (DOCTORS WORKBENCH)

This area of the doctor's work bench is used to discharge patients after they have recovered from their illness.

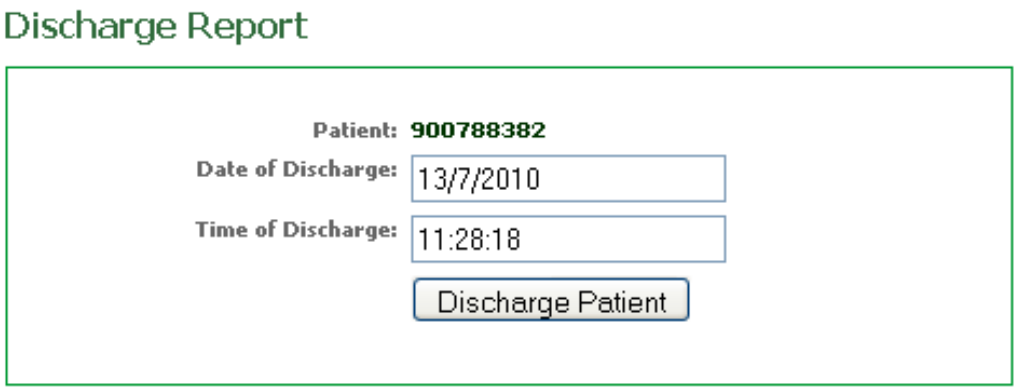


Fig 4.16 Discharge form

The data and time are entered. Once the discharge button is clicked, the patient becomes automatically discharged.

4.16. REFERAL SYSTEM: this form (fig 4.17) is used to refer patients from one department / specialist to another. From the doctors' workbench, at the patient specific level, the doctors click on referral to load the referral form

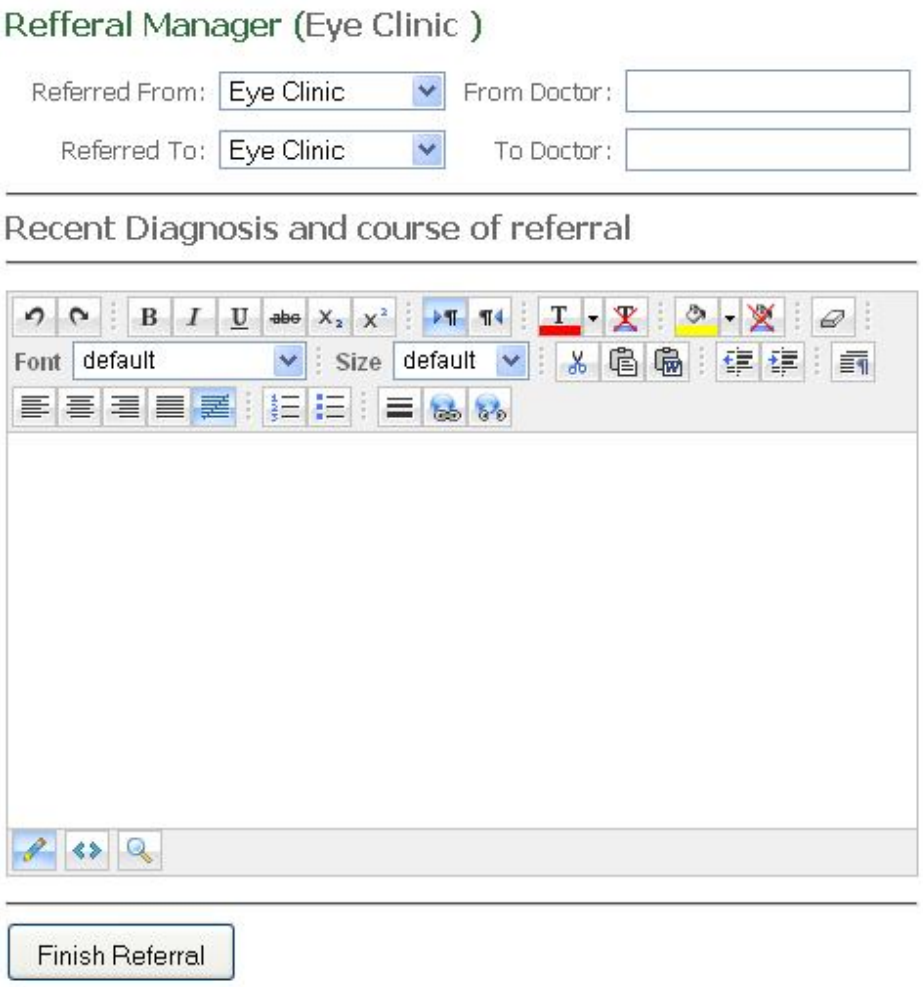


FIG 4.17 REFERRAL FORM

From the form, the doctor fills in the necessary data for referral and click refer button to refer the patient; and write the details for referral and click finish referral to send the form.

4.17 DEATH (NURSE / DOCTORS WORKBENCH): Once a patient is confirmed dead, the death option is clicked. Date and time of this death report is automatically stored.

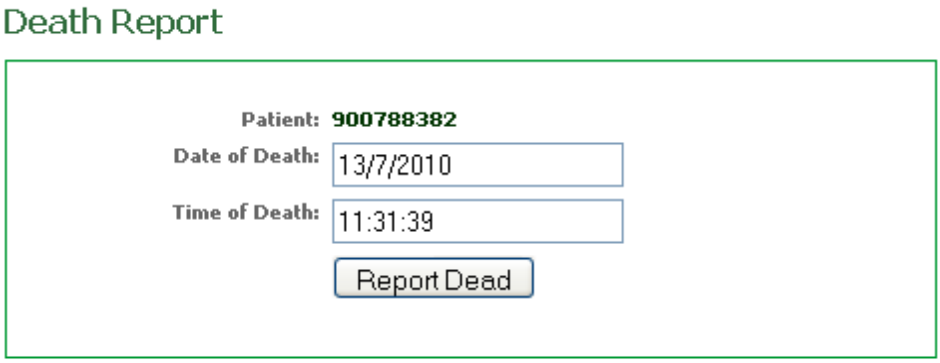


Fig 4.18 Death report form.

CHAPTER 5

5.0 IMPLEMENTATION AND TESTING:

Implementation is the realization of a technical specification or algorithm as a program or software component. It involves the accurate transform at or of the software design into some executable program code using any programming language of choice. A design may be implemented in various ways depending on the priorities of the software developer. In this work, several factors were taken into consideration during implementation. These factors include:

A. Correctness: The implementation was carried out with the aim of the final product meeting the user's need.

B. Robustness: Robustness is the quality of being able to withstand stresses, pressures or changes in procedure or circumstance. Robustness was emphasized extensively in the implementation of this work. Defensive programming techniques were applied. Strict checking procedures were included to eliminate the possibility of unacceptable effects on system response.

C. Performance: Software performance is the extent to which a product meets its constraints with regard to response or space requirements. Performance optimization especially as regards speed / response time and appropriate search techniques were employed to ensure good response time.

5.1 CHOICE OF PROGRAMMING LANGUAGE

Active Server Page.Net (ASP.NET) was chosen as the programming language which serves as the client to enable me to create the input and output forms while the oracle database was used as the database server.

DOT NET (.NET) is a framework (programming) for development of enterprise application using object oriented programming. For most software applications there exists a wide variety of languages in which the application may be

implemented. Apart from mere suitability of the programming languages, many factors influenced the use of ASP.NET as the programming language for the source code shown in the APPENDIX and the oracle database as the server.

5.2 THE FACTORS THAT INFLUENCED THE CHOICE OF THE ASP.NET.

1. Speed: Being a compiled language, it is very fast and speed is important in database application.
2. Environment: It can run in windows.
3. Efficient: The final code tends to be compact and run quickly.
4. Portability: If compiled, it can be executed in different machines with alteration of source code.
5. Maintainability: To ensure maintainability, this program is broken into modules and each module assigned a specific function. This will make maintenance of the system easier.
6. Security: it has proper backups, quality control mechanism for all modules and unauthorized access to sensitive data is prohibited.

5.3 WHY ORACLE DATABASE WAS CHOSEN:

1. Oracle maintains a high level of security compared to others such as MYSQL, Microsoft SQL, and Access.
2. Oracle database ensures maximum data throughput (i.e. accepting of data with ease).
3. Oracle database has a very high data storage capacity limit, several nanobyte and terabytes
4. Oracle is supported by many operating system platform e.g. Linux, Mac, windows and DOS
5. Oracle has several data management and administrative services.

6. Oracle comes with built-in front end (client) and back end (DB sever) programming architecture. This makes oracle a suitable application development framework.

7. Oracle has data back up and recovery management services.

8. Oracle supports open sources application e.g. MY SQL.

9. Oracle can be installed as a cluster servers- this makes it possible for two or more oracle database servers to be united as a common server in a cluster server

5.4 WHY ORACLE AND DOT.NET FRAMEWORK ARE NEEDED.

1. ASP.net supports full object oriented programming giving us more control over the graphic user interface

2. A.S.P. Net supports all the new AJAX programming (Asynchronous Java and XML (extensible markup language). It makes the graphic user interface friendly.

3. The ASP.NET framework supports multilingual coding platform which include visual basic, C Sharp (C#), C++, J#, J++.

5.5 USER INTERFACE:

User interface is the system by which users interact with a machine. The user interface includes hardware and software components. User interfaces exist for various systems and provide a means of:

- Input, allowing the users to manipulate a system.
- Output, allowing the system to indicate the effects of the user's manipulation.

The main aim of human-machine interaction is to produce a user interface which makes it easy, efficient enjoyable for humans to operate a machine in a way which produces the desired result.

5.6 TYPES OF USER INTERFACE

5.6.1 GRAPHIC USER INTERFACE: This type accepts input via devices such as computer keyboard and mouse and provides articulated graphical output on the computer monitor.

5.6.2 WEB-BASE USER INTERFACES: Accepts input and provide output by generating web pages which are transmitted via the internet and viewed by the user using a web browser program.

5.6.3 COMMAND LINE INTERFACE: The user provides the input by typing a command string with the computer keyboard and the system provides output by printing text on the computer monitor.

5.6.4 TOUCH USER INTERFACE: These are graphical user interfaces using a touch screen display as a combined input and output device.

5.6.5 NATURAL LANGUAGE INTERFACE: Natural language interface is used for search engines and on WebPages. The user types in a question and waits for a response.

In this design, ease of use was paramount; robust input procedures, error checking procedures, system e.t.c were included in implementation to ensure easy and efficient use of the software. This of course was achieved at the cost of bulkier code and resulting in increase of occupied memory space. The trade-off, however is justified as most target users may have little or no computer training and, thus require a very simple and straight forward user interfaces.

5.7 SECURITY

Security is vital for this project. About 95% of computer security problems is attributed to

1. Lack of proper backups.
2. Lack of quality control mechanisms.
3. Unauthorized access to sensitive data such as unauthorized reading of data, unauthorized modification of data, unauthorized deletion of data.

Quality control on the implementation was enhanced by the use of structural techniques as well as subjective testing for all stages and modules of the software system.

Unauthorized access to data was handled by the inclusion of password protection for all sensitive modules of the system; thereby reducing the probability of inadvertent or malicious access to the sensitive area of the system.

However, for the hospital management system, there are two major categories of security deployed thus;

1 Client software security

2 Database server (oracle) security.

5.7.1 CLIENT SOFTWARE SECURITY: This level of security ensures that only authorized persons such as doctors, nurses, consultants etc can have access to the system. The system therefore presents a login box requesting for the users user name and password. The username and password information are both stored in the database. Hence, during login, the entered

information must be validated in comparison with the account information in the database.

The above means that only authorized users can have access to the software.

5.7.2 DATABASE SERVER (ORACLE) SECURITY: The database is oracle and thus maintains an architectural security enabled profile. As a result, at run-time a connection must be established from the client software to the database server. This is a one-way connection and authentication is required. Full access to the oracle database also requires that the connection in client (user) must have the following information's

1 Correct username and password

2 Oracle server link or URL USUALLY LOCALHOST FOR Private web server

3 Correct port number of the server

Incorrect supply or error in the above information will lead to access denial to the oracle database. This also enhances the security detail of the system.

5.8 SOFTWRAE TESTING/VERFIFICATION

In this stage, the software design is realized as a set of programs or program units. Each unit is tested to verify that it meets its specific action. This exercise proves the correction of the software application. Three different approaches can be used to demonstrate that the codes are correct:

Test based purely on structure, test based purely on function and a formal proof of correctness. Each approach leads to the conclusion that complete testing on the sense of a proof is not theoretically possible.

Again to completely ascertain the software throughput, various testing method. Each method is categorically deployed to check for reliability, strength, weakness, and efficiency of the software. Among the testing methods used includes;

5.8.1 DEBUGGING: This test was carried out before the final compilation of the project for final publishing. This testing was used to check for code and syntax errors.

5.8.2 OPERATIONAL FLOW TESTING:

This test was mainly used ensure that the program at runtime follows the proper flow system. Here common issues like false links and broken hyperlinks were checked.

5.8.3 DATA INTEGRITY AND FORMAT TESTING;

This testing was used to check for data validation. The make sure the system accepts only the set data format and to report error when wrong data is keyed in.

5.8.4 LOAD TESTING ;

This is an efficiency test. The system is subjected to high operating condition and the behavior of the software monitored. Several assumptions were also made; this includes the average number of users accessing the data at a time and the number of concurrent connections to the oracle database server.

Finally, the above test methods generally provides the analytical result on the performance and integrity of the software

5.9 PROJECT COST

Cost in a project of this nature can be classified either as recurring or non-recurring cost. Recurring costs are costs associated with on-going use of the system once it comes on screen and include consumables, the cost of operating the system as well as the cost for dedicated labour (staff time)

Non-Recurring costs are costs incurred in system development or facilitation of system environment for instance providing hardware for the users. Part of it is development cost, which includes the cost of staff and all consumables used, computer and so on.

CHAPTER 6

6.0 EVALUATION

The main aim of this project is to deliver effective information and management services. It is a software-based application to deliver operational speed and service efficiency in any target hospital. The project Automated Hospital Management System is very accurate in its approach and suits all environments including large, medium or small scale hospitals.

In evaluating the hospital management system, it is observed that the project is successful . It is designed and tested to provide the following benefit:

1. Hospital management system not only provides an opportunity to the hospital to enhance their patient care but also increases the profitability of the organization.
2. The hospital will now require smaller number of staff to cater for more patients in the same time or even less.
3. Hospital Management System enable the hospital to serve the rapidly growing number of health care consumers in a cost-effective manner.
4. This software system allows for development of additional modules and service automations as the resources and job tasks of the hospital grow in time.
5. Upgrading of the software does not and will not require taking down of the existing running application modules.
6. Hospital administrators would be able to significantly improve the operational control and thus streamline operations.
7. Hospital Management System would enable the hospital to improve the response time to the demands of patients care because it automates the process of collecting, collating and retrieving patient information.
8. The hospital management system software interface saves a lot of time

for Doctors.

9. Accounting sometimes becomes awfully pathetic and complex. This product eliminates such complexity since the retrieval of information through its management information system will become virtually on their fingertips.

These advantages will justify the decisions of hospitals to invest or purchase this cost saving and life saving management system.

6.1 ACHIEVEMENT

The use of automated system will improve the quality of the patient care by

- Reducing the time spent by staff filling form and searching for folder for more critical tasks.
- Increase the nursing and doctors productivity
- Better the quality of care, procedures and service to patients.
- Control over the cost incurred by diagnosis – related groups.
- Each department can be deployed as a differential part of the hospital while integrally managed from the administrative level.
- Each AHIMS registered staff can logon to the AHIMS domain from any where within the hospital network coverage.
- Unified management of resources and asset which can be inherently transferred from one administrative end to another.
- The integral accounting system enables each department to maintain a separate account and billing system.
- The project targets over fifteen department in the hospital with each department running its own branched and independent part of the AHMS.
- The package has 100% growth allowance if the hospital wishes to introduce more departments or more functional tasks to be integrated.
- Centrally storing the hospitals data and information in a secure safe database has secondary backup base.

- ❖ Setting up an intranet server in the hospital.
- ❖ Making the AHMS user friendly and interactive.

6.2 COST ANALYSIS OF THE PROJECT

The AHMS project is sub-grouped into different modules with each module bearing its own cost detail.
The breakdown of the cost implication for the design, development and implementation of the AHMS are as follows:

Upload of each folder [N150/folder]
Production of hospital card [500]

Cost Breakdown:
MODULE 1 [N250,000.00]
PATIENT REGISTERATION SYSTEM
Computerized Hospital Management
Waiting list/Queue
Patient Data and archival
Medical histories and report generation

MODULE 2 [135,000.00]
PATIENT DATA ARCHIVE, HISTORY AND RECORD SYSTEM
Medical history and record
Patient data archive
Medical treatment and follow-up
Medical diagnosis reporting

MODULE 3 [130,000.00]

HOSPITAL INFORMATION MANAGEMENT SYSTEM

Hospital administration

Personnel /employee management

Hospital resource management

Appointment and schedule management

Staff message board /chat

MODULE 4[510,000.00]

HOSPITAL ADMINISTRATION SYSTEM

Appointment manager

Bed management

Ward management

Specialist clinic management

Clinical and clerking

Patients waiting list

Doctors workbench

Nurses workbench

MODULE 5[N345,000,00]

PHARMACY INFORMATION MANAGEMENT SYSTEM

Drug stock inventory

Drug prescription request

Drug dispensary

Analysis and inventory

Pharmaceutical report generation

Pharmaceutical sales management

MODULE 6 [440,000.00]

HOSPITAL LABORATORY MANAGEMENT SYSTEM

Laboratory workbench

Laboratory history /record reporting

Radiology and X- ray

Laboratory tests analysis

MODULE 7 [280,000.00]

HOSPITAL FINANCIAL ACCOUNTING AND BILLING SYSTEM

Financial accounting

Patents billing

Integrated hospital virtual banking

Staff/ personnel payroll and tax system

Voucher and invoicing

Integrated financial reporting

MODULE 8

HARDWARE INSTALLATION AND MAINTAINANCE

Installation shall be made

SERVA COMPUTER

The AHMS data center server consists of the

Primary server (installed in the hospital)

secondary backup server(internet based sever)

vsat equipment and internet connection

PRIMARY SERVA HARDWARE REQUIREMENTS

4GHz+CPU

4.5GB+RAM

350GB disk/database space

Cost N 560,000.00

CLIENT HARDWARE REQUIREMENTS

1.8GHz+ CPU

1GB RAM

1.0GB Drive space

Printer

Scanner

Ups

Cost; 250,000.00

OVERALL COST = 2,900,000.00

MODULE 9 [NEGOTIABLE]

TRAINING OF STAFF

Training of staff on the use of the software by staff of the hospital shall be provided in this module.

6.3 RECOMMENDATION

Since data management of a hospital is a vital part of its operations and its survival in the modern world, it must be well updated.

I recommend further work on the possibility of putting the project online with a security code to stop unauthorized persons from accessing the information.

6.4 CONCLUSION

In designing the computerized system, a survey of the existing system was made. A complete design of a database application for searching and locating patient folders has been carried out. The computerized automated hospital management system will provide better services for the nurses and doctors such as reduction in time taken to find a folder, accuracy and timeliness of record preparation e.t.c. In the implementation of this project much has been done to eliminate data redundancy, inconsistency and improve on the integrity of the data stored in the system.

The software model used is the waterfall model. Structured design was also employed in the design stage. The security of the computerized system was also employed to avoid unauthorized person or persons having access to data.

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REFERENCES

Adrain P. “Sensors have expanding opportunities for use in wearable devices for health monitoring”, 2005.

AHIMA Task Force. “A Vision of the e-HIM Future.” Chicago: AHIMA, 2003. Available at http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_020477.pdf (accessed June 28, 2004).

Alpati, Sam R. (2008). *Expert Oracle Database 11g Administration.* The expert’s voice in Oracle. Apress. P. 170.

Amarasingham R, Diener-West M, Weiner M, Lehmann H, Herbers JE, Powe NR: Clinical information technology capabilities in four U.S. hospitals: testing a new structural performance measure. *Med Care* 2006, 44(3):216-224. PubMed Abstract

Amarasingham R, Pronovost PJ, Diener-West M, Goeschel C, Dorman T, Thiemann DR, Powe NR: Measuring clinical information technology in the ICU setting: application in a quality improvement collaborative. *J Am Med Inform Assoc* 2007, 14(3):288-294. PubMed Abstract

American Hospital Association. “Forward Momentum Hospital Use of Information Technology,” AHA, 2005. Available at http://www.ahapolicyforum.org/ahapolicyforum/resources/content/FINALNonEmbITSurvey105.pdf p. 3 (accessed March 4, 2006).

B. Glover and H. Bhatt, “RFID Essentials”, *O’ Reilly Media*, Inc. 1005 Gravenstein Highway North, Sebastopol, CA 95472, Jan 2006, pp. 54-169.

B. Hollingsworth, P.J. Dawson, ad N. Maniadakis, ”Efficiency measurement of Health care: A review of non- parametric methods and application” Health Care Management Science, Volume 2, No.3, 1999, pp. 161-172

Bates DW: The quality case for information technology in healthcare. *BMC Med Inform Decis Mak* 2002, 2:7. PubMed Abstract | BioMed Central Full Text |

Bates DW, Gawande AA: Improving safety with information technology. *N Engl J Med* 2003, 348(25):2526-2534. PubMed Abstract | Publisher Full Text .Return to text

Berg M: Implementing information systems in health care organizations: myths and challenges. *Int J Med Inform* 2001, 64(2–3):143-156. PubMed Abstract |

Bates, David. “Physicians and Ambulatory Electronic Health Records.” *Health Affairs* 24, no. 5 (2005): 1180-1189.

Brailer, David J., and Emi L. Terasawa. “Use and Adoption of Computer-Based Patient Records.” California HealthCare Foundation, 2003: 1-42. Available at http://www.chcf.org/documents/ihealth/UseAdoptionComputerizedPatientRecords.pdf (accessed June 18, 2004).

Caring 2004 , 23(11):50-51. PubMed Abstract

Carol, Ruth. “EHRs, the Doctor Will See You Now.” *Journal of AHIMA* 76, no. 4 (2005): 24-28.

Caputo, A, Pelagagge, P,& Scacchia, F (2003) Integrating transport system in supply chain management software tools, Industrial Management & Data Systems, 103(7), 503-515.

Cavalleri, M, Morstabillini, R, & Reni, G. (2004) A wearable device for a fully automated in- hospital staff and patient identification. In Proceedings of the 26th Annual international Conference of the IEEE EMBS, 3278- 3281.

Computers Informatics Nursing 2005 , 23(2):85-92.

Curtin, J., Kauffman R. J 7 Riggins, F.J. (2007). Making the “most” out of RFID technology : A research agenda for the study of the adoption, usage, and impact of RFID, information technology and management, 8(2) 87 110.

Davidson E, Heslinga D: Bridging the IT Adoption Gap for Small Physician

Da've D: Benefits and Barriers to EMR Implementation. Practices: An Action Research Study on Electronic Health Records. .

DesRoches CM, Campbell EG, Rao SR, Donelan K, Ferris TG, Jha A, Kaushal R, Levy

DE, Rosenbaum S, Shield AE, Blumenthal D: Electronic Health Records in Ambulatory Care - A National Survey of Physicians.

DeLone WH, McLean ER. Information systems success: The quest for the dependent variable. *Inf Sys Res* 1992;3:60–95.

Erika Fischer- Lichte; the transformative power of Performance: *A new aesthetics*, Routledge 2008,

F.A. Correa, M.J. Gil, and L.B. Redin, " Benefits of Connecting RFID and Lean principles in Health Care," *Working paper 05-4*, Business Economics Series 10, 2005.

Fisher, J. A, & Monahan, T. (2008) Tracking the social dimensions of RFID systems in hospitals, international Journal of medical informatics, 77 176 183

Friedman CP, Wyatt JG.(1997) Evaluation Methods in Medical Informatics. New York, Springer-Verlag,

GAORFIS," RFIS Solutions for Health industry", http: //healthcare. Gaorfid. Com/, accessed on 10 February 2007.

Greenwald, Rick; Stackowiak, Robert; Stem, Jonathan (2007) *Oracle Essentials*: Oracle Database 11g. Essential Series (4 ed) . O'Reilly media P. 31. ISBN 9780514549.

Goodman EC. A methodology for the 'user-sensitive implementation' of information systems in the pharmaceutical industry: a case study. *Int J Inform Manag* 1998;18:121–38.

Häyrinen K, Saranto K, Nykänen P: Definition, Structure, Content, Use and Impacts of Electronic Health Records: A Review of the Research Literature.

Hersh, William. "Health Care Information Technology: Progressand Barriers." *Journal of the American Medical Association* 292, no. 18 (2004): 2273-2274.

Institute of Medicine. "Key Capabilities of an Electronic Health Record System," 2003. Available at http://books.nap.edu/html/ehr/NI000427.pdf (accessed June 26, 2004).

Kaplan B. Addressing organizational issues to the evaluation of medical systems. *JAMIA* 1997;4:94–101. [PMC free article] [PubMed]

McLane S: Designing an EMR Planning Process Based on Staff Attitudes Toward and Opinions About Computers in Healthcare.

Medical Records Institute. “Medical Records Institute’s Seventh Annual Survey of Electronic Health Record Trends and Usage for 2005,” 2005. Available at http://www.medrecinst.com/files/ehrsurvey05.pdf (Accessed March 14, 2006).

Moreno, Lorenzo. “Electronic Health Records: Synthesizing Recent Evidence and Current Policy.” 2003

Nunamker, J.F, Chen, M,& Purdin, D.M.(1990) System development in information system research, journal of management information system, 7,89-106.

P. Abrahamsson, O. Sallo, J Ronkainen and J Warsta,” agile Software Development Method – Review & Analysis,” VTT Publications 478, VTT technical Research Centre of Finland, Finland, 2002.

Palgrave Summerville, I . (2007) Software Engineering, 8th Eition, New York, Addison Wesley.

Paul Beynon- Davies (2004) Database Systems. Houndmills, Basingstoke, UK

Poissant L, Pereira J, Tamblyn R, Kawasumi Y: The Impact of Electronic Health Records on Time Efficiency of Physicians and Nurses: A Systematic Review. *J Am Med Inform Assoc* 2005, 12:505-516. PubMed Abstract | Publisher Full Text | PubMed Central Full Text

Swartz, Nikki. “Electronic Medical Records’ Risks Feared.” *Information Management Journal* 39, no. 3 (2005): 9.

Safaribooksonline. com iemiec, Richard (25 June 2007)” 1.30.New Background processes in 10g” Oracle Database 10g performance Tuning: tips & techniques Oracle press P. 967

van der Loo RP, Gennip EMSJ, Bakker AR, Hasman A, Rutten FFH. Evaluation of automated information systems in health care: An approach to classify evaluative studies. *Comput Methods Programs Biomed* 1995;48:45–52. [PubMed]

www.oracle .com

www. Database .com

www.medinous.com
www.acgil.com
www.wikipedia.org
www.wrebmyne.com
www.vclcomponent.com
www.freelancer.com

Wears RL, Berg M: Computer technology and clinical work: still waiting for Godot. *Jama* 2005, 293(10):1261-1263. PubMed Abstract

Zender, Anne. “Ready for the EHR? A New Survey Measures EHR Implementation and Individual Readiness.” *Journal of AHIMA* 76, no. 3 (2005): 54-55.

APPENDIX

Login Code

```
Partial Class login
    Inherits System.Web.UI.Page


    Private IsCanGo As Boolean

    Private Function Vilidate() As Boolean
        IsCanGo = True
        If pStaffId.Text.Trim = "" Then
            IsCanGo = False
        End If
        If pPassword.Text.Trim = "" Then
            IsCanGo = False
        End If
        Return IsCanGo
    End Function

    Protected Sub btnLogin_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnLogin.Click
        If Vilidate() Then
            Response.Redirect("Default.aspx")
        End If
    End Sub
End Class
```

Patient Registration (GOPD)

```
Imports Oracle.DataAccess.Client

Partial Class new_gopd
    Inherits System.Web.UI.Page

    Private RegType As String = "GOPD"

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        Dim pid_hip As String = GetPID()
        txtRegNumber.Text = pid_hip
    End Sub

    Protected Sub btnRegister_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnRegister.Click
```

```
        Dim bday As String = CStr((pDay.Text.Trim).ToString & ":" &
(pMonth.Text.Trim).ToString & ":" & (pYear.Text.Trim).ToString)
        Dim ks As String = "Data Source=xe;User
ID=agu.chux;Password=delta1201"

        Dim a As String = txtRegNumber.Text
        Dim b As String = txtRegNumber.Text
        Dim c As String = pSurname.Text.Trim
        Dim d As String = pOthernames.Text.Trim
        Dim es As String = pSex.Text.Trim
        Dim f As String = bday
        Dim g As String = pCivilstatus.Text.Trim
        Dim h As String = pContactaddress.Text.Trim
        Dim i As String = pReligion.Text.Trim
        Dim j As String = pNationality.Text.Trim
        Dim k As String = NKFullname.Text.Trim
        Dim l As String = NKPhone.Text.Trim
        Dim m As String = NKRelationship.Text.Trim
        Dim n As String = NKAddress.Text.Trim
        Dim o As String = "GOPD"
        Dim P As String = Now.Date

        Dim sCon As OracleConnection = New OracleConnection(ks)

        Dim cmStr As String = "insert into PATIENTS" & _

"(PID,HID,SNAME,ONAME,SEX,BDAY,CSTATUS,ADDRESS,RELIGION,NATIO
NALITY" & _
        ",NKNAME,NKPHONE,NKRELATIONSHIP,NKADDRESS,REGTYPE) " & _
        "values('" & a & "','" & b & "','" & c & "','" & d & "','" & es & "','" & f & "','" & g &
"','" & h & "','" & i & "','" & j & "','" & k & "','" & l & "','" & m & "','" & n & "','" & o & "')"

        Dim sComm As New OracleCommand(cmStr, sCon)

        Try
            sCon.Open()

            sComm.ExecuteNonQuery()
            Response.Redirect("queryDone.aspx")
        Catch ex As OracleException
            errMsg.Text = ex.ToString
        Finally
            sCon.Close()
        End Try
    End Sub
```

```
End Class
```

Patient Registration (GIPD)

```
Imports Oracle.DataAccess.Client
Partial Class new_gipd
    Inherits System.Web.UI.Page
    Private RegType As String = "GIPD"

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        Dim pid_hip As String = GetPID()
        txtRegNumber0.Text = pid_hip
    End Sub

    Protected Sub btnRegister_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnRegister0.Click
        Dim bday As String = CStr((pDay0.Text.Trim).ToString & ":" &
(pMonth0.Text.Trim).ToString & ":" & (pYear0.Text.Trim).ToString)
        Dim ks As String = "Data Source=xe;User
ID=agu.chux;Password=delta1201"

        Dim a As String = txtRegNumber0.Text
        Dim b As String = txtRegNumber0.Text
        Dim c As String = pSurname0.Text.Trim
        Dim d As String = pOthernames0.Text.Trim
        Dim es As String = pSex0.Text.Trim
        Dim f As String = bday
        Dim g As String = pCivilstatus0.Text.Trim
        Dim h As String = pContactaddress0.Text.Trim
        Dim i As String = pReligion0.Text.Trim
        Dim j As String = pNationality0.Text.Trim
        Dim k As String = NKFullname0.Text.Trim
        Dim l As String = NKPhone0.Text.Trim
        Dim m As String = NKRelationship0.Text.Trim
        Dim n As String = NKAddress0.Text.Trim
        Dim o As String = "GIPD"
        Dim P As String = Now.Date

        Dim sCon As OracleConnection = New OracleConnection(ks)


        Dim cmStr As String = "insert into PATIENTS" & _
```

```
"(PID,HID,SNAME,ONAME,SEX,BDAY,CSTATUS,ADDRESS,RELIGION,NATIO
NALITY" & _
        ",NKNAME,NKPHONE,NKRELATIONSHIP,NKADDRESS,REGTYPE) " & _
        "values('" & a & "','" & b & "','" & c & "','" & d & "','" & es & "','" & f & "','" & g &
"','" & h & "','" & i & "','" & j & "','" & k & "','" & l & "','" & m & "','" & n & "','" & o & "')"

        Dim sComm As New OracleCommand(cmStr, sCon)

        Try
            sCon.Open()

            sComm.ExecuteNonQuery()
            Response.Redirect("queryDone.aspx")
        Catch ex As OracleException
            errMsg.Text = ex.ToString
        Finally
            sCon.Close()
        End Try
    End Sub

End Class
```

Control Panel

```
Imports Oracle.DataAccess.Client
Imports System.Data

Partial Class cpanel_patient
    Inherits System.Web.UI.Page

    Public PatientPostId As String

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        PatientPostId = Request.QueryString("pid")
        LoadPatientData(PatientPostId)
    End Sub

    Public Sub LoadPatientData(ByVal ValueText As String)
        Dim strSQL As String = "select * from patients where pid='" & ValueText &
"'"
```

```
    Dim sCon As OracleConnection = New OracleConnection(k)
    Dim sComm As New OracleCommand(strSQL, sCon)
    Dim drd As OracleDataReader
    Dim dt As New DataTable
    Dim dr As DataRow
    Try

        sCon.Open()
        drd = sComm.ExecuteReader
        dt.Load(drd)
        dr = dt.Rows(0)

        ' all data here
        cfullname.Text = dr("SNAME").ToString & " " & dr("ONAME").ToString
        csex.Text = dr("SEX").ToString
        cbday.Text = dr("BDAY").ToString
        cdepartment.Text = dr("REGTYPE").ToString

        cbed.Text = dr("BED").ToString
        cclinic.Text = dr("CLINIC").ToString
        cward.Text = dr("WARD").ToString

        'cfullname.Text = dr("")
        'cfullname.Text = dr("")
        'cfullname.Text = dr("")
        'cfullname.Text = dr("")
        'cfullname.Text = dr("")
        'cfullname.Text = dr("")
        'cfullname.Text = dr("")
        'cfullname.Text = dr("")

        cphone.Text = dr("NKPHONE").ToString
        cstatus.Text = dr("CSTATUS").ToString
        cregtype.Text = dr("REGTYPE").ToString
        nkname.Text = dr("NKNAME").ToString
        nkphone.Text = dr("NKPHONE").ToString
        nkrelationship.Text = dr("NKRELATIONSHIP").ToString

        'data ends
    Catch ex As OracleException

    Finally
        sCon.Close()
    End Try
End Sub
```

```
    Protected Sub LinkButton1_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton1.Click
        Response.Redirect("PatiendAdmissionWizard.aspx?pid=" & PatientPostId)
    End Sub

    Protected Sub btnRefer_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnRefer.Click
        Response.Redirect("referral.aspx?clk=" & pSpecialistClinic.Text & "&pid=" &
PatientPostId)
    End Sub

    Protected Sub LinkButton3_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton3.Click
        Response.Redirect("examination.aspx?clk=" & pSpecialistClinic.Text &
"&pid=" & PatientPostId)
    End Sub

    Protected Sub LinkButton2_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton2.Click
        Response.Redirect("LabsWizard.aspx?clk=" & pSpecialistClinic.Text &
"&pid=" & PatientPostId)
    End Sub

    Protected Sub LinkButton7_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton7.Click
        Response.Redirect("referral.aspx?clk=" & pSpecialistClinic.Text & "&pid=" &
PatientPostId)
    End Sub

    Protected Sub LinkButton9_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton9.Click
        Response.Redirect("death.aspx?clk=" & pSpecialistClinic.Text & "&pid=" &
PatientPostId)
    End Sub

    Protected Sub LinkButton6_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton6.Click
        Response.Redirect("discharge.aspx?clk=" & pSpecialistClinic.Text &
"&pid=" & PatientPostId)
    End Sub

    Protected Sub LinkButton5_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton5.Click
        Response.Redirect("paybill.aspx?clk=" & pSpecialistClinic.Text & "&pid=" &
PatientPostId)
    End Sub
```

```
    Protected Sub LinkButton8_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles LinkButton8.Click
        Response.Redirect("diagnose_patient.aspx?clk=" & pSpecialistClinic.Text &
"&pid=" & PatientPostId)
    End Sub
End Class
```

Oracle Database Connection Class

```
Imports Microsoft.VisualBasic

Namespace unn
    Public Class Header
        Public BaseTitle As String = "ahims.net"
    End Class

    Public Class DbConnection
        Private ConString As String
        Private ConnectionString As String = ""

        'Connection string
        Public Property GetOracleConString() As String
            Get
                ConnectionString = "Data Source=xe;User
ID=nkechi;Password=nneka"
                Return ConnectionString
            End Get
            Set(ByVal value As String)

            End Set
        End Property
    End Class

    Public Class PageReferal
        Private CurPage As String
        Private InitialPage As String
    End Class
End Namespace
```

Discharge Module

```
Partial Class login
    Inherits System.Web.UI.Page
```

```
    Private pid As String

    Private IsCanGo As Boolean

    Private Function Vilidate() As Boolean
        IsCanGo = True
        If pTimeDeath.Text.Trim = "" Then
            IsCanGo = False
        End If
        Return IsCanGo
    End Function

    Protected Sub btnLogin_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnLogin.Click
        If Vilidate() Then
            Response.Redirect("queryDone.aspx")
        End If
    End Sub

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        pid = Request.QueryString("pid")
        Label1.Text = pid
        pDateDeath.Text = (Now.Day & "/" & Now.Month & "/" & Now.Year)
        pTimeDeath.Text = (Now.Hour & ":" & Now.Minute & ":" & Now.Second)
    End Sub
End Class
```

General Home Page

```
Imports Microsoft.VisualBasic
Imports Microsoft.Win32
Imports System.IO
Imports System.Data
Imports Oracle.DataAccess.Client

Partial Class _home
    Inherits System.Web.UI.Page

    Protected Sub btnManage_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnManage.Click
        If pNumber0.Text.Trim <> "" Then


            Dim strSQL As String = "select pid from patients where pid='" &
pNumber0.Text & "'"
```

```
        Dim sCon As OracleConnection = New OracleConnection(k)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Dim val As String = ""
        Try

            sCon.Open()
            drd = sComm.ExecuteReader

            If drd.HasRows Then
                dt.Load(drd)
                dr = dt.Rows(0)
                Response.Redirect("cpanel_patient.aspx?pid=" &
pNumber0.Text.Trim)

            Else
                errMsg.Text = "Patient does not exist"

                Exit Sub
            End If

            Response.Redirect("cpanel_patient.aspx?pid=" &
pNumber0.Text.Trim)

        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
    End If
End Sub

Public Sub GetRowValue(ByVal ValueText As String)

End Sub

Protected Sub btnNewPatient_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnNewPatient.Click
    Response.Redirect("new_patient.aspx")
End Sub

Protected Sub ImageButton2_Click(ByVal sender As Object, ByVal e As
System.Web.UI.ImageClickEventArgs) Handles ImageButton2.Click
    Response.Redirect("manage_patient.aspx")
End Sub
```

```
    Protected Sub btnDiagnose_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnDiagnose.Click
        Response.Redirect("diagnose_patient.aspx?pid=" & pNumber1.Text.Trim)
    End Sub
End Class
```

Admission Module

```
Imports Oracle.DataAccess.Client
Imports System.Data

Partial Class PatiendAdmissionWizard
    Inherits System.Web.UI.Page

    Public PatientPostId As String

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        PatientPostId = Request.QueryString("pid")
        LoadPatientData(PatientPostId)
    End Sub

    Protected Sub btnAdmit_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnAdmit.Click
        AdmitPatient(pWard.Text, pWard.Text, pBed.Text,
pDescription.Content.ToString)
    End Sub

    Public Sub AdmitPatient(ByVal cl As String, ByVal wd As String, ByVal bd As
String, ByVal ds As String)
        Dim strSQL As String = "UPDATE PATIENTS SET BED ='" & bd & "',
ward='" & wd & "', clinic='" & cl & "' WHERE PID='" & PatientPostId & "'"
        Dim sCon As OracleConnection = New OracleConnection(k)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Try

            sCon.Open()
            If sComm.ExecuteNonQuery <> 0 Then
                Response.Redirect("cpanel_patient.aspx?pid=" & PatientPostId)
            Else
                errMsg.Text = "Update failed"
            End If

        Catch ex As OracleException
            errMsg.Text = ex.ToString
```

```
        Finally
            sCon.Close()
        End Try
    End Sub

    Public Sub LoadPatientData(ByVal ValueText As String)
        Dim strSQL As String = "select * from patients where pid='" & ValueText &
"'"
        Dim sCon As OracleConnection = New OracleConnection(k)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Try

            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)


            pname.Text = dr("SNAME").ToString & " " & dr("ONAME").ToString

        Catch ex As OracleException

        Finally
            sCon.Close()
        End Try
    End Sub


End Class
```

Diagnosis Module

```
Partial Class diagnose_patient
    Inherits System.Web.UI.Page


    Public PatientPostId As String

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        PatientPostId = Request.QueryString("pid").ToString
        Label2.Text = Now.Date
```

```
        Label3.Text = Now.TimeOfDay.ToString
        Try
            iPId.Text = PatientPostId.ToString
            iPname.Text = "Agu Chux"
            pReferralDetail0.Content = ""

        Catch ex As Exception
        End Try
    End Sub

    Protected Sub btnDiagnose_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnDiagnose.Click
        pReferralDetail0.Content = pReferralDetail0.Content &
"<br/><br/><hr/><p/>" & pReferralDetail.Content
        pReferralDetail.Content = ""
        'Response.Redirect("queryDone.aspx")
    End Sub
End Class
```

Referral Module

```
          artial Class referral
    Inherits System.Web.UI.Page

    Dim click As String
    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        click = Request.QueryString("clk")
        pClinic.Text = click
    End Sub

    Protected Sub btnRefer_Click(ByVal sender As Object, ByVal e As
System.EventArgs) Handles btnRefer.Click
        Response.Redirect("queryDone.aspx")
    End Sub
End Class
```

Major Functions and subroutines

```
Imports Microsoft.VisualBasic
Imports System.Data
Imports System.IO
```

```
Imports System.Drawing
Imports Oracle.DataAccess.Client

Public Module Modules

    Public iPage As String
    Public CurrPage As String

    Private IsAdmin As Boolean = False
    Private IsDoctor As Boolean = False
    Private IsNurse As Boolean = False
    Private IsStaff As Boolean = False
    Private IsUser As Boolean = False
    Private UserType As String = False
    Private AccountId As String = False

    Public IsLoggedIn As Boolean = False
    Public LoginType As String
    Public currentPage As String
    Public previousPage As String
    Public currentUser As String
    Public currentUserId As String
    Public currentUserFullname As String
    Public HeadTitle As String = "UNN unn: Hospital Management Software"

    Public k As String = "Data Source=xe;User ID=agu.chux;Password=delta1201"


    Public Sub Logout()
        IsLoggedIn = False
        currentUser = "User"
        currentPage = "login.aspx"
    End Sub


    Public Function GetPID() As String
        GetPID = "UNN" & CStr(Now.Year & Now.Month & Now.Day & "-" &
Now.Hour & Now.Minute & Now.Second)
        Return GetPID
    End Function

    Public Function GetRowValueAsText(ByVal rowText As String, ByVal
TableName As String, ByVal keyText As String, ByVal ValueText As String) As
String
        Dim strSQL As String = "select " & rowText & " from " & TableName & "
where " & keyText & "='" & ValueText & "'"
```

```
        Dim k As New unn.DbConnection
        Dim sCon As OracleConnection = New
OracleConnection(k.GetOracleConString)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Dim val As String = ""
        Try
            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)
            val = dr(rowText)
        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
        Return val
    End Function

    ''' <summary>
    '''
    ''' </summary>
    ''' <param name="DDMobj">Drop down box</param>
    ''' <param name="ValtxtData"></param>
    ''' <param name="valData"></param>
    ''' <param name="tbl"></param>
    ''' <remarks></remarks>
    Public Sub GetTableData(ByVal As DropDownList, ByVal ValtxtData As
String, ByVal valData As String, ByVal tbl As String)
        Dim strSQL As String = "select * from " & tbl
        Dim k As New unn.DbConnection
        Dim sCon As OracleConnection = New
OracleConnection(k.GetOracleConString)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Try
            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)

            DDMobj.DataSource = dt
```

```
            DDMobj.DataMember = valData
            DDMobj.DataTextField = valData
            DDMobj.DataValueField = ValtxtData
            DDMobj.DataBind()
        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
    End Sub

    Public Sub GetDepartments(ByVal DDMobj As DropDownList)
        Dim strSQL As String = "select departmentname from departments"
        Dim k As New unn.DbConnection
        Dim sCon As OracleConnection = New
OracleConnection(k.GetOracleConString)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Try
            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)

            DDMobj.DataSource = dt
            DDMobj.DataMember = "departmentname"
            DDMobj.DataValueField = "departmentname"
            DDMobj.DataBind()
        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
    End Sub


    Public Sub GetClinic(ByVal DDMobj As DropDownList)
        Dim strSQL As String = "select clinicname from clinics"
        Dim k As New unn.DbConnection
        Dim sCon As OracleConnection = New
OracleConnection(k.GetOracleConString)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Try
```

```
            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)

            DDMobj.DataSource = dt
            DDMobj.DataMember = "clinicname"
            DDMobj.DataValueField = "clinicname"
            DDMobj.DataBind()
        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
    End Sub


    Public Sub GetWard(ByVal DDMobj As DropDownList)
        Dim strSQL As String = "select ward from wards"
        Dim k As New unn.DbConnection
        Dim sCon As OracleConnection = New
OracleConnection(k.GetOracleConString)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Try
            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)

            DDMobj.DataSource = dt
            DDMobj.DataMember = "ward"
            DDMobj.DataValueField = "ward"
            DDMobj.DataBind()
        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
    End Sub

    Public Sub GetSpacialty(ByVal DDMobj As DropDownList)
        Dim strSQL As String = "select * from specialties"
        Dim k As New unn.DbConnection
        Dim sCon As OracleConnection = New
OracleConnection(k.GetOracleConString)
```

```
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
        Dim dt As New DataTable
        Dim dr As DataRow
        Try
            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)

            DDMobj.DataSource = dt
            DDMobj.DataMember = "specialty"
            DDMobj.DataTextField = "specialty"
            DDMobj.DataValueField = "staffid"
            DDMobj.DataBind()
        Catch ex As OracleException
        Finally
            sCon.Close()
        End Try
    End Sub
End Module
```

Report Code

```
Imports Oracle.DataAccess.Client
Imports System.Data

Partial Class reports
    Inherits System.Web.UI.Page

    Public PatientPostId As String

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Me.Load
        PatientPostId = Request.QueryString("pid")
        LoadPatientData(PatientPostId)
        rDate.Text = FormatDateTime(Now, DateFormat.ShortDate) & " :" &
FormatDateTime(Now, DateFormat.ShortTime)
    End Sub

    Public Sub LoadPatientData(ByVal ValueText As String)
        Dim strSQL As String = "select * from patients where pid='" & ValueText &
"'"
        Dim sCon As OracleConnection = New OracleConnection(k)
        Dim sComm As New OracleCommand(strSQL, sCon)
        Dim drd As OracleDataReader
```

```
        Dim dt As New DataTable
        Dim dr As DataRow
        Try

            sCon.Open()
            drd = sComm.ExecuteReader
            dt.Load(drd)
            dr = dt.Rows(0)

            ' all data here
            cfullname.Text = dr("SNAME").ToString & " " & dr("ONAME").ToString
            csex.Text = dr("SEX").ToString
            cbday.Text = dr("BDAY").ToString
            cdepartment.Text = dr("REGTYPE").ToString

            cbed.Text = dr("BED").ToString
            cclinic.Text = dr("CLINIC").ToString
            cward.Text = dr("WARD").ToString

            cphone.Text = dr("NKPHONE").ToString
            cstatus.Text = dr("CSTATUS").ToString
            cregtype.Text = dr("REGTYPE").ToString
            nkname.Text = dr("NKNAME").ToString
            nkphone.Text = dr("NKPHONE").ToString
            nkrelationship.Text = dr("NKRELATIONSHIP").ToString

            'data ends
        Catch ex As OracleException

        Finally
            sCon.Close()
        End Try
    End Sub
End Class
```