UNIVERSITY OF GHANA
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A PROPOSED AUTOMATED MEDICAL RECORDS TRACKING SYSTEM FOR THE RIDGE HOSPITAL

BY

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF M. A. DEGREE IN ARCHIVES ADMINISTRATION.

SEPTEMBER, 2003.

DECLARATION

I hereby declare that except for references to other people's work which I have duly acknowledged, this project is the result of my own research work and it has neither in part nor wholly been presented elsewhere for another degree.

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DEDICATION

This research work is dedicated to Lerner Adjoa Obeng and my family.

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I thank the Almighty God for the time and chance he granted me to complete another degree programme.

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ABSTRACT

The astronomical increase in attendance rate at health institutions confront medical records managers with large volumes of records to manage. Records storage facilities and information retrieval systems are therefore faced with several challenges in medical records management. This situation is very crucial if patients medical records retrieval systems are wholly manual. At the Ridge hospital, the manual medical records tracking system contributes immensely to missing patients medical records, delays and long queues patients endure before receiving medical treatment. This paper therefore employs the systems analysis and design approach, (also known as systems development lifecycle) to design and develop an automated medical records tracking system. This proposed system is a case study at the Ridge Hospital which is limited to tracking and management of only inpatients records. Based on the adopted methodology, preliminary investigations and analysis of the manual system were conducted to find the scope of the problem. Following the results of the systems analysis, Microsoft Access database program was used to develop a logical design to automate the manual tracking system. The design was finally modified and developed by using Microsoft Visual Basic 6 codes to operate as an automated medical records tracking system. The developed system does not only track records faster and more efficiently than the manual system but can also perform other records management functions such as generation of reports on admissions and discharge cases.

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CHAPTER ONE

BACKGROUND TO THE STUDY

1.0 Introduction

Health institutions experience tremendous increase in the number of medical records in their repository due to patients visitation and emergency cases. When medical officers attend to patients and clients, records of all transactions are kept for essential future use. In some cases, returning patients cannot receive adequate treatment if their case files or hospital cards are misplaced. Large volumes of records demand appropriate records management practices in order to ease storage and retrieval of records.

Although computerisation of medical records has become a modern phenomenon, hard copies of records still maintain their traditional values and thus, must be managed accordingly. Diamond (1991), stated that "retrieval speed is improved through the use of both non-paper based technology and appropriate records management system".

Automated medical records tracking system is resourceful in providing fewer tasks in retrieving records and tracing the movements of records. Chopra (1990) defines automation as "the technology concerned with the design and development systems that minimise the necessity of human intervention in their operation".

The Ridge Hospital Records Unit has a workforce of sixteen employees, and operates twenty-four hours daily. The active records section is currently keeping about a hundred and seventy thousand records and with about hundred and fifty new records created daily. When patients files remain inactive for five years, they are sent to the hospital's archives for preservation and storage.

Authorised users of patients files are the nurses, doctors, staff of the pharmacy unit, and personnel at the accounts section. Circulation of a patient's record during treatment begins from the active records section. Then, it goes to the consulting room, followed by the pharmacy and accounts units respectively, and finally, returned to the Records Unit for filing, in a case of an outpatient.

Inpatients records are kept provisionally by nurses on duty in the wards where they are receiving treatment. The records are however, returned to the Records Unit following discharge of patients. Apart from regular circulation schedule, records can be requested for use any time necessary by any of the legitimate users for an official action.

All file requests are recorded in a book referred to as "folder movement book". Ideally tracer cards or outguides are the most suitable instruments for this function. Nurses as provisional custodians of files from the time a patient is admitted to discharge, also keep records on all the inpatients files in their possession in a form of a folder movement book. In a situation where a patient's folder is needed immediately but not found on shelf, a search is done by going through all the folder movement books to locate who is using the file.

Taking into consideration the large volumes of records and the mechanism used to track records, it is important to consider automation as a beneficial solution to problems posed by the manual system. In addition, networking the automated system to other units of the hospital where patients records are relevant to their legitimate operations will ensure a centralised online monitoring system. This will be a desirable solution compared to searching through the folder movement book.

In hospitals where automated tracking systems are used, movements of records are easily monitored, and retrieval of records is efficient. Siemon and Kuratomi (1982) remarked that, "an automated system is not only an efficient method of tracking and

retrieving records, but an efficient tool for management purpose as an integrated component of a management information system".

1.1 Statement of the Problem

The Ridge Hospital has a policy on records movements. Request for medical records must be recorded in order to monitor and manage the movements of records as they play vital role in the medical process. However, in compliance with this policy the following situations, which are the main problems of the study, are encountered:

Due to the large number of people who visit the hospital daily, this policy is limited to only inpatients records. Tracking or tracing records is fully manual and in certain cases demands critical detective work. The use of folder movement book instead of tracer cards or outguides consequently, makes the manual system cumbersome to operate. It is difficult to trace a file when it is not found on shelf at the time of demand.

Patients join long queue at the Records Unit waiting for their files to be retrieved before any medical attention is offered to them. The delays are caused by the inability of Records Unit staff to retrieve patients files within the shortest possible time.

Personnel time expended in tracking records is formidable due to insufficient storage facilities and the absence of tracer cards for faster tracing of files. Problems therefore arise when a patient's file is needed immediately during the course of diagnosis but the file is not found on shelf. Such a file could be in the possession of any of the legitimate users but may take Records Unit staff considerably a long time before detecting which of the users is keeping the file. Unfortunately, although the Records Unit at the hospital is undergoing computerisation, it does not cover tracing of records. This study seeks to design an automated records tracking system which can conveniently replace the existing manual system at the Ridge Hospital.

1.2 Aim of the Study

The study sought to explore, identify and analyse the difficulties inherent in the manual tracking system with the view to designing an automated medical records tracking system for the Ridge Hospital.

1.3 Objectives of the Study

The study had the following objectives:

- To identify problems inherent in the manual system
- To justify the need for automating the records tracking system
- To design a systems flowchart to reflect an automated system
- To develop a proposed application to replace the manual system

1.4 Literature Review

Automation has become a critical resource for information storage and retrieval systems. Due to the ever-increasing array of volumes of information, records keeping and claims processing have become a complex and never ending task.

A study conducted in the United States shows that in the 1940s 57% of the United States labour force were factory or manufacturing plant workers, and 31% information related activities workers. After 40 years, 34% of the labour force were factory workers and 54%, information related activities workers. This change was due to factories and manufacturing industries using automation systems as a resource for their production processes (Bohl, 1990).

The study, however, suggests that automation systems have been amply used by large manufacturing industries to enhance efficiency and to increase productivity. Bohl, revealed that today, doctors, clinics, and hospitals can operate more efficiently with computerisation and automation especially when large volumes of records are involved.

Furthermore, in the hospital settings automation plays very important role in administrative paper work, patients records, billing, insurance claims, accounts receivable, payroll, and recording of patients clinical history.

In Ghana, some academic research works have considered automation of academic libraries. Others have evaluated the effects of automation on libraries and records management systems. Agbe (1997), gave several reasons why automating the Balme Library of the University Of Ghana was a credible course to pursue. His reasons included, "to manage a process more rapidly and more accurately, or less expensively". He further observed that automation in the Balme Library was indispensable, due to increase in student population and high demand for library services. The project demonstrated that automation of the cataloguing system could reduce the time expended to retrieve a piece of information thus, lessening the difficulty in the manual use of catalogues. This is comparatively parallel to automating records tracking system in a health institution for faster retrieval of records.

In records management, previous literature concentrated predominantly on the evaluation of electronic database management, hardware and software for database management, networking, data storage, etc. Amehoe (2000) evaluated the impact of automation on students records management in the University of Ghana. He recommended personnel training, decentralisation of students data, networking, and high capacity data storage facilities as a means of enhancing the automation project.

Siemon and Kuratomi (1982) evaluated the numerous problems faced by manual systems, and proposed automating medical records tracking system as a significant means of support for operations, management and decision making function of a hospital.

This study adopted Seimon and Kuratomi's approach to developing an automated tracking system as a component of management information system using the systems analysis and design methodology.

1.5 Methodology

The systems design and analysis or systems development lifecycle approach was employed for the study. This process involved, preliminary investigation, systems analysis, systems design, systems development, systems implementation and systems maintenance. The methodology is most suitable for achieving the objectives of the study; this is in conformity with Badu's (2001) view on the post-positivist approach, where an adopted methodology is what the researcher considers appropriate for the study and uses it effectively to achieve the objectives of the research.

The systems analysis and design methodology has been prescribed by authors such as O'Brien (1997), Williams, Sawyer and Hutchinson (1999), and Laudon and Laudon (2000), as efficient in appraising systems building alternatives and offers a step-by-step procedure for examining and developing an information system. The systems analysis and design methodology entailed the following steps:

1.5.0 Preliminary Investigation

This stage determined the objectives and structure of the Records Unit. Secondly, the nature and scope of the problem were identified. This was achieved by critical observation and analysis of the manual system in order to obtain deeper understanding of the problem.

1.5.1 Systems analysis

All the processes involved in the manual tracking system and circulation of medical records were analysed and illustrated using data flow and connectivity diagrams.

The diagrams depicted areas in the manual system where major problems are located.

1.5.2 System Design

A preliminary design was done to lay out the requirements of all the components of the automation system and a detailed design to determine the software and hardware requirements for input, output, process, and storage systems.

1.5.3 Systems Development

Following the outcome of the previous stages, Microsoft Access was used to develop a database management application for the automation system. The database was further modified and customised with Microsoft Visual Basic programming language which converted the manual tracking process into an automated tracking system. Testing and debugging was finally conducted to assess and remove programming errors within the developed system.

1.6 Data Collection and Analysis

Data was gathered by observation, from interviews and available written documents such as annual reports, manuals and policy statements. The officials interviewed were: the hospital administrator, the head and two staff members of the Records Unit, four senior nurses, two doctors, and a person each from the pharmacy and accounts units.

The systems analysis modelling tools prescribed by Williams, Sawyer and Hutchinson (1999) were used to analyse the data collected. These analytical tools such as dataflow diagrams, systems flowchart, and connectivity diagrams were used to represent the analysed data in a pictorial format pending the outcome of the systems analysis.

1.7 Description of Chapters

Chapter one comprises introduction, statement of the problem, purpose of the study, objectives of the study, methodology, data analysis, and literature review.

Chapter two looks at background information about The Ridge hospital, structure of the Records Unit, flowchart of records circulation, problems with storage facilities, systems design and analysis, and the need for automation.

Chapter three looks at systems design and development of programs for automating the tracking system.

Chapter four covers the evaluation and review of the system

Chapter five documents findings, conclusion and recommendations.

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CHAPTER TWO

PRELIMINARY INVESTIGATION AND SYSTEMS ANALYSIS

2.0 Introduction

This chapter looks at the background information about the Ridge Hospital including statistical information about medical services that are provided annually. The structure of the Records Unit and records management practices, principles and policies were studied carefully.

The chapter sought to study in detail all the steps and procedures involved in the manual system of tracking records as part of the preliminary investigation stage of the systems analysis and design methodology, in order to reveal the problems that exist in the system. This was followed by the systems analysis stage, where a diagram was used to illustrate the record circulation paths and how patients records flow within the manual system. Finally, the chapter was concluded by considering the need for automating the manual system.

2.1 Background Information about Ridge Hospital

The Ridge Hospital, once known as the European Hospital is located in the centre of the commercial and administrative capital city Accra. The hospital was established around 1928. The geographical location of the hospital is within an area which was mainly European settlement during the colonial era in Ghana (Ridge Hospital Annual Report, 2002).

The Ridge Hospital operates as a regional hospital for the Greater Accra region, receives referral cases from poly clinics, private hospitals, quasi government institutions and health posts in the region and other regions. The mission of the hospital is "to provide universally accessible, efficient, quality and affordable specialist services to the people of the Greater Accra Region". To accomplish this

mission the hospital has adopted the five main objectives of the Ministry of Health and the Ghana Health Service (MOH-GHS) namely:

1. Increase access to health care
2. Improvement in quality of care
3. Improvement in efficiency
4. Foster collaboration with stakeholders
5. Equitable and efficient resource distribution (Ridge Hospital Annual Report, 2002).

With these objectives the hospital has put in place strategies to develop and improve the medical and non-medical units, sections or departments. The strategies include capacity development of units/departmental heads in that they can administer their duties more efficiently, generate effective systems of evaluating and reporting on hospital activities, ensure efficient and effective resource mobilisation, and motivate staff.

With clinical services the hospital seeks to strengthen its 24 hour emergency service, supply of drugs and to intensify in-service training in order to upgrade the capabilities and skills of staff.

Computerisation is one of the top priorities on the lists of facility development. The hospital is currently networking all its computer operations. The Records Unit which is receiving much attention from the computerisation programme is being networked with the pharmacy and the accounts units. This facility makes it more efficient for the pharmacy unit to serve drugs to only patients who have approved prescription from a staff physician. It is however within the scope of the hospital's future plans to have a local network which covers all the various units in order to share information resources, and to communicate effectively. This is being supported by the provision of a 24 hour power supply to computers and other information and communication technology appliances.

2.2 The Structure of the Hospital

The hospital is structured under three main divisions; Clinical, Clinical Support and Support Services. The clinical division is made up of Internal Medicine, Paediatrics, Obstetrics and Gynaecology, Surgery, Dental, and Accidents and Emergency. Pharmacy, Laboratory, X' Ray, Blood Bank, Physiotherapy and Public Health falls under the Clinical Support Division. The Support services are General Administration, Medical Statistics, Catering, Environmental Health, Medico-Social, Information Technology, Welfare, Transport, Estate, and Engineering and Maintenance.

Ridge Hospital has 36 Doctors including 9 specialist, 192 nurses, 197 paramedical staff and 48 other staff all totalling about 482. The Outpatients Department attendance is more than 50 thousand per annum. Between the year 2000 and 2002, outpatients attendance increased by 18.6 percent (Ridge Hospital First Quarter Report, 2003).

The Inpatients Care Unit is supported by 172 beds. The unit has a surgical ward, mobile ward, female ward, maternity ward, children's ward and Very Important Personalities (VIP) Ward. Statistics show that from the years 2000 to 2002 there was an average of 7136 admissions per year. Table 2.0 shows the details of admission from the year 2000 to 2002 (Ridge Hospital Annual Report, 2002).

Inpatient Analysis Year 2000-2002 *Table 2.0*

YEAR	2000	2001	2002
Admissions	5737	10451	5220
Discharge	5222	8820	5096
Number of Beds	173	180	169
Average admission per day	16	29	14
Average length of stay	8	9	10

Source: *(Ridge Hospital Annual Report, 2002)*

The given data (table 2.0) suggests the number of times medical records are searched for, retrieved and returned to shelf after treatment. It is therefore established that efficient medical services also depend on efficient medical records management. To every health institution medical records are as important as the treatment offered to patients. The increasing attendance and admission rates at the hospital demand effective and efficient records management activities in order to speed up medical services.

Apart from general outpatients services the hospital also has a dental clinic, an eye clinic, diabetic clinic, and an emergency recovery ward. All these sub clinics experience increasing attendance rate. The dental clinic for instance, recorded 20 percent increase on attendance from 2001 to 2002, while the eye clinic treated 8,887 cases in the year 2002. The outpatients department also carries out a *cervicare* project dubbed "Ghana Safe Demonstration Project", where screening for cervical cancer is done. This project is sponsored by a non governmental organisation (Ridge Hospital Annual Report, 2002).

All the various medical units receive a great deal of service from the Records Unit. It is within the hospital's policy framework that the personnel at the Records Unit who are the custodians of all medical records must be able to retrieve records before treatment procedure begins. This task is however becoming increasingly difficult due to the astronomical increase in attendance rate which paints a clear picture of the work load on the Records Unit staff. This situation is much severe in the early hours of each day particularly working days when hundreds of files must be retrieved for hundreds of patients seeking medical attention, before they can see a physician to make their complains.

2.3 The Records Unit

The Records Unit operates a 24 hour service. There are 16 workers at the unit running on shift. The unit has an active section and an archive section. The archive section keep records which have been declared redundant - that is records which have been inactive for more than five years.

The active section is located within the main outpatients department block. It covers an area of about 28 cubic metres with 12 feet ceiling height. The section is partitioned into three rooms. The first room is known as the server room where all patients must first visit for their hospital cards retrieval process to begin. New identification and hospital cards are created for first time patients. All other requests on medical records and complains are received in the server room for necessary actions to be taken. This room is equipped with information and communication resources that run the pilot computerisation program on medical records. One of the other two rooms is used as an office for records staff and as a stack area purposely for inpatients records. The third room is however, fully used for keeping outpatients and a few inpatients records.

The stack room where outpatient records are kept currently holds about 180,000 cards. About hundred and thirty cards are generated daily. Cards are arranged serially and laterally on shelf. Files are often found arranged on the bear floor or on desks due to insufficient shelving capacity. This situation makes the stack room somehow congested. Folder Movement Books, Admissions and Discharge Books, and Daily Ward State Books are arranged on the floor and on writing desks because they have no place on shelves.

Besides managing records, the Records Unit also keeps records and reports on admissions and discharge cases. The Admissions and Discharge note book is used to report daily admissions and discharge cases whiles the Daily Ward State book is for recording patients on admission, total admitted, number of empty beds, patients

transferred from one ward to another and bio data of admitted and discharged patients.

The unit generates reports on the number of admissions and discharge cases, deaths, and so on, quarterly and annually. This information is very useful to the hospital administration to aid their strategic planning for the hospital.

The unit is also responsible for the archives section. Records within the archives are patients cards which have remained inactive for 5 years. The records within the archives are in boxes and there is a special list that is used as a finding aid for the records.

2.3.0 Computerisation Program

The computerisation program at the unit handles creation of new hospital identification numbers for patients, creates soft copy of patients bio data, and other information such as occupation, address, region of birth, etc. Hospital identification numbers are generated uniquely by the computer program. The program is basically an integrated database management system. It has the capabilities of generating reports by simple instructions and can also run basic *query* functions such as finding out daily outpatients attendance, number of new identification cards generated, and so on.

Such query functions are resourceful for tracking outpatients records. Though the program is not designed specifically to track movement of medical records, some of the query functions can be used to aid tracking of records. For example, the daily attendance report can also be used to determine the number of cards that were retrieved.

2.3.1 General Records Management

Most of the records management activities take place at the active section which is located within the outpatients department. The archives section is only used when a

patient whose record has been inactive for more than five years revisits the hospital. In such situation the record is sent to the active section after use and remains active again.

All outpatient information is written on a card. The card is measured 10.5cm by 15cm which is about the size of an A5 paper and a soft copy of bio data information is kept in a computer system. When the writing space for physicians is exhausted a new card is attached to the old one.

Inpatients cards are kept in folders. When a patient is discharged and his or her folder is returned to the Records Unit, the card is taken out of the folder and kept among the outpatients cards, and the folder is kept among the inpatient folders. If a patient is detained again on his next visit his folder is then retrieved and his card is kept in it again until discharged.

2.3.2 Circulation of Records

The server room is the first point of contact for any medical records request. Apart from emergency cases every patient must first visit the server room to make a request for their hospital card. Patients make their request by first submitting their hospital identification card. A first time patient would however get the hospital identification card created for him or her.

In case of an emergency, as soon as patients are rushed into the emergency ward they are given numbers which are sent to the Records Unit for provisional identification cards and records to be created for them. Afterwards, when all the necessary bio data and other information about patients have been collected, all information on temporary cards is transferred into appropriate hospital records.

The requests made by outpatients are sent to the stack area for extraction of records which are sent to nurses at the outpatients department. These nurses then schedule

consultation arrangement for the incoming patients to see a physician. After consultation all the records are sent back to the Records Unit for shelving.

2.3.3 Inpatients Record

When a doctor asks for the detention of an outpatient in order to continue intensive medication, the patient is declared an inpatient. The patient is then sent to a ward with his records. Ward nurses then send a request to the Records Unit for an inpatient records folder. If the patient has not been admitted before, a new folder is created for the patient's medical records.

The inpatients folders are kept by nurses at the wards till patients are discharged. They are then returned to the Records Unit for shelving. It is a policy for nurses to return inpatients folders within one week after their discharge, however in many cases folders stay at least two weeks in the wards after patients are discharged.

Whiles the folder is in the ward where the inpatient is receiving treatment it may be requested for by other legitimate users. All these requests first go to the Records Unit for tracing. To trace an inpatient record in transit the folder movement book is used.

2.3.4 The Folder Movement Book

The folder movement book is used instead of a tracer card. A tracer card simply replaces a folder when it is removed from the shelf. Therefore, when a folder is not on shelf the tracer card is checked to determine whether the folder has been loaned. The tracer card also contains details of the loan agreement in order to trace the movements of folders.

The folder movement book functions the same as the tracer card. The book has a *column* for the name of the borrower, purpose for borrowing, patients number, date of loaning, date returned, ward or destination of the folder, and so on. All these information aid the records staff to be able to track records when needed.

A version of the Folder Movement Book is kept by nurses at the wards to enable them keep records on movements of folders which are in their custody. This folder movement book is very useful in tracking records. It is the principal mechanism for locating a file not on shelf. It is only used for inpatients folders. Despite the usefulness of the folder movement book, it is sometimes cumbersome to use. This is because to locate for example, a folder that was last used for instance, weeks or months ago it means that one must spend time going through many rows and pages in a the folder movement book or books.

To design an automated tracking system simply means automating the folder movement book. The folder movement book must be studied critically to be restructured into an automated system. This can also be considered alongside the other recording books, such as the daily ward state note book, and the admissions and discharge notebook because they are also used as finding aids to track records. For example, it is always possible that if by mistake a staff at the Records Unit did not record in their folder movement book that a folder has been requested for by a legitimate user, the admissions and discharge note book can be used to determine the date of admission or date of discharge of the patients who bears the folder in question.

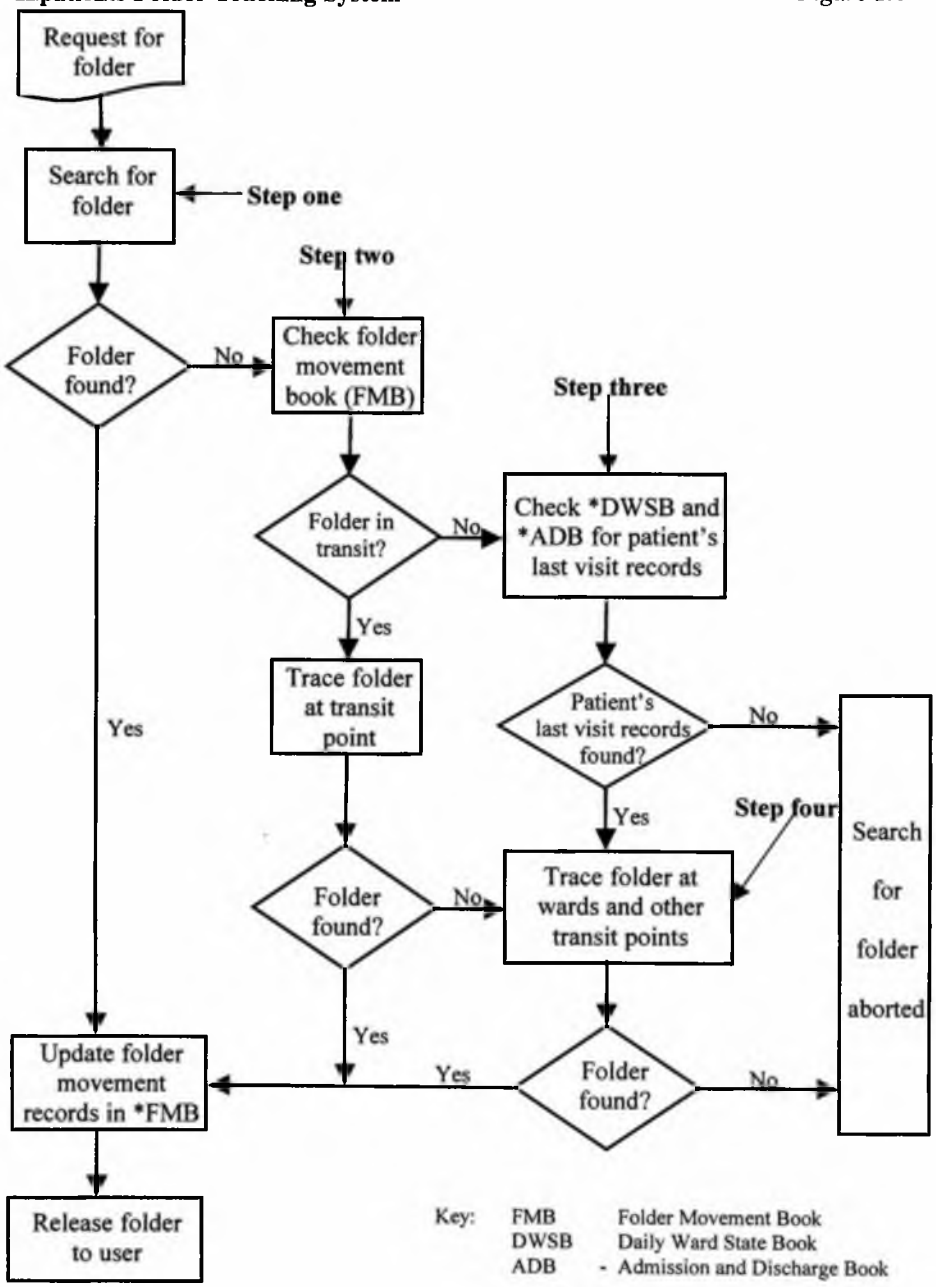
This will further, lead to a cross check in the daily ward state book to determine the ward where the patient was admitted. As the investigation proceeds, nurses on duty during the period may also be questioned leading to possible clue about the transit point of the folder.

All these processes are useful to the automation process which would mean; integration of all the mechanism involved in using the folder movement book, admissions and discharge book and the daily ward state book.

2.4 Manual Tracking of Records

Figure 2.0 is a graphical representation of how folders are tracked by the use of the folder movement book.

Inpatients Folder Tracking System *Figure 2.0*



Step One

At step one attempt is made to search the shelf for the folder requested for by a user, with the assumption that the folder has been returned to the Records Unit by the last user. If the folder is found all requests proceedings are recorded in the folder movement book. The folder is then submitted to the user.

Step Two

The folder movement book is consulted to trace folders transit point. At this point it may be helpful to find the last time the patient was admitted. Such information may be gotten from the patient or other sources, such as the admissions and discharge note books. When folder requests information is found in the folder movement book it is then traced to the transit point, if not, tracking then continues by following investigation proceedings at step three.

If the folder is found at the transit point request information is updated in the folder movement book before submitting to user else step four is followed.

Step Three

All the recording books are checked to retrieve patient's last visit information such as ward of admission, date discharged, whether patient was transferred from one ward to another, and all other folder movement books are consulted. After the success of this exercise the folder is traced to all possible transit points (step four). Request proceedings are then updated in the folder movement book if the folder is found, else the folder search is aborted with the assumption that it is missing.

This step requires a lot of intelligence and detective work to track the folder. The staff believes strongly that a missing folder may be lying on a doctor's desk in his office, under certain files in a ward and so on. However, a successful search depends on accurate information about patients last visit.

Step Four

Step four is the real physical search for folders at all possible transitional point. This include ward of admission, transferred ward, accounts and pharmacy units, consulting rooms and sometimes offices of doctors. This step also depends on accurate information about patient last visit to speed up the search process.

2.5 Problems within the System

The problems within the manual records tracking system to a large extent cannot be entirely solved by introduction of an automated system. The folder movement book which is the principal aid for tracking the movement of records is very resourceful, and can be reliable if all the policies on folder requests are followed. This is because many complicated cases during tracking of folders are due to the fact that the appropriate *modus operandi* for folder request, or transfer from one user to another were not followed.

In situations were requests for folders are for emergency cases staff may postpone the requests recording proceedings in a folder movement book. However, if the folder requests records are not updated later, such a folder may be on a transitional path which will be difficult to track in future.

The major factors involved in tracking folders are;

a) the time taken to retrieve folder
b) available tracking aids
c) effectiveness and efficiency of tracking aids

Within any tracking system these among other factors give problems to the manual system. The time taken to track records at the Ridge hospital in many cases depends on how long the records have been inactive. Tracking a folder that has been used a month ago takes a shorter time to find than say, a folder which was last active six

months ago. This is due to the structure of the folder movement book which depends on time to go through pages and many rows and columns.

The main problem with the folder movement book is the time spent to go through in search for information about a folder which is not on shelf. Even the different styles of handwriting can slow down searching for folder request information.

The structure of how requests for folders are recorded in the folder movement book does not seem to be of much problem. However, though it takes about a minute to record a folder request it takes about five to ten minutes to search for request information about a folder which has remained inactive for about a month. It can therefore be said that efficiency in the use of folder movement book is affected by the time taken to search for folder requests information. This situation is worsened when there is no information about folder request and yet does not exist on shelf.

In such a situation the other finding aids, Daily Ward State Book and Admissions and Discharge Book are used. These can only provide information about a patient's last visit to the hospital, the ward in which the patient received treatment and other relevant information which can aid tracking investigation.

Another prevalent problem with the manual system is that there is no appropriate mechanism to determine which folders are in transit or on shelf. It is only when an attempt to retrieve a folder on shelf fails does the folder movement book is consulted for information about the folder's transit point. This has resulted to a situation where one cannot know by any means whether a folder is present on shelf or not till it is requested for by a user. This is because there are no tracer cards which can be used to check for folders in transit and that on shelf.

In summary it was observed that the main problems within the manual systems can be enlisted as;

- The time taken to search for folder information is formidable

- Because the Records Unit does not use tracer cards there is no mechanism to determine which folders are in transit and that on shelf.
- Records staff and nurses failure to record appropriately folder requests information proceedings contribute to much of the difficulties in tracking folders.

2.6 The Need for Automation

Automation cannot on a full hundred percent scale solve the problem within the manual system. An effective and efficient manual system may not need any automation. However the following reasons can be considered for an automated tracking system.

- An automated tracking system can significantly reduce the time spent to retrieve information about folder movements compared to the folder movement book and other finding aids.
- All the information needed to track records in steps one, two, three and four in figure 2.0 on page 19 can be displayed at ones on a computer screen or printed on paper by a well designed database management program.
- An automated system can also be used to generate reports about folder movement and can be queried to retrieve specific information about folders.

Taking into consideration figure 2.0, one would observe that considerable minutes are spent to just retrieve folder request information before physical search for the folder begins. Therefore, if automatic machines cannot be designed to search for folders physically, a database management program can be designed to reduce the time spent to search for folder request information from the folder movement book or the other finding aids.

Tracking records takes two segments. In the first segment, search for information about the needed folder is conducted. The second segment is the physical search for folder at a ward or other possible transit points. The time spent at the first segment

is equal to or more than the time spent at the second segment. The need for automation is to speed up the search for folder request information which in actual sense reduces the time spent to track records.

One burden of the Records Unit is generating of reports on admissions and discharge cases, and preparing daily ward state report which is done daily, quarterly and then annually. Report generation can be part of the automated tracking system. This is possible because the sources of information for tracking and reports generation are linked with folder request information.

To automate the Records Unit at the Ridge hospital means developing a database system which is an integration of all records management practices at the Records Unit. This database must be expandable with the incorporation of the folder movement book, the daily ward state book, admissions and discharge note books and all other recording books at the unit. This is because when tracking records an average of three recording books are consulted as finding aids.

Finally, there is a need to create a database management system that can manage all recordings at the unit, by integrating the various recording note books into one database management system as a requirement for an automated tracking system. Such database management system will be very efficient and cost effective in information retrieval for tracking folder movement, report generation and other records management activities at the Records Unit.

2.6 References

1. Ridge Hospital Annual Report, 2002
2. Ridge Hospital First Quarter Report, 2003

CHAPTER THREE

SYSTEM DESIGN AND DEVELOPMENT

3.0 Introduction

The system design stage in a development life cycle begins with a logical design followed by physical design specification to establish major systems requirements; namely, input requirement, output requirement, storage requirement, processing requirement, and maintenance requirement.

In this chapter, preliminary design that reflects the procedure in the manual tracking system was developed. This was followed by a detailed design to determine system requirements for the automation system.

Microsoft Access database version 2002 was used at the logical design stage to create a database meant to function as the folder movement book, the daily ward state book and the admissions and discharge book. Diagrams such as connectivity tools and systems flowchart are given to reflect the functional requirements of the input, output, and processing. Finally, the detailed design was customised and refined with visual basic programming language.

3.1 Database Management System

Laudon and Laudon (2002) defined a database management system as "the software that permits organisations to centralise data, manage them efficiently, and provide access to the stored data by application programs". A database management system has the capacity to allow managing and sharing of information very much easier, and make information retrieval faster and efficient.

Data redundancy can be reduced efficiently by database management software. For example, *fields* are not repeated in different *files* within the same database. In the

case of the Records Unit at the Ridge Hospital, files would be considered as the folder movement book and the other recording books. To speed up records management activities requires a database management program as a component of information management.

The Records Unit at the Ridge Hospital is no exception from institutions that need a database management program to improve their records and database management activities. The number of tasks associated with records management at the Records Unit, can be integrated into a unique database management program to reduce repeated task. The use of the folder movement book, daily ward state report book and other recording books is associated with repeated tasks. A typical example is a "patient date of admission". This field is a given column in all the recording books. A database program will be efficient by reducing all the repeated operations to just a single task by linking field records to many tables within the database.

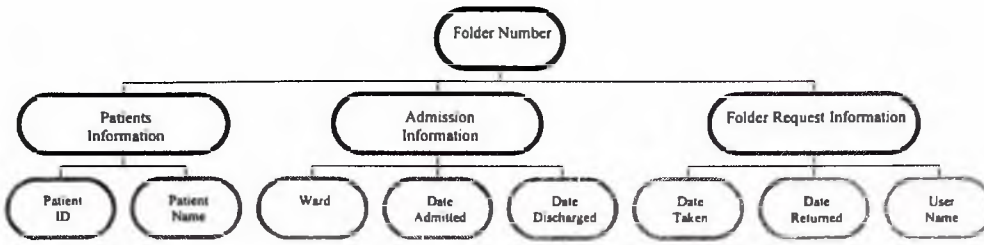
3.2 Models of Database

Every database management system has a structure or a logical principle for organising and representing data. Laudon and Laudon (2000), William, Sawyer and Hutchinson (1999) categorised the structure of database as models, namely, Hierarchical, Network, and Relational data models.

3.2.0 Hierarchical Model

In this structure, data is represented from the root, which is a top level segment to a lower level segment. The hierarchical model resembles parent – child relationship. Parents can have many children but, a child, just one parent. Figure 3.0 on page 28 illustrates how a folder will be traced if hierarchical model of arrangement was used for the automated system.

Example of Hierarchical Database Model *figure 3.0*

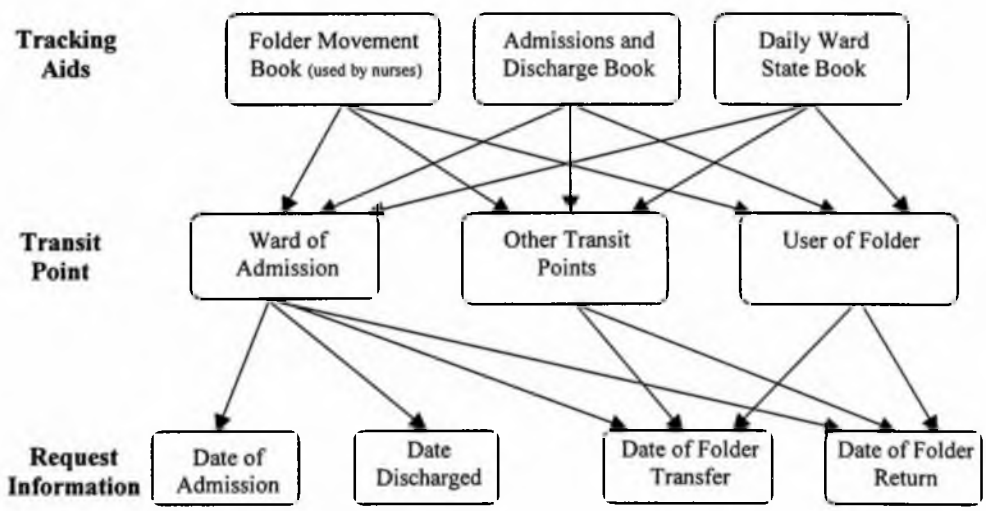


3.2.1 Network Model

Laudon and Laudon (1999) described the network model as "variation of hierarchical data model". A database can be converted from network into hierarchical and vice versa. Unlike the hierarchical model which is a one-to-many arrangement the network functions as many-to-many arrangement.

The network model follows the method used to track records which has no request information about a folder in the folder movement book but has patients last visit information in the daily ward state report. In searching for such a folder all possible transitional points are checked. Figure 3.1 represents how tracking could be conducted if the system is based on the network database model.

Example of Network Database Model *Figure 3.1*



It shows the relationship that may exists between transit points and finding aids. For example, information about a patient's ward of admission can be traced to all the three finding aids, and the date a folder was transferred from shelf to a user, or from one user to another, can be traced at all the transit points. These examples depict the many-to-many relationship of the network data model.

The network data model permits retrieval of specific information in a database from different sections within the database system but follows a sequential order of arrangement. Accessing records from a database system which follows the hierarchical data model is rigid. The rigidity is due to the fact that a restricted path must be followed, starting from the root (upper segment), to the branches (lower segment). This depicts the parent-to-child relationship.

3.2.2 Relational Model

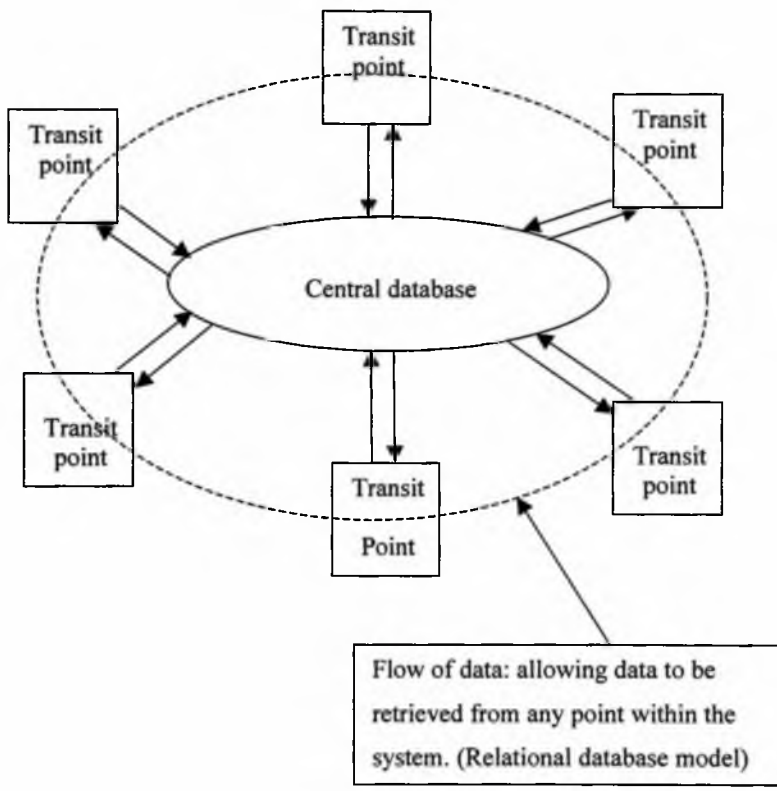
The relational data model is a very flexible system. Modern database management software such as Microsoft Access has relational database model capabilities. This model is the integration of the other two models. *Tables* from different database can be connected into one database. It does not restrict itself to paths as hierarchical and network models do. Certain relational database management programs have been developed into what is known as Object Oriented Database which can allow graphical images, videos, sound and other multimedia functions to be used within its interface.

In order to make the automated tracking system efficient, the logical principle for data representation, arrangement and tracking is based on the relational database model. The flexibility of the relational model permits search for information through *columns* and *rows* which contain related records. This feature which is incorporated within the automated system makes it undemanding for report generation since specific records can be retrieved from different tables and columns within the same database system.

It is this flexibility that Laudon and Laudon (2000), described as "power to combine information from different sources, simplicity of design and maintenance, and the ability to add new data and records without disturbing existing programs and applications". Figure 3.2 illustrates how all the transit points are linked to the central database where all folder records are kept. This is to ensure uniformity of folder information and prevent duplicate records.

Relational Database Model of the Automated System *Figure 3.2*

(Illustration of a relational database model using the case of Ridge Hospital as an example)



This structure allows automatic update of folder request records within the system. With such a system installed, tracking of records will not be the only function of the

automated system, but a speedy generation of reports which also form part of records management activities at the Records Unit.

Microsoft Access with its *structured query language* (SQL) which has relational data model features was used to develop the first phase of the data base for the automation. With the structured query language support, updating records, adding records and deleting records can be performed by simple task, and it does not require a user much knowledge and skills to be able to manage the database.

3.3 Structured Query Language (SQL)

SQL is used to specify how a system should combine and select data from a table or tables within a database. Burrow and Langford (2000) defined structured query language as "the standard for manipulating database management system". With SQL incorporated into the automation program, report generation and retrieval of specific information such as folder request for tracking of records can be done more efficiently.

Another relevance of SQL incorporation into a database management system is that it reduces redundancy in the retrieval of specific information, and can also be used to retrieve data from several database files from many programs that have compatibility with each other.

3.4 System Requirements

The system design stage requires that all the various requirements for a new system: input requirements, output requirements, storage requirements and maintenance requirements must be determined after a logical design. William, Sawyer and Hutchinson (2000), recommended that functional capabilities of the system should be described at this section.

3.4.0 Input Requirements

Input requirements for the system considered compatibility with computer systems used at the hospital. The ongoing computerisation program at the Records Unit is built on Windows NT technology, and complies with SQL *server*. To save cost in acquiring a new server technology, the automation system and the network server, are within compliance with the Microsoft Windows NT and SQL server technology.

3.4.0.0 Input Interface Requirements

The user interface considered the following;

- Users of the program
- Data entry method

The user interface uses terminologies that Records Unit staff and other legitimate users of medical records are familiar with to facilitate acquaintance with the system. It is likely that if captions of menu items, labels, *command buttons*, *message boxes*, etc. are written in a vocabulary that is different from their usual terminologies they may see the system as alien which will lead to a situation where it will not fulfil the purpose for which it was designed.

Workers at the Records Unit have at least skills in mouse usage which presupposes that graphical and menu driven interface was suitable. *List box*, *check box* and *option buttons* which are features of graphical driven interface facilitate speedy retrieval of records.

The type of data to be entered, are mainly names of patients, dates, patients identification numbers, etc. Other data such as wards, folder user names, etc. have been input in a list box for selection during data entry. For an automated tracking system, the user interface should be such that users do not spend much time to retrieve needed information. The user interface should be such that information is retrieved by just some few mouse clicks or menu item selections.

3.4.1 Output Requirements

The user interface design stage considered soft copy output. This is because hard copies may not be needed all the time. If a folder request information is needed a user may prefer to just view it on a computer screen. Output requirement depends on the use of the information retrieved from the system. Output such as report will demand a hard copy. A printer is therefore required to be part of the system.

Soft copy display should be possible for printing if a hard copy is required. This required that the system should have features to transfer retrieved information into other applications, for example, a word processor to aid suitable printing layout. William, Sawyer and Hutchinson (2002), recommended that irrespective of the output (soft or hard) a database should be designed with a format such that headings, columns, rows, menu etc., are clearly distinct in appearance.

3.4.2 Processing Requirements

Software and hardware for running an automation program basically determines the efficiency of a system in relation to retrieval and processing speed. Running a database with modern database management system requires high speed processing capacity, such as Pentium 4, large hard disk size including the use of Redundant Array of Independent Disk (RAID), and servers for efficient operations.

The Microsoft Corporation recommends the following specification as the minimum hardware requirements for the installation of Windows XP professional:

- 233 megahertz (MHz) Pentium or higher microprocessor (or equivalent)
- 128 megabytes (MB) recommended (64 MB of RAM minimum)
- 4 gigabytes (GB) of RAM maximum)
- 1.5 GB of free space on your hard disk
- VGA monitor
- Keyboard
- Mouse or compatible pointing device
- CD-ROM or DVD (http://www.microsoft.com/hcl/).

Though the Microsoft Office XP version of Access Database System and Visual Basic 6 codes were used for the development of the automation system, it is also possible to run the program on previous versions of the mentioned platforms. It could be made possible by straightforward conversion from current version to other previous versions. The decision to convert to older platforms will mean that management of the hospital is not yet ready to upgrade from the present Microsoft windows 98 and 2000 edition operation system software, and Microsoft office 2000 which is commonly used at the hospital.

Software requirements, however, can be fully optimised in Microsoft windows and office XP professional environment which support a lot of database management system. The software requirements lead to determining the hardware required for processing and storage.

Microsoft Office has complex software utilities that can aid a preferred report layout and other analytical tools such as graphs, chart, etc. The hardware requirements examined the processes involved with the tracking system, the storage requirement, and the total volume of operations within the system.

Aside memory size, storage capacity and central processing units speed, communication and networking facilities are also required for the system. Modems, network cards, port hub, and Ethernet cables which are basic accessories for a local network must not only be compatible with the software platform on which the operation system is built, but also require a capacity that can match up with features of the software designated for the system. Table 3.0 on page 35 shows the standard hardware and software requirements for the system.

Hardware and Software Requirements *Table 3.0*

HARDWARE/SOFTWARE	MINIMUM CAPACITY/SPEED/VERSION
Storage	10 Mega byte (Mb) for each computer
Memory(RAM)	64 per computer
Disk Operating System	Windows 98: Windows XP preferred
Microsoft Office	Office 97: Office XP preferred
Network card	Ethernet type
Network cables	Ethernet standard cabling
Port hub	24 channel
Processor	Pentium 400 Megahertz per PC
Keyboard	102 keyboard
Mouse	Ps2/serial Mouse
Monitor	15/17 inches

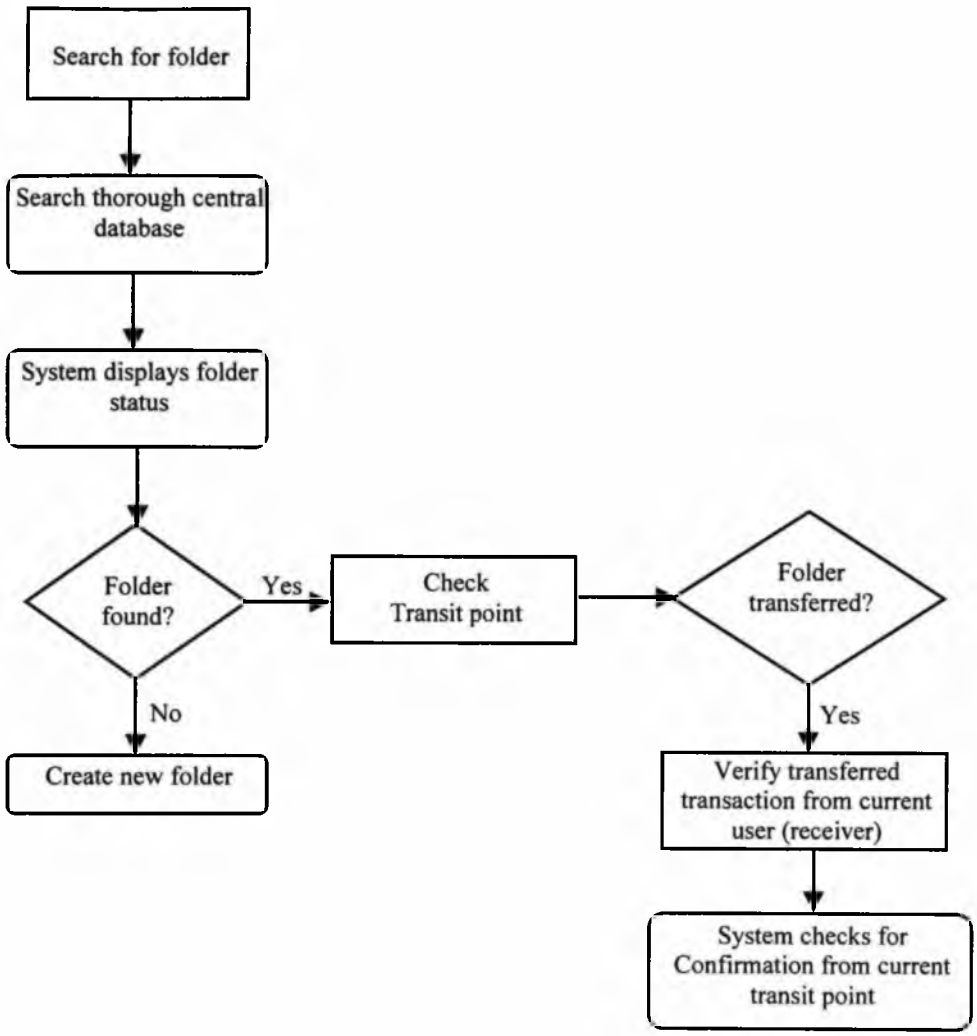
Source: Roger Jennings (1999). Special Edition Using Microsoft® Access 2000
http://www.microsoft.com/hcl/

The automation system requires that all the transit points for folders should be networked with information and communication facilities installed equitably at all transit points. This would enable a standard speed for the automation. The Records Unit must, however, be equipped with a server machine with a large storage device and high speed processing capacity. The server will serve as a backbone for efficient electronic storage purposes.

A minimum of 40 mega byte hard disk, Pentium 4 processor, and 256 random access memory size could be given as server properties. The transit points suggest a minimum of 24 channel port hub with all the computers having network and Ethernet adaptors and cables. All the computers at the transit points must run the same operation system and office suite program such as Microsoft office.

3.5 The Design Interface

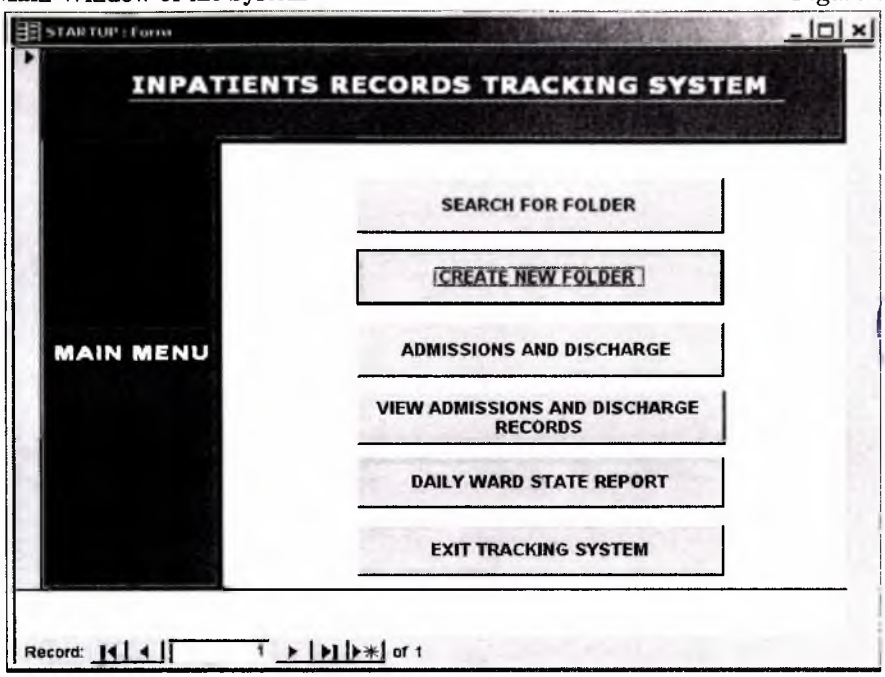
Folder Tracking Procedure *Figure 3.3*



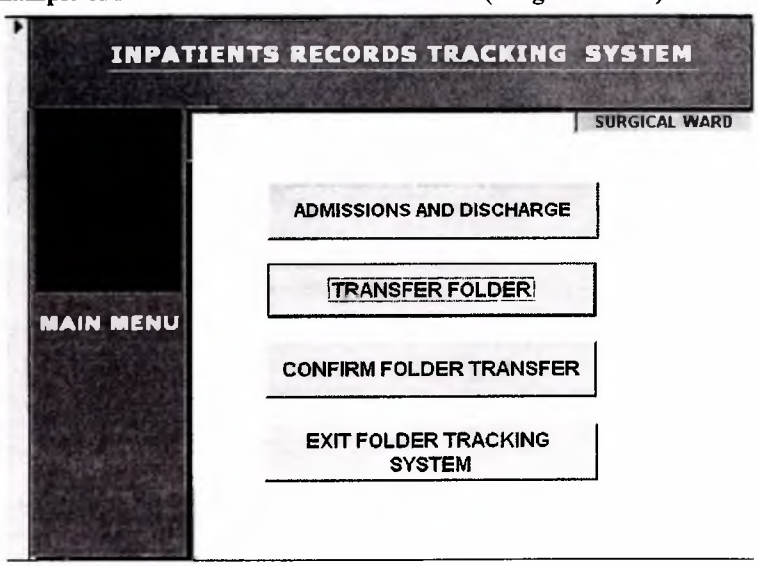
This diagram is an automated version of the manual dataflow diagram (figure 2.0 on page 19) which reflects how folders are tracked with the manual system. Base on figure 3.3, tracking a folder can be done from any transit point. If it appears that a folder is transferred from one user to another, the system can be commanded to display details about the transfer. This is done to find out whether the supposed current user has confirmed that a folder has been transferred to him.

Based on figure 3.3 on page 36, figures on pages 38 and 39 show an example of how the system tracks folders. Figures 3.4 and 3.5 are main windows of the system and transit points.

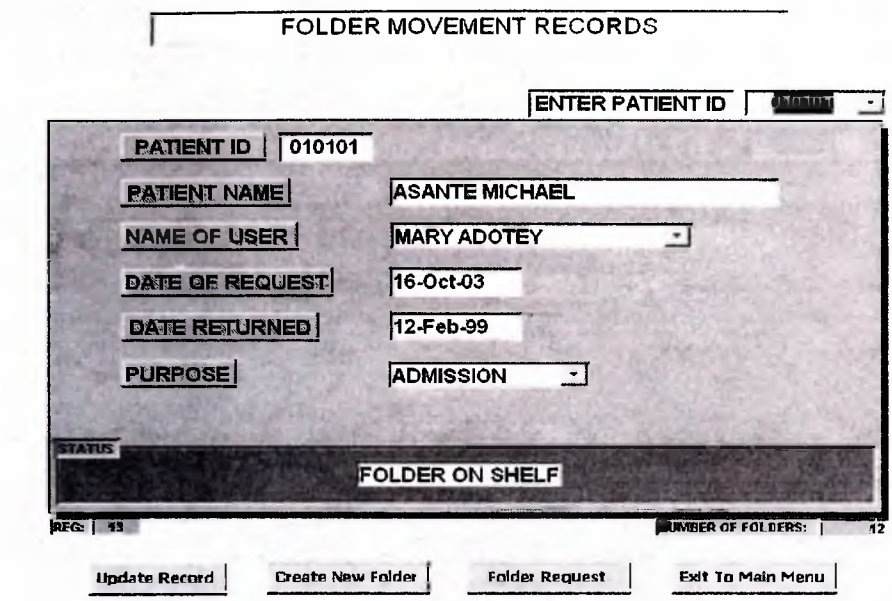
Main Window of the System *Figure 3.4*



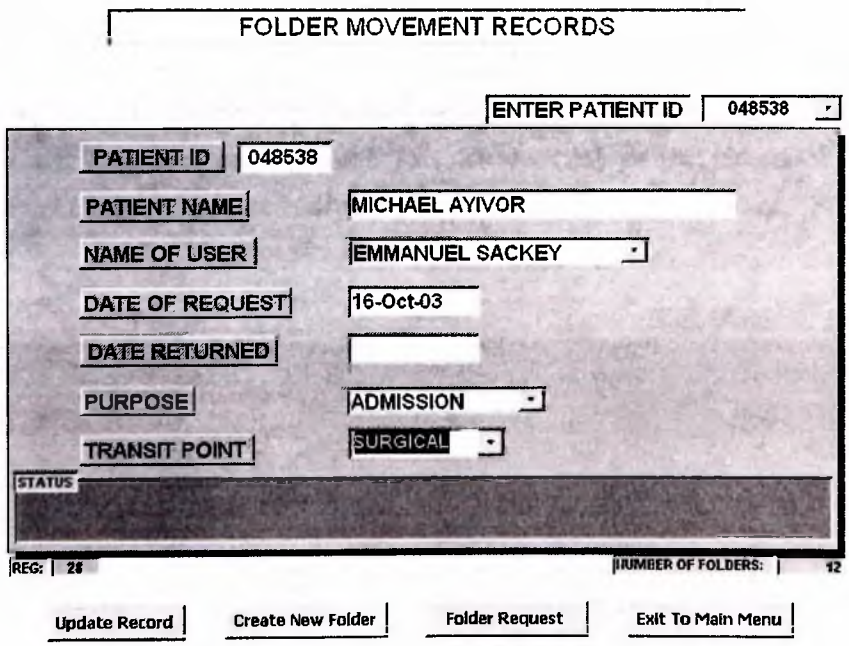
Example of Main Windows of Transit Points (Surgical Ward) *Figure 3.5*



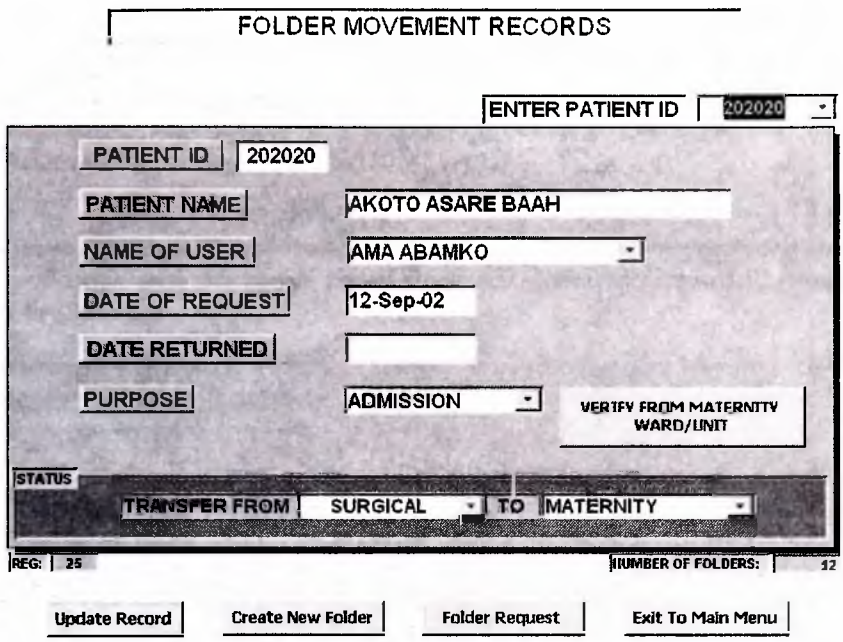
Display of folder request information during tracking: The folder status states that it is on shelf. *Figure 3.6*



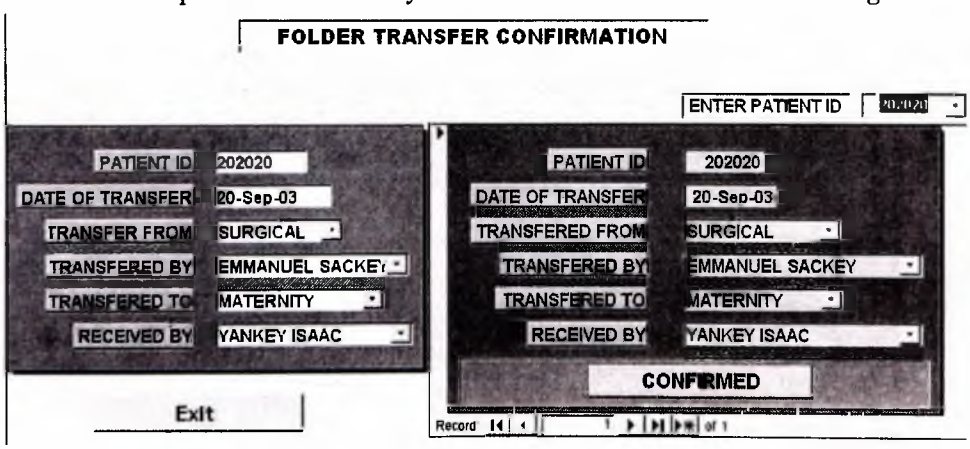
Display of folder request information showing transit point. *Figure 3.7*



The system shows that the folder being tracked has been transferred from the surgical to maternity ward. The transfer details can be verified by clicking "VERIFY FROM MATERNITY WARD/UNIT" command button.



The system displays transfer details after clicking "VERIFY FROM MATERNITY WARD/UNIT" command button. The transferred details have been confirmed by the user from the maternity ward. This, however, proves that indeed the folder's current transit point is the maternity ward. *Figure 3.9*



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3. Burrow, William E. and Joseph D. Langford (2000). *Programming Business Application with Microsoft Visual Basic 6.0.* Irwin McGraw-Hill, Boston, pp. 386–388

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CHATPER FOUR

EVALUATION OF THE SYSTEM

4.0 Introduction

This chapter reviews the proposed automated tracking system, taking into account the cost of developing, running and maintaining the system. The hardware and software requirements and the efficiency level of the system were reviewed. Further evaluation was conducted to forecast future challenges that may possibly confront the system.

The user interface, characteristics of the program and general functions of the system were carefully examined in order to ascertain the strength and weakness of the system. Other database related issues such as data integrity, security, networking, backup and maintenance were also evaluated.

4.1 Review of the Proposed Design

The program was basically designed in Microsoft Access from the Office XP Professional version based on the relational database model which permits several flexibility properties for retrieval of data. Bradley and millspaugh (1998) stated that "user interface should to clear and consistent". In line with this the program was highly designed with a graphical user interface (GUI) model. This makes it possible to retrieve or track data by few mouse clicks.

Basic functions such as deleting, adding records, updating records, and others including tracking records, printing, view report, etc. were customised into command buttons to reduce the burden of selecting from menus or typing *commands*. A significant property of the user interface is that all functions to be performed by a user are delegated to command buttons.

The introduction screen or the *main window* of the system displays command buttons of the main functions that the system performs (figure 3.4 on page 37). Such functions include tracking, retrieving, viewing and report generation.

Each *window* has a link to the main window and links to other windows. This makes is easier to move directly to other windows within the systems without going to the main window. For example, the "search for folder" window has a link to "folder request" window. This is because it is mostly imperative to records staff that searching for a folder means a request for it has been made.

The linking of window to window attribute of the tracking system follows similar proceedings within the manual system. The navigation therefore follows the flowchart (figure 2.0 on page19), which reflects the searching procedure in the manual system. Another feature of the program that makes data entry easier is the pull down lists or *combo* boxes for selection of items. Fields such as USER, PURPOSE, TRANSIT POINT, etc. have items listed in a combo for a user of the program to just click a *pull down button* to select name of user, transit point, and so on, order than typing which may be slower. This function also reduces typing errors and ensures consistency in the fields which have such property.

Another advantage of the combo box is that it prevents the user from entering data which is not acceptable. For example, all ward names and transit point are given within the TRANSIT POINT field. Therefore, no user can enter any other data for transit points apart from what is given in the combo box.

This does not however mean that for instance, if a new user is introduced to the system his name cannot be added. The combo boxes are expandable. New items can be added or removed from a combo box. This function is limited to the systems administrator who can use a special window within the system to add or delete items to and from combo or list boxes.

4.2 Software and Hardware

In selecting a software and hardware for the system the author seriously considered not only the application he has adequate proficiency to develop an automation system for tracking records, but, most importantly a software environment which is most common to the users at the hospital.

Early interactions and observation period of the this study revealed that all computers at the hospital are basically running Microsoft windows and Microsoft Office using, Microsoft word for all word processing tasks such as reports, letters, memos, etc. They use Microsoft Excel for accounting and spreadsheet functions, including graphs, charts and statistical functions. Microsoft PowerPoint is the only software known to the hospital for presentations and demonstration on computers. This software is resourceful at seminars and training sections for the hospital.

Based on the fact that users are already familiar with the Microsoft environment and have gained knowledge in the basics of the Microsoft Windows operating system and its graphical characteristics, the author recognised the significance in designing a system in this environment.

The advantages are that it will stimulate users affinity to adapt the system within a short period. On the other hand, it may not be the best information and communication technology platform for development of an automated system. The author for this reason admits that all the weaknesses, limitations, and challenges of the Microsoft systems as well as its essential advantageous properties will be characterised by the automation system.

Another benefit of choosing the software can be discerned taking into account the cost involved in acquisition of new software. The author measured major issues that are inseparable from new software and systems acquisition. They include training of users, supportive hardware, expertise, and the fiscal implications of the whole system. Already, management of the hospital are facing financial challenges in

information and communication technology resource acquisition for basic needs. It will therefore be and extra burden to acquire new technologies though it may be relevant and resourceful.

The author sees the need for an automated system to improve efficiency in tracking records. The records unit and users of the records also expressed the need for an automated system irrespective of the financial challenges. It is reasonable and a challenge to an information technology professional, systems analyst, or records administrator to design a system by the exploitation of available resources, both hardware and software impeccably at the least cost. With this knowledge, the author, resolved to design the automation system with Microsoft Access database management system and visual basic 6 codes which can be installed on the already available Microsoft applications in the hospital.

There are other platforms which can be used to develop an automation system more efficiently. An example of such system is oracle database system. However, it means that a lynus server or lynus machines must be used to run the program.

The program demands training users to:

- Understand the navigation and linking of windows within the system
- New terminologies in the system
- Error messages
- How to perform tracking operations and report generation

This training does not involve any strenuous learning and can be conducted within hours. In future old users can also train new users to understand the system. A user is not required to have any knowledge in Microsoft Access or any data base management system. Nevertheless, a fair knowledge in windows graphical environment will be a plus.

The systems administrator will have to undergo comprehensive training to understand the framework of the system. A fair knowledge in Microsoft Access would be a plus. Apart from that any person who has certain amount of knowledge in Microsoft windows and office environment can be trained as systems administrator. The function of the administrator would include:

- Adding new users
- Adding, deleting and updating records items in list or combo boxes
- Changing passwords
- Deleting or adding records
- General maintenance of the system

4.3 Data Integrity

One of the most crucial challenges of every electronic database management system is about whether and electronic data in reality represents what it stands for. The integrity of a database system can be measured by:

- The impossibility of data alteration by unauthorised users
- Validation rules that govern data entry

It is very important that any information retrieved from the system represents precisely what it stands for. Name of patients, patient identification number, and information about a folder's transit point must not be different from what is retrieved from the system. It is not impossible for a database to recall wrong information about an item within its records. Another possible misinformation could be that two patients may bear the same identification number in the database, or the system may indicate that a patient's ward of admission is for instance, the mobile ward, but in reality it is the surgical ward. If these and many other possible examples are common in a database management system, then data integrity of the system is at stake.

Data integrity is affected by many issues including:

- Wrong coding
- Entering wrong data by users
- Common syntax error
- Bugs
- Insufficient error checks

To ensure data integrity, peculiar measures must be taken during the design stage of system. A program must be tested thoroughly in search for errors and bugs. Mitchell and Atkinson (2003) observed that "the more code you write, the more bugs you will create, and the larger your application, the more bug-ridden it will be". They recommended that the time spent in programming should be equal to; if not more than, the time spent to ensure that a program is free of bugs and errors in order to achieve high data integrity.

Certain measures have been put in place to ensure that information within the automated system represents what it stands for. To obtain this, error checks have been encoded into the system to ensure the following:

- Patients identification numbers are not duplicated
- Correct dates are entered
- A transferred folder can be verified from the user who received the folder
- A user cannot edit a transferred form from another user
- A user does not mistakenly confirm that he has received a folder
- The central database cannot be edited by any user apart the systems administrator.
- Unauthorised users cannot have access to the system

All these steps have been put in place to reduce errors and to achieve high data integrity. To ensure this, two main checking systems were employed into the program. These are Validation Rule and Security systems.

4.3.0 Validation Rule

The validation rule is a mechanism to ensure that only appropriate data is entered. Jennings (2003) stated that validation rules govern the format by which data is entered and prevents invalid data entry. For example, the system has a validation rule that prevents a user from entering say, the date a folder was returned not earlier than the date the folder was taken. It also regulates date format to "day", "Month", and "year" sequence.

Validation rule goes with what is known as validation text. The validation text is a warning message that appears on a screen when the validation rule is violated. For example the system may display a message box that reads "Invalid date format, enter correct date". Data can never be accepted by the system if it does not comply with validation rule. There is another validation rule within the system that prevents more that one person to bear the same patients identification number.

4.3.1 Security System

The system ensures that unauthorised users do not have access to the system. This is ensured by the use of passwords, and assigning *read only* property to files that should not be edited by any user except the system administrator. Apart from passwords the system has been designed in a manner that makes it impossible for a user to have access to co-users transfer form. A transfer form is filled when a user receives a folder transferred to him from any transit point. To certify that indeed a user has received a folder from another user, a transfer form from the receiver's transit point is checked to seek for confirmation from him through the system.

The important issue about transfer form is that it serves as prove of folder transfer transaction, for both the unit that transferred the folder and the unit that received it. This is put in place to avoid a situation where a user claims he has transferred a folder, but the supposed recipient does not accept responsibility to that effect.

Another security system is the user *access permission* facility. All users have permission to view only patients' folders information and current state of folders. The permission is also extended to viewing admissions and discharge records. Any user can therefore have a read only access to all patients folder records. Access is however denied to users to perform the following functions:

- Delete records
- Modify another users transfer form
- Change system settings
- Modify system design
- Add records

In conclusion the system can be said to function exactly as the manual system but with high speed and several flexibility which makes it more efficient. Within the manual system, report generation is a separate exercise. The fragmented finding aids such as folder movement book, daily ward state book, admissions and discharge book are integrated into a central database system which makes the automation system quiet dynamic and multi-purpose.

One important feature is that the system is easily expandable and can go through redesign and modification without troubling the database. However, the author admits that the system will face all the challenges that confront the Microsoft application systems including errors that are not yet debugged.

4.4 References

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CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.0 Conclusion

The methodology employed in designing this automated tracking system has led to several discoveries within the manual tracking system and records management practices as a whole at the Ridge Hospital. The most remarkable finding is the use of the folder movement book which is the prime mechanism for tracking folders in place of tracer cards. In fact, it is based on this folder movement book that the logical framework was derived to develop the automated tracking system.

An automated tracking system is one of the swift mechanisms to enhance electronic database management systems. The designed automated tracking system basically aims at finding solutions to part of the problems that confront the manual system, especially the use of folder movement book to track records. However, the system exceeds the primary function of tracking folders, but can be used to generate daily ward state, and admissions and discharge reports. The system can also be queried to generate daily, monthly, quarterly or annual reports.

The systems analysis and design methodology was employed to develop the automated tracking system. Following the procedure of the methodology, preliminary investigation commenced by finding some information about the Ridge Hospital and specifically the records unit. The structure of the hospital and the Records Units were carefully studied. This led to finding some useful statistics about operations of the hospital and the effects of the increasing patients attendance rate on records management.

The manual tracking system was analysed based on the systems analysis theory. The folder movement book was however discovered as the prime mechanism for tracking folders. Detailed analysis of the folder movement book was conducted to

reveal problems that exist within the manual system. A dataflow diagram was drawn to reflect how tracking of folders is done manually.

From the systems analysis, problems within the manual tracking system were identified. It was observed that the automated tracking system may face similar problems that challenge the manual system if folder request policies are not followed. The need for automating the manual tracking system was, however, justified after the systems analysis stage.

The systems design and development stage of the methodology followed the results of the systems analysis to design and develop an automated system. A logical design was done in Microsoft Access. The logical design paid attention to different data models or structures and considered the relational model as suitable for the system due to its flexible characteristics. During the logical design, other records management functions apart from tracking folders were also incorporated into the system. These functions are, management of patients admissions and discharge records and creation of daily ward state report.

All the systems requirements: input requirements, output requirements, processing and storage requirements were determined. The system requirements analysed prospective users of the system and information and communication technology infrastructure at the Ridge Hospital. These aided the design of a suitable user interface. The system was therefore designed to be compatible with software and hardware already used at the hospital.

To complete a detailed design, steps were taken to make the system efficient. This included validation rules, security systems, debugging and testing of the system to ensure data integrity. The design was finally modified and customised with Microsoft Visual Basic codes into an automated system.

Though the automated system does not necessarily combats all the problems within the manual tracking system, its advantages outweigh that of the manual system especially in the case of the Records Unit at the Ridge hospital. If the need for speed is imperative to a tracking system, then, there is no doubt that the proposed automated tracking system should be operational as a component of electronic medical records management system.

In conclusion, the author seeks to develop the system to cover both outpatients and inpatients records. If this automated tracking system is put to effective use the future challenges of the system will reveal strategies to improve the system in order to gain high efficiency level and enough flexibility. This will therefore enable the system to be expandable to finally cover all medical records management activities at the Ridge Hospital.

5.1 Recommendations

The most important issue of medical records management to the author is not the fact that there is a tracking system that is very efficient or inefficient; but, simply the concern about human lives which are at stake. If legitimate folder users do not understand, or are ignorant of the importance of patients folders to health delivery systems, no matter how intelligent a tracking system is designed, it will not be successful.

To make this proposed automated tracking system work efficiently the author has the following recommendations to make:

1. Considering the importance of folders to health administration, all legitimate users of folders must be well informed about the significance of patients medical records. If the users have such valuable knowledge it will definitely affect their approach to handling of folders, and therefore, comply with all the regulations that go with the use of the automated tracking system. This knowledge can be acquired through organised seminars and workshops.

2. Considering the platform on which the automated system was designed, it is important that whoever takes the duty as systems administrator should have sufficient knowledge of the Microsoft windows and Office environment. He should also be familiar with database management systems and have fair understanding of Microsoft Access database system.

3. All prospective users of the automated system should also be trained to understand how the system works and how to handle error messages. Users must also make sure that they fill transfer forms whenever they transfer or receive folders. By doing so the automated tracking system will always reflect the exact transit points of folders.

4. It is also recommended that there should be available support systems to ensure constant operation of the system. Such support systems include, power supply backup systems and storage backup facilities.

5. All the computers at each transit point must run the same disk operating system and the same version of Microsoft Office applications to avoid any irregularities in the network.

6. In order to ensure compliance with all the hardware facilities, the hospital should engage the services of an information and communication technology expert to acquire network and communication facilities.

7. Finally, the author recommends that the system should be implemented alongside the manual system till users gain enough understanding of the automated system before full implementation of the system commences.

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GLOSSARY

Access permission	A set of attributes that specify what kind of access a user has to data or objects in a database.
Check Box	A check box permits a user to select or deselect options
Code	A statement in a programming language
Column	A vertical section of a grid in a table of a database
Combo Box	Holds a list of items that a user can select from. A user cannot add new items to a combo box *(see list box)*
Command	An instruction to perform a specific task in a program
Command Button	A button clicked to activate a procedure in a program
Debugging	Checking through a program to eliminate errors (bugs)
Fields	A unit for collecting information in a database
File	A unit that uniquely identifies data, program or a document in a system
List Box	Holds a list of items that a user can select from. A user can add new items to a list box *(see combo box)*
Main window	The first user interface in a program. If a program is instructed to run the main window is the first to appear
Modus operandi	Proper procedure for performing an operation or task
Network	A group of computers and other devices, such as printers, connected by a communication link, enabling all the devices to interact and share resources with each other
Option Button	Permits a user to select only one item from several options
Pull down button	This button is clicked to display a menu

Query	A structured statement that specifies the information you want to find in a database
Read only	An attribute that allows a user to view data only
Row	A horizontal section of a grid in a table of a database
Server	A computer that provides shared resources to network users.
Table	A two dimensional array that contains data about a specific topic within a database system. Data within tables are organised in rows and columns
Window	A portion on a computer screen where programs and processes run. Microsoft programs run in windows.

APPENDIX

6.0 Some Major Visual Basic Codes within the System

These codes determine the status of a folder by scanning through all the transit points

```
Private Sub Combo27_AfterUpdate()
' Find the record that matches the control.
  Dim rs As Object

  Set rs = Me.Recordset.Clone
  rs.FindFirst "[ID] = " & Str(Nz(Me![Combo27], 0))
  If Not rs.EOF Then Me.Bookmark = rs.Bookmark


  If DATE_RETURNED <= Date Then

      TRANSIT_POINT.Visible = False
      FOLDER_STATUS = "FOLDER ON SHELF"
      FOLDER_STATUS.Visible = True
      Verify_Confirmation.Visible = False

  Else:  TRANSIT_POINT.Visible = True
      FOLDER_STATUS.Visible = False

  End If


   If DATE_OF_TRANSFER > (#1/1/1900#) Then

      DoCmd.Beep
      TRANSFER_FROM.Visible = True
      TRANSFERED_TO.Visible = True
      TRANSIT_POINT.Visible = False

  With Verify_Confirmation
      .Caption = "VERIFY FROM " & TRANSFERED_TO.Value & " WARD/UNIT"
      .Visible = True

  End With

  Else

       TRANSFER_FROM.Visible = False
       TRANSFERED_TO.Visible = False


  End If
```

```
End Sub
```

These codes make the system verify folder transferred from one transit point to another

```
Private Sub Verify_Confirmation_Click()
On Error GoTo Err_Verify_Confirmation_Click


Dim stDocName As String
Dim stLinkCriteria As String


'Connect to surgical ward

If TRANSFERED_TO = "SURGICAL" Then


   DoCmd.Beep

   DoCmd.Close

   stDocName = "TRANSFER SURGICAL WARD"
   DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Verify_Confirmation_Click:
   Exit Sub

Err_Verify_Confirmation_Click:
   MsgBox Err.Description
   Resume Exit_Verify_Confirmation_Click


End If


'Connect to VIP ward

   If TRANSFERED_TO = "VIP" Then


   DoCmd.Beep

   DoCmd.Close
```

```
    stDocName = "TRANSFER VIP WARD"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

End If

'Connect to MATERNITY ward

If TRANSFERED_TO = "MATERNITY" Then

    DoCmd.Beep

    DoCmd.Close

    stDocName = "TRANSFER MATERNITY WARD"
    DoCmd.OpenForm stDocName, , , stLinkCriteria


End If


'Connect to PHARMACY unit

If TRANSFERED_TO = "PHARMACY" Then

    DoCmd.Beep

    DoCmd.Close

    stDocName = "TRANSFER PHARMACY UNIT"
    DoCmd.OpenForm stDocName, , , stLinkCriteria


End If


'Connect to ACCOUNTS unit

If TRANSFERED_TO = "ACCOUNTS" Then

    DoCmd.Beep

    DoCmd.Close

    stDocName = "TRANSFER ACCOUNTS UNIT"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

End If

'Connect to CHILDRENS ward
```

```
If TRANSFERED_TO = "CHILDRENS" Then

    DoCmd.Beep

    DoCmd.Close

    stDocName = "TRANSFER CHILDRENS WARD"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

End If


'Connect to MOBILE  ward

If TRANSFERED_TO = "MOBILE" Then

    DoCmd.Beep

    DoCmd.Close

    stDocName = "TRANSFER MOBILE WARD"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

 End If


'Connect to FEMALE  ward

If TRANSFERED_TO = "FEMALE" Then

    DoCmd.Beep

    DoCmd.Close

    stDocName = "TRANSFER FEMALE WARD"
    DoCmd.OpenForm stDocName, , , stLinkCriteria


End If


End Sub
```

Codes to confirm folder transfer

```
Option Compare Database

Private Sub CmdNo_Click()
lbAbort.Visible = True
cmdyes.Visible = False
Command25.Visible = False
DoCmd.Beep
End Sub


Private Sub CmdYes_Click()
CONFIRMATION = "CONFIRMED"
lbUpdate.Visible = True
cmdno.Visible = False
Command25.Visible = False
DoCmd.Beep
End Sub

Private Sub Command25_Click()
ConfirmMessage.Visible = True
cmdyes.Visible = True
cmdno.Visible = True
DoCmd.Beep
End Sub

Private Sub Command45_Click()
CONFIRMATION = " "
ConfirmMessage.Visible = False
cmdyes.Visible = False
cmdno.Visible = False
lbUpdate.Visible = False
Command25.Visible = True
lbAbort.Visible = False
DoCmd.Beep
End Sub

Private Sub UPDATE_Click()
On Error GoTo Err_UPDATE_Click

ConfirmMessage.Visible = False
cmdyes.Visible = False
cmdno.Visible = False
lbUpdate.Visible = False
Command25.Visible = True
lbAbort.Visible = False
DoCmd.Beep
   DoCmd.DoMenuItem acFormBar, acRecordsMenu, acSaveRecord, , acMenuVer70
```

```
Exit_UPDATE_Click:
    Exit Sub

Err_UPDATE_Click:
    MsgBox Err.Description
    Resume Exit_UPDATE_Click

End Sub
Private Sub Command50_Click()
On Error GoTo Err_Command50_Click


    DoCmd.Close

Dim stDocName As String
 Dim stLinkCriteria As String

    stDocName = "STARTUP"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command50_Click:
    Exit Sub

Err_Command50_Click:
    MsgBox Err.Description
    Resume Exit_Command50_Click

End Sub
```

Codes for navigating through the system

```
Option Compare Database

Private Sub NEW_FOLDER_Click()
On Error GoTo Err_NEW_FOLDER_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "PATIENTS RECORDS"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_NEW_FOLDER_Click:
    Exit Sub

Err_NEW_FOLDER_Click:
    MsgBox Err.Description
```

```
    Resume Exit_NEW_FOLDER_Click

End Sub
Private Sub FOLDER_SEARCH_Click()
On Error GoTo Err_FOLDER_SEARCH_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "FOLDER REQUEST UPDATE"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_FOLDER_SEARCH_Click:
    Exit Sub

Err_FOLDER_SEARCH_Click:
    MsgBox Err.Description
    Resume Exit_FOLDER_SEARCH_Click

End Sub
Private Sub Command4_Click()
On Error GoTo Err_Command4_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "PATIENT REQUEST INFORMATION"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command4_Click:
    Exit Sub

Err_Command4_Click:
    MsgBox Err.Description
    Resume Exit_Command4_Click

End Sub
Private Sub Command5_Click()
On Error GoTo Err_Command5_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "ADMISSIONS AND DISCHARGE"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command5_Click:
    Exit Sub

Err_Command5_Click:
```

```
    MsgBox Err.Description
    Resume Exit_Command5_Click

End Sub
Private Sub Command6_Click()
On Error GoTo Err_Command6_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "ADMISSION AND DISCHARGE INFORMATION"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command6_Click:
    Exit Sub

Err_Command6_Click:
    MsgBox Err.Description
    Resume Exit_Command6_Click

End Sub
Private Sub Command7_Click()
On Error GoTo Err_Command7_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "FOLDER REQUEST INFORMATION"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command7_Click:
    Exit Sub

Err_Command7_Click:
    MsgBox Err.Description
    Resume Exit_Command7_Click

End Sub
Private Sub Command8_Click()
On Error GoTo Err_Command8_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "FOLDER  REQUEST INFORMATION"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command8_Click:
    Exit Sub
```

```
Err_Command8_Click:
    MsgBox Err.Description
    Resume Exit_Command8_Click

End Sub
Private Sub Command9_Click()
On Error GoTo Err_Command9_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "ADMISSIONS AND DISCHARGE UPDATE"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_Command9_Click:
    Exit Sub

Err_Command9_Click:
    MsgBox Err.Description
    Resume Exit_Command9_Click

End Sub
Private Sub WARD_STATE_Click()
On Error GoTo Err_WARD_STATE_Click

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "CURRENT ADMISSIONS"
    DoCmd.OpenForm stDocName, , , stLinkCriteria

Exit_WARD_STATE_Click:
    Exit Sub

Err_WARD_STATE_Click:
    MsgBox Err.Description
    Resume Exit_WARD_STATE_Click

End Sub

Private Sub Command47_Click()
On Error GoTo Err_Command47_Click

    DoCmd.Close

    Dim stDocName As String
    Dim stLinkCriteria As String

    stDocName = "PATIENTS RECORDS"
    DoCmd.OpenForm stDocName, , , stLinkCriteria
```

```
Exit_Command47_Click:
   Exit Sub

Err_Command47_Click:
   MsgBox Err.Description
   Resume Exit_Command47_Click
```

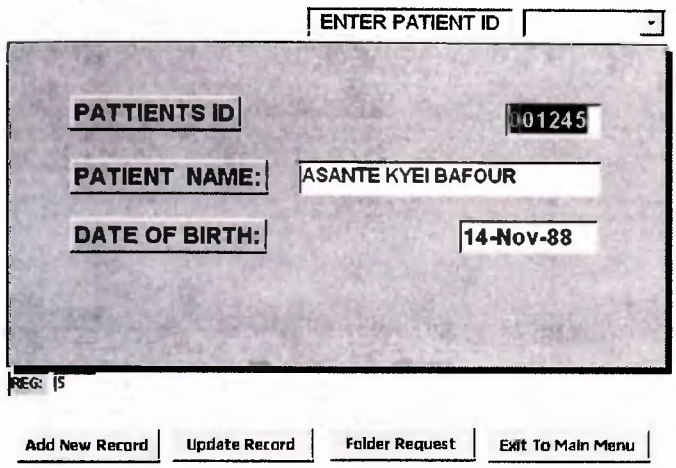
Some codes to generate admissions and discharge report

```
=Count([DATE ADMITTED])-[TEXT24]

=IIf([DEATH]="DECEASED","DECEASED",IIf([DATE
DISCHARGED]=Date(),"OUT",IIf([DATE ADMITTED]=Date(),"IN")))

=Count([DATE DISCHARGED])

=Count([DEATH])
```

6.1 Major Windows in the Automated Tracking System

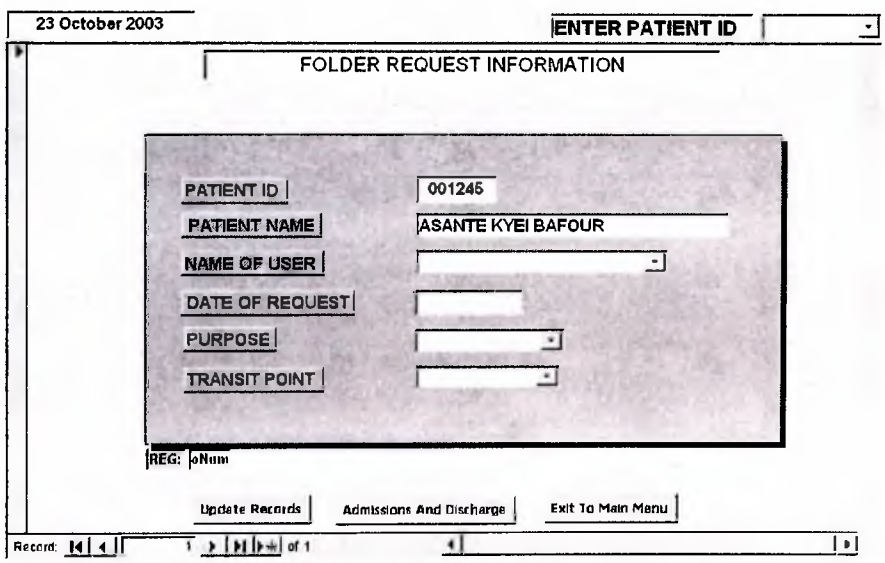
Folder Creation Window

Figure 6.0

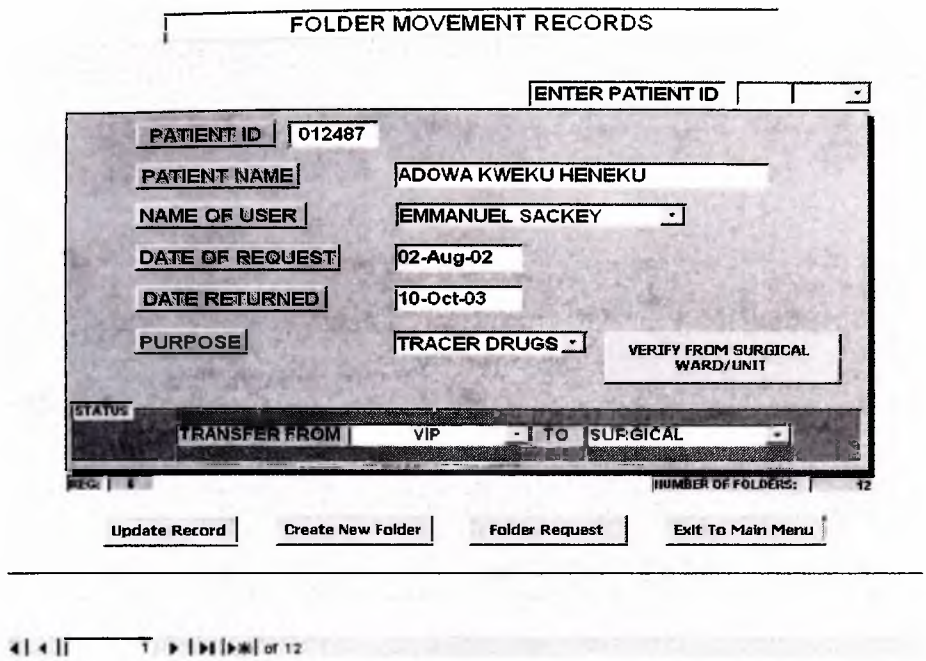


Folder Request Window

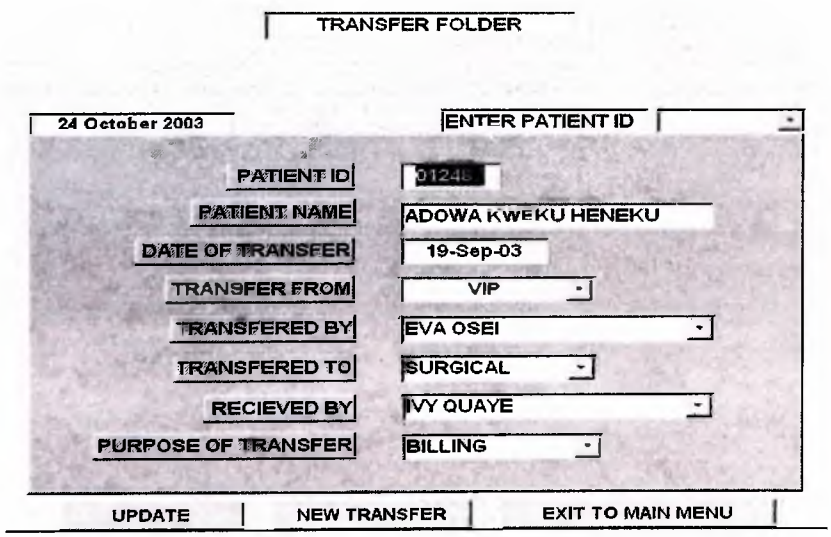
Figure 6.1



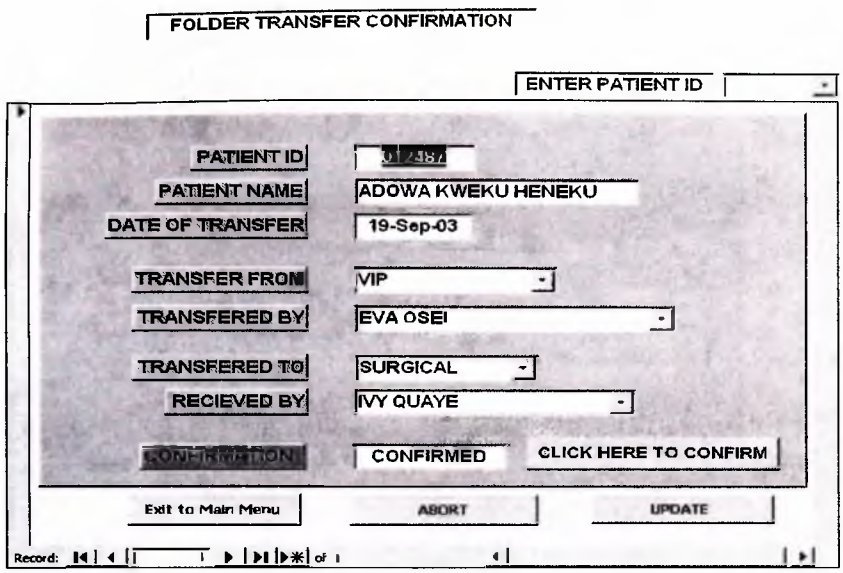
Folder Tracking Window *Figure 6.2*



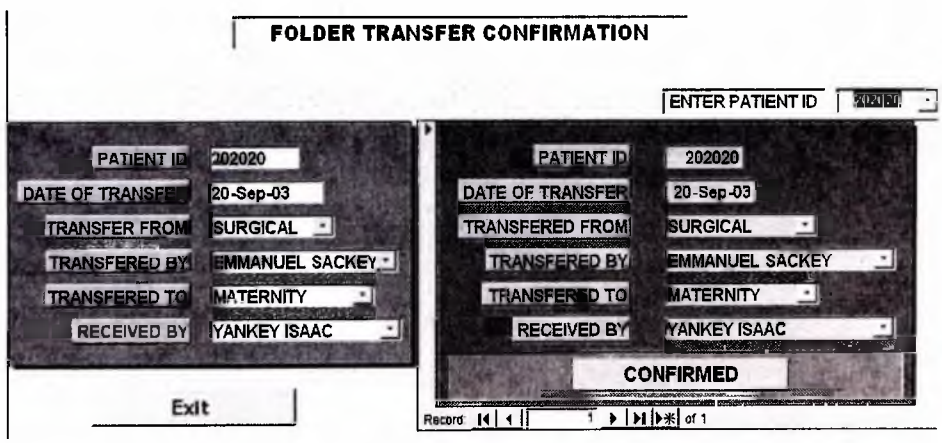
Folder Transfer Form *Figure 6.3*



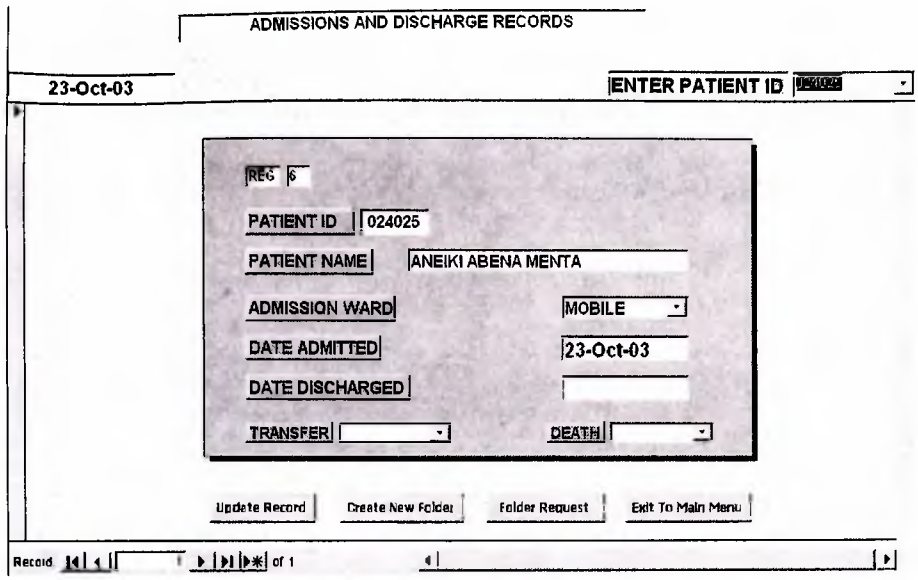
Folder Transfer Confirmation Form *Figure 6.4*



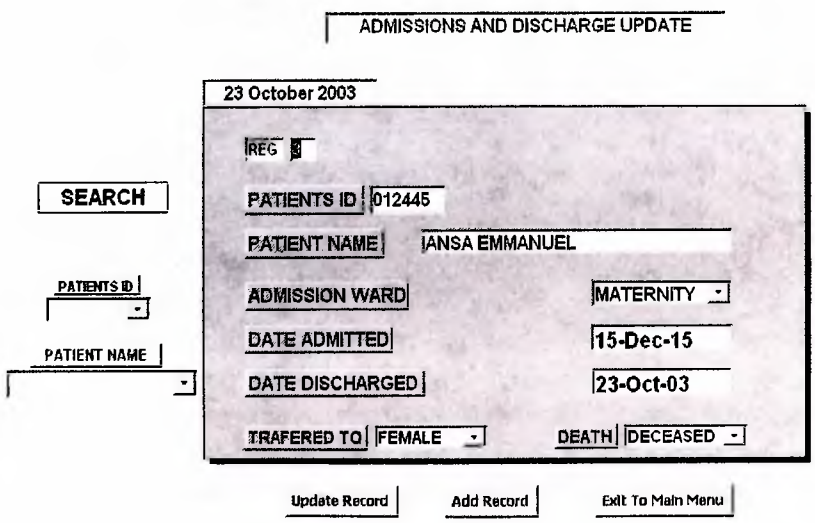
Folder Transfer Verification Window *Figure 6.5*



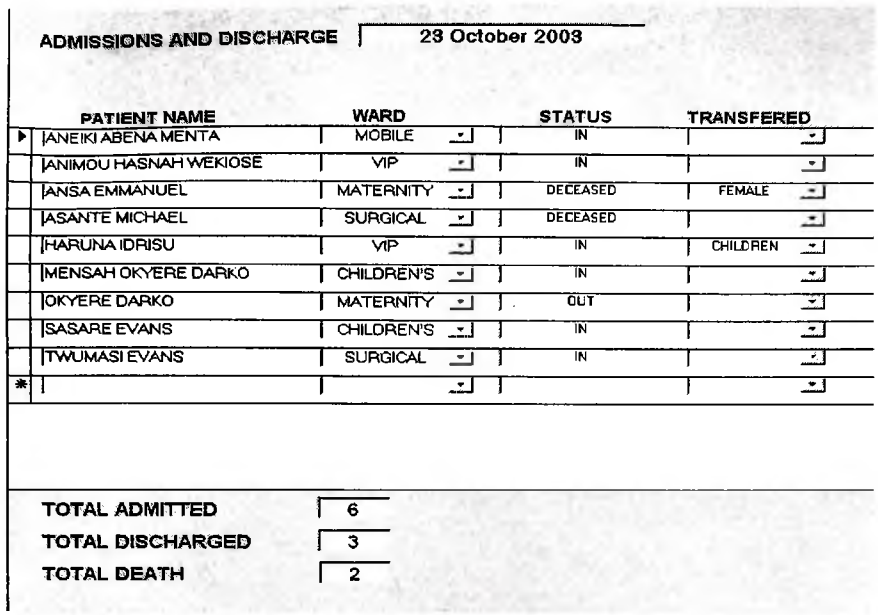
Admissions and Discharge Records Window (editable) *Figure 6.6*



Admissions and Discharge Records Window (read only) *Figure 6.7*



Admissions and Discharge Report Window *Figure 6.8*



ADMISSIONS AND DISCHARGE 23 October 2003

PATIENT NAME	WARD	STATUS	TRANSFERED
ANEIKI ABENA MENTA	MOBILE	IN	
ANIMOU HASNAH WEKIOSE	VIP	IN	
ANSA EMMANUEL	MATERNITY	DECEASED	FEMALE
ASANTE MICHAEL	SURGICAL	DECEASED	
HARUNA IDRISU	VIP	IN	CHILDREN
MENSAH OKYERE DARKO	CHILDREN'S	IN	
OKYERE DARKO	MATERNITY	OUT	
SASARE EVANS	CHILDREN'S	IN	
TWUMASI EVANS	SURGICAL	IN	

TOTAL ADMITTED 6
TOTAL DISCHARGED 3
TOTAL DEATH 2