Bugolobi Nursing Home Database and Information Management System

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Declaration

We hereby declare that this Project Report is the sole result of our personal efforts and has never been presented anywhere before for an award of a university Degree.

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Dedication

This research work is dedicated to our sisters and brothers, uncle, all relatives and friends who have been very instrumental in providing moral and financial support to the success of our academic career

Acknowledgement

First and foremost we thank the Almighty God for everything He has done for us and most importantly for the gift of life. Our deepest and sincere gratitude goes to relatives whose generous contribution made us successful in education. Special thanks go to my Supervisor, Mr. Zirimmenya for his commitments and professional guidance since the beginning of this project work, may God bless him. We also register our sincere heart full thanks to all our friends for being so dear to us when times seemed to get a bit tough God Bless You.

Acronyms

BNH	Bugolobi Nursing Home
OPD	Outpatient Data.
CPU	Central Processing Unit
DBMS	Database Management System
DSAP	Database Software Application Program
ICT	Information Communication Technology
IHC	ICT Health Care
ISAM	Indexed Sequential Access Method
RAM	Random Access Memory
SQL	Structured Query Language

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Abstract

In Uganda most health service providers are faced with a challenge of providing quality health services to the large number of patients and clients thus necessitating health service providers to continuously ensure availability of quality and timely data to enable the provision of better and improved health services to the patients. Bugolobi Nursing Home is one of the health service providers, but it uses a manual system which fails in provision of a timely and quality data for its clients. Based on this background, Bugolobi Nursing Home Database and Management System was developed to ensure that challenge of providing quality health services and timely data are addressed. It is therefore on this remark that we chose to write about an electronic information system development project in a hospital setting- (Bugolobi Nursing Home).

Chapter One

1.1 Introduction.

This chapter included the background, statement of the problem, purpose of the study, objectives, significances of the study and the scope of the study.

1.2 Background.

Bugolobi Nursing Home (BNH) is one of the Private Hospitals in Kampala the capital city of Uganda located at Bugolobi Trading Centre, 5kms south east of Kampala city centre. It was established in 1995 as a small clinic. Currently the hospital has a capacity of 22 beds, operates 24 hours a day and 7 days in a week. The Outpatient Department consists of 9 clinics; it has an Inpatient department with 22 single occupancy rooms. The hospital has a manual database system where the bio data of all patients is first registered in a central register at the reception and all the information including the bio data of the patient is entered in registers which exist at the individual sections within the hospital.

The manual database system at the hospital aimed at ensuring that all the information generated from the patients was properly recorded and well kept for easy access whenever a patient comes back for treatment, whenever administrative decisions were to be made and to facilitate the timely generation of information required to be summarised in Kampala City Council Authority reports.

However the system faced a challenge of providing quality health services to the large number of patients and clients thus necessitating health service providers to continuously ensure availability of quality and timely data to enable the provision of better and improved health services to the patients. This was because information was extracted and compiled manually. This took a lot of time and delays in delivery of reports to Kampala city council. It was therefore on this remark that we chose to implement a project to ensure timely information in Bugolobi Nursing Home.

1.3 Statement of the Problem

Despite the efforts made by management of BNH to improve on their manual information system, the system is still associated with a number of problems such as data redundancy which leads to duplication, data inconsistency, and delays in accessing data due to slow and late deliverance of the reports hence calling for research to create a database management system that can handle problems associated with use of the manual system in the hospital. .

If this system was not urgently improved, it was likely to lead to loss of information, poor information utilization, unreliable information which eventually may lead to the failure of the hospital to achieve its intended goals and objectives.

In reality all managers needed information which cross functions, applications and levels, effective Management of information is very crucial to any organization.

1.4 Objectives of the Study

1.4.1 Main Objective

The main objective of the project was to implement a computerized Database and information management system for managing outpatient information in BNH.

1.4.2 Specific Objectives

The specific objectives of the study were:

1. To study the manual system used by BNH.
2. To identify problems associated with the manual system.
3. To design a system to overcome some of the identified problems.
4. To implement and test the new system.

1.5 Research Questions.

1. Was it possible to come up with the system which would solve the problems in BNH for example data redundancy?
2. Did we have an information system which was used for managing outpatient information?
3. What was the relationship between Database Management System and effective outpatient information management at BNH?

1.6 Significances of the Study

1. The study helped the Management of BNH to manage its' Outpatient information effectively.
2. The study benefited BNH to have a competitive advantage over some hospitals that had not established similar project both nationally and internationally.
3. It was a useful source of secondary data for future researchers.
4. It was a way of widening the researchers' knowledge on the development of database driven software applications.

1.7 Scope of the Study

The study was carried out at Bugolobi Nursing Home Outpatient Department. The system focused on data obtained from the patients who visited the various outpatient clinics at the hospital.

Chapter Two

2.0 Literature Review

2.1 Introduction

In this chapter, the researchers looked at the definitions and what different authors wrote about Database Management Systems, Information Management and the relationship between Database and Information Management Systems.

2.2 Database Management System

According to Ramakrishna (2006), a database management system is a collection of programs that enables you to store, modify, and extract information from a database, on addition to that, there are many different types of Database management systems ranging from small systems that run on personal computers to huge systems that run on mainframes, examples of some of these database applications are computerized library systems, automated teller machines, flight reservation systems, computerized parts inventory systems.

Connolly (2004) contends that, a database management system is a software system that enables users to define, create, maintain and control access to the database.

Vowles (2001) views a database management system as a more sophisticated and flexible form of file management together with a flexible tool for data extraction and often other "high level" tools.

2.3 Data and Definition of a Database

Chapple (2005) states that, Data consists of a series of facts or statements that may have been collected, stored, processed or manipulated but have not been organized or placed into context, hence when data is organized, it becomes information. Information can be processed and used to draw generalized conclusions or knowledge.

Bench (2000) defines Data as raw facts, measurements, numbers and that it can also exist in any form, but is commonly identified with electronic digital signals.

According to Abbott (2004), Data is technically raw facts and figures such as orders and payments, which are processed into information, such as balance due and quantity on hand, however in common Usage, the terms data and information are used synonymously. In

addition, the term data is really the plural of "datum," which is one item of data. But datum is rarely used, and data is used as both singular and plural in practice.

On addition to that, Hoffman (2003) says that, a database is a collection of records stored in a computer in a systematic way, so that a computer program can consult it to answer questions. For better retrieval and sorting, each record is usually organized as a set of facts.

Connolly (2004) asserts that, a database is a shared collection of logically related data and a description of this data designed to meet the information needs of an organization.

According to Hongjun (2000), a database is defined as a set of related files that is created and managed by a DBMS. Currently, DBMS's can manage any form of data including text, images, sound and video and databases and file structures are always determined by the software.

George (2005) says that, a database is a computerized record keeping system. More completely, it is a system involving data, the hardware that physically stores that data, the software that utilizes the hardware's file system in order to 1) store the data and 2) provide a standardized method for retrieving or changing the data, and finally, the users who turn the data into information. He adds that databases were created to solve the problems with file-oriented systems in that they were compact, fast, easy to use, current, and accurate, allowed the easy sharing of data between multiple users, and were secure.

French (1996) classifies databases into 3 categories and these are;

a. Relational

This is a database category that uses the SQL to extract and update data and conform as closely as possible to the theoretical relational rules of normalization examples of relational databases are Oracle, Sybase and Informix. It works best when the data structures have been "normalized" to eliminate data and field duplication. Data is organized within "Tables" (files) and relationships expressed between tables and data elements.

b. Hierarchical.

Data structures are often forced to conform to the hierarchical model in order to take advantage of the management and programming aspects of the products. Hierarchical Database defines hierarchically-arranged data. Perhaps the most intuitive way to visualize this type of relationship is by visualizing an upside down tree of data. In this tree, a single table acts as the "root" of the database from which other tables act as "branch".

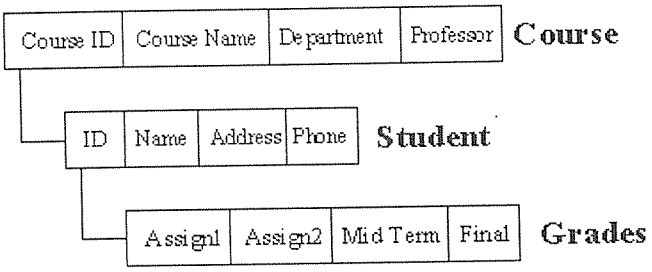


Figure 2.0 an example of a hierarchical database scheme.

Some disadvantages of hierarchical databases are associated with redundancy. This occurs because it handles one-to-many relationships well but do not handle many-to-many relationships well. This is because a child may only have one parent. However, in many cases you will want to have the child be related to more than one parent. For instance, the relationship between student and class is a "many-to-many". Not only can a student take many subjects but a subject may also be taken by many students. Though this problem can be solved with multiple databases creating logical links between children. Faced with these serious problems, the computer brains of the world got together and came up with the network model.

c. Network.

In many ways, the Network Database model was designed to solve some of the more serious problems with the Hierarchical Database Model. Specifically, it solves the problem of redundancy by representing relationships in terms of sets rather than hierarchy. It's very efficient in storage and allows complex data structures to be built.

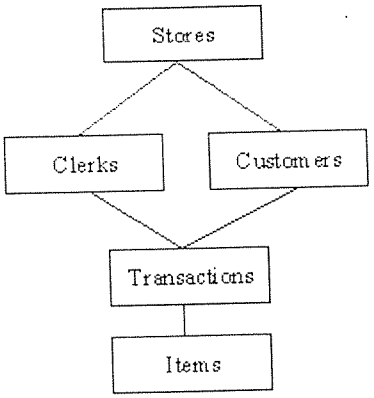


Figure 2.1 an example of a Network Database

Visually, a Network Database looks like a hierarchical Database in that you can see it as a type of tree. However, in the case of a Network Database, the look is more like several trees which share branches. Thus, children can have multiple parents and parents can have multiple children.

The network model is very similar to the hierarchical model actually. In fact, the hierarchical model is a subset of the network model. However, instead of using a single-parent tree hierarchy, the network model uses set theory to provide a tree-like hierarchy with the exception that child tables were allowed to have more than one parent. This allowed the network model to support many-to-many relationships.

2.3.1 Advantages of a Database.

The National Computing Center (2006) states that, in most businesses, the more you know about your customers, your suppliers, and your competitors, the better. Therefore the gathering, storing and processing of information in the form of databases can provide you with a distinct advantage.

It continues to suggest that many businesses do not have the time or resources available to gather and process large quantities of information. Therefore they may lack information about how their business is performing, how profitable their product lines are, whether customers are making repeat purchases etc. This information can help deal with specific operational problems or make future strategy. It is not always obvious what information could be valuable in the future so you should gather as much data as possible.

Using a sophisticated relational database management system at the heart of your business operations allows you to do this, and the store of data that is built up over time can become increasingly useful and valuable. For example, historical data can show you business trends, or sales records can identify valuable customers. In addition, the disciplines required to gather, enter and process such data can help to ensure that your business is run in a regulated and properly managed fashion.

Captaris (2006) states the advantages of using database technology in any business as:

1. Reducing the amount of time managing data.
2. Giving you the ability to analyze data in a variety of ways.
3. Promoting a disciplined approach to data management.
4. Turning disparate information into a valuable resource.
5. Improving the quality and consistency of information.

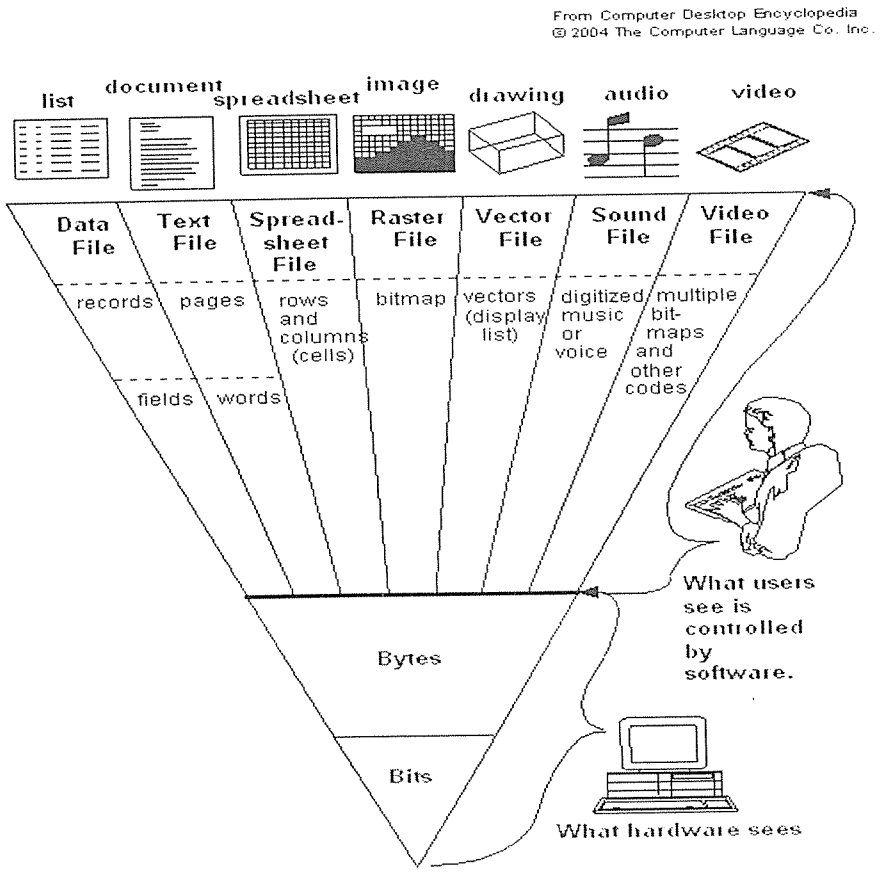


Figure 2.2 shows what databases can do, it was adapted from computer Desktop Encyclopedia (2004)

According to Oliver (1993), a database is normally set-up to meet the information needs of major parts of the organization. She also states that if a database is implemented in any organization, it can help to protect data against unauthorized users, safeguarding data against corruption and providing recovery and restart facilities after a hardware or software failure.

So according to all the above scholars, a database can be taken as a collection of data which has been organized so that a computer program can quickly select desired items.

2.4 Information Management System

Captaris (2006) asserts that, Tyler Memorial Hospital after being overwhelmed by paper-based records, which made retrieval difficult and time-consuming, the hospital, it implemented a combination of fax and document management applications and this has helped to increase efficiency, assist with regulatory compliance and enhance service at the hospital.

Addessi (2005) contends that, effective management of information is vital to the success of any enterprise, and that most small business owners balance their checkbook, track inventory, monitor expenses, and log hours of staff work. Most can tell you how much business they did in a week, a month or a year. They can do all that by searching different programs or sets of books or even loose pieces of paper.

According to Peter (2000), the ways on which effective organizations perform their information work include:

1. They recognize that information is not a proprietary, departmental resource, but an enterprise resource.
2. Information producers know who their information "customers" are and care about them so they capture all the information with the quality needed to effectively perform their jobs.
3. Information producers are able to provide high quality customer service to their information customers because the information customers themselves, and their own information producers, create quality information that they need to do their jobs effectively.
4. Managers work for goals that benefit the enterprise, not just their own department; for at the end of the day, there is only one profit or loss figure.

5. The executives at the top of the enterprise are leading their enterprise in the same way the symphony conductor leads the orchestra - as a single whole. They manage across the value chains to optimize them. Enlightened executives know there are no such things as "profit centers" and "cost centers." They know the perceived profit centers cannot make a "profit" without the services provided by the perceived cost centers. Therefore, they do not manage the functions as independent entities. Rather, they manage them as interdependent components of the various business value chains.
6. The performance measures reward synergistic teamwork that maximizes knowledge and information sharing for the good of all.

2.5 Relationship between Database Management System and Information Management.

The business link in UK (2004) states that, databases is one of the cornerstones of information technology, and its ability to organize, process and manage information in a structured and controlled manner is a key to many aspects of modern business efficiency.

Chapple (2005) further says that, databases are designed to offer an organized mechanism for storing, managing and retrieving information. Databases do this through the use of tables for example spreadsheets like in Microsoft Excel.

He further argues that databases are actually much more powerful than spreadsheets in the way you're able to manipulate data. He gives some few actions that one can perform on a database that would lead to effective information management that other applications cannot perform:

1. Retrieve all records that match certain criteria
2. Update records in bulk
3. Cross-reference records in different tables
4. Perform complex aggregate calculations

2.6 Investigation of the Existing System

BNH has a manual information system whereby all patients/clients who visit the hospital are recorded in the registers which exist at individual departments and one register is placed at the reception which records the bio data of all patients who visit the hospital.

The bio data of patients is centrally captured at the reception but the individual section information plus the bio data of the patients is again captured at the respective sections where the patient is sent for treatment at the hospital, this information is recorded on the OPD

Patient form which is later returned to the reception for filing when the patient is leaving the hospital and it is this same file that is retrieved when ever a patient comes back at the hospital for additional treatment.

There is a one Data Clerk who is in charge of ensuring that the information of all patients who visit the Hospital is captured and well kept/stored and later generates summaries of the collected information (manually) weekly and monthly.

The Hospital Administrator felt that the system is not adequately meeting the expectations of providing timely, accurate and complete information to enable the hospital meet its goals and objectives effectively and in addition he said that there is a lot of duplication in recording data while carrying out various tasks at the hospital.

2.7 Constraints in the Existing System

It is discovered that there is a lot of duplication in recording the patient data e.g. recording the same patient data in a number of registers at the hospital which increases on the staffs' workload, delays the provision of services to the patients and leads to the continuous generation of errors and a number of records kept may contain the same information, thus making it voluminous.

Access of information stored in patient files takes along time (time wasting) and in situations where a patient's file can not be traced then the whole of the respective patient information is lost since there is no back-up system at the hospital.

Error occurrence rate is so high i.e. during the process of recording data in the registers and also when coming up with weekly and monthly reports.

Information only stored in hardcopy form hence is lost at any time due to the demerits of storing data in hardcopy form e.g. fire, water, insects and in addition to that, the existing system does not meet the expectations of the users of providing reliable information.

Chapter Three

3.0 Methodology

3.1 Introduction

This chapter focused on the methodology which the researchers used to carry out the study. It contained the data collection techniques, data sources, data representations and sample selections. This chapter also provided some information including the systems requirement specifications.

3.2 Data Collection Techniques

The researchers moved to the hospital and generated data through interviewing, focus group discussions, observation, use of questionnaires and document review.

3.2.1 Interviewing

This method involved gathering of information from the hospital through face to face encounter with a cross section of stakeholders these including the staff, management of the hospital which helped the researchers to identify the system problems and discuss the possible solutions. The interviews used were both guided (with use of questionnaires) and unguided interviews (without use questionnaires).

3.2.2 Observation

This method helped the researchers to witness with their eye, activities carried out at the hospital e.g. data collection, recording and hence make judgement on the user requirements, identify the system constraints and the method was the best in identifying those requirements which could not be easily expressed by staff at the hospital.

3.2.3 Questionnaires

The researchers also came up with a template of questions where some were self-administered especially for the stakeholders who were busy and could not be interviewed during working hours and the other questionnaires used were drop-in questionnaires.

3.2.4 Focus Group Discussions

The researchers also met groups consisting of some hospital staff in order to brain storm issues regarding the performance of the current information system and the groups came-up with suggestions on how to improve the system. During these meetings the resolutions were noted and incorporated into the system.

3.2.5 Document Review

The project developers also gathered information from the hospital documents, Libraries, the Internet, Newspapers, Journals, textbooks and reviewed other relevant published literature on the development of an effective hospital information system.

3.3 Data Sources

Data was gathered from both primary and secondary sources, that is, primary data gathered direct from the respondents at the hospital and secondary data from secondary data sources like the Internet, text books, magazines, and journals.

3.3.1 Primary Data

The source of primary data was basically the staff and management of BNH and most specifically those involved in data collection, recording in the registers, users of the hospital information plus the Management of the hospital this including the Head of the Hospital and this was through the use of questionnaires and interviewing.

3.3.2 Secondary Data

Secondary data was obtained through literature review of already published literature, the Internet, journals, newspapers and other relevant documents.

3.4 Data Processing and Presentation.

3.4.1 Data Processing.

Data was processed and analysed using a database application which was developed using Ms Access. Continuous editing and modification was carried out to ensure that the database management system meets the intended objectives.

3.4.2 Data Presentation.

The researchers presented data using a number of conceptual table frameworks which were developed using Ms. Access, Word and PowerPoint.

3.5 Research Design.

The researchers used logical designs when coming-up with the actual design of the database application and practically implemented the database application designed to examine and test how the database application developed would lead to efficiency in the management of outpatient information at the hospital.

3.6 Target Population

The hospital managers, the data management section staff and other hospital staff involved in collecting and recording of outpatient data at the hospital were the ones targeted for the research study.

3.7 Sample Selection

Due to the limited time for conducting the study, a few respondents were selected from the hospital management, the data management section and few staffs at the Outpatient department involved in data collection and recording. A total of 10 respondents from the mentioned departments were chosen randomly.

3.7.1 Sample Size

Table 3.0 showing sample size selected from Hospital Management.

No.	Category	No. of Respondents
1	Hospital Management	2
2	Data Managers	2
3	Records Clerks/ Other staff involved in data Collection	6
	Total	**10**

3.8 Systems Requirements and Analysis of Specifications.

This section focused on what the researchers collected on the existing system. Areas that were investigated include:

1. User requirements
2. Functional requirements
3. Non functional requirements
4. System requirements

3.8.1 User Requirements

This involved the identification and analysis of end user requirements through generation of information by conducting a survey on the concerned parties. The requirements identified included:

1. How data will be captured and entered into the system?
2. Who will enter data in the system and process it when required?
3. What data will be processed regularly (daily, weekly, monthly and annually) and how?

4. Developing check codes which will identify and validate records entered
5. Maintaining and updating of the database

3.8.2 Functional Requirements

The Database application was analyzed to make sure that it performs the following functions:

1. Authentication
2. Caption of data variables
3. Production of reports
4. Validating and updating data

1. Authentication.

The system required a password for verification purposes before logging onto the system, entry of the password permitted the user to input, process and output data but not to modify the database as this is left to the system Data Manager only.

2. Caption of Data Variables

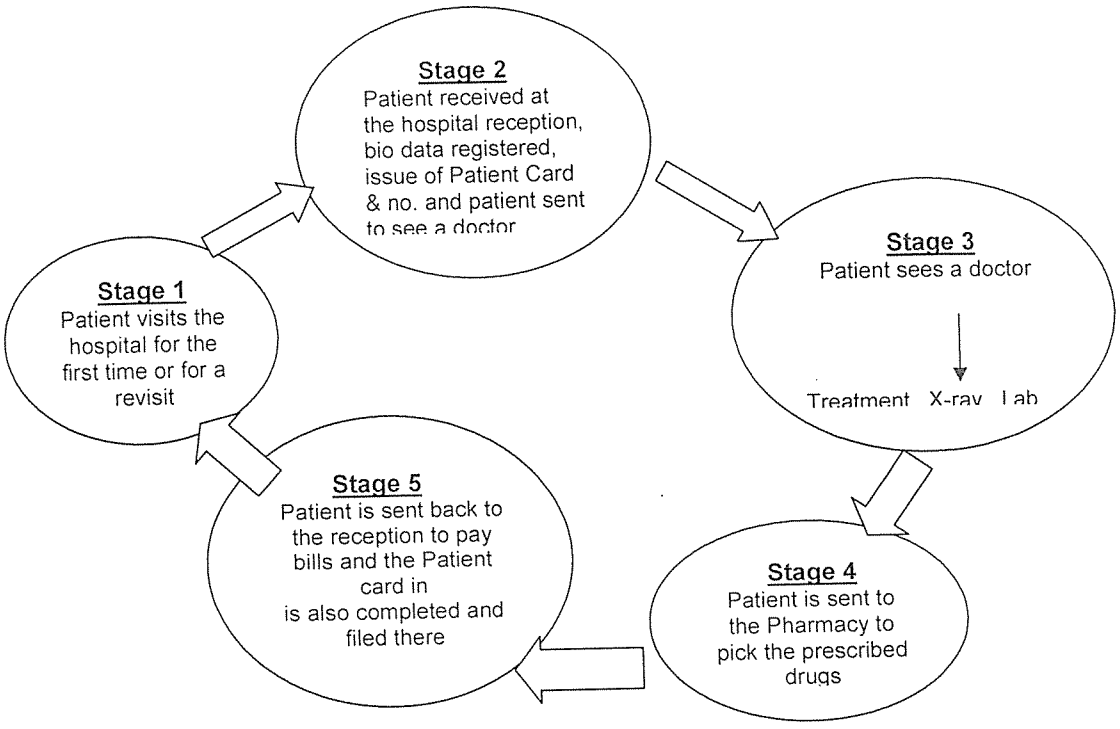


Figure 3.0: Patient Treatment Cycle

1. **Input**: The system captured the details of each patient coming for any outpatient service at the hospital and details were recorded on the patient card that is the bio data which included the names, age, sex, family/company, telephone, email and address of the patient plus the respective clinic data.

2. **Process**: The user specifies and selects what data he/she wanted to process and in which respective period then keys in a few commands and the system automatically processes it.

3. **Output**: The system automatically produced reports as required by the user

3. Validating and Updating.

The User allocates a unique outpatient number for each patient who visited the hospital and the presence of primary keys also helps to avoid duplication of records. The system has provisions of updating in case the user likes to modify some of the data already entered in the system.

4. Users.

1. Administrators/Management
2. Data Managers
3. Records Clerks

3.8.3 Non-functional Requirements.

The project developers determined the attributes required to be included in the functional requirements. The following are the non-functional requirements:

1. Users who were in position to use the system had to first be trained so as to acquire skills on how to operate the system.
2. Only the trained and experienced users were able to perform functions on the system.
3. Only those authorized users with usernames and passwords were in position to access the system.
4. The system allowed centralized processing of information.

3.9 Conclusion.

According to all the above scholars it was evident that the secret to the successful use of database technology is the way in which data or information is structured to enable efficient processing and that database tools and applications are designed to help you store and manage data in a controlled and structured manner. This showed that if a database application is designed for Bugolobi Nursing Home this will lead to efficient data processing, storage and hence effective management of its Outpatient information.

Chapter Four

4.0 System Design

4.1 Introduction

This chapter included the description of the system and the system tables (entities and attributes).

4.2 Description of the System

The BNH Database Management System was designed using Microsoft Access application (Version Number 11) and this works as a relational database management system basing on the current system which is manual. Tables, attributes and data types were identified basing on the different data gathered in the section respective registers. During the design, attention was put on the physical and logical design layout of the database and several objects were put in perspective when creating the application.

4.3 System Tables and Attributes

Diagrams showing the entity Relations Model (table and their respective attributes) of the hospital database.

Table 4.0: Patient

Table	Attributes	Data types	Description
Patient	PatientNo.	Text	Primary key for the table and it indicates the unique number allocated to each patient on the first day of attendance at the hospital
	First Name	Text	It indicates the first name of the patient
	Last Name	Text	It indicates the Second name of the patient
	Name of Family or Company	Text	Indicates the family or company name which the patient is seeking services on
	Date of birth	Date/Time	Indicates the date of birth for the patient
	Sex	Text	Indicates the sex of the patient

	Residential address	Text	Indicates the residential address where the patient stays
	Telephone no.	Text	Indicates the telephone contact of the patient
	Email	Text	Indicates the email of the patient
	Date of 1st visit	Date	Indicates the date when the patient first attended the hospital
	AccountName	Text	Indicates the account name of the patient/family/company
	AccountNo	Text	Indicates the account number of the patient/family/company

This table stored the bio data for all patients who visited the hospital.

Table 4.1: Treatment

Table	Attributes	Data types	Description
Treatment	TreatNo.	Text	**Primary key** and it indicates treatment number which was allocated to each patient on every visit
	PatientNo.	Text	Unique number allocated to each patient on the first day of attendance at the hospital
	Diagnosis	Text	Indicates the diagnosis the patient was found with
	Date of visit	Date	Indicates the date when the patient visited the hospital
	Visit No.	Number	Indicates the visit number the patient had attended the hospital within the same month
	Visit Charge	Currency	Indicates the amount charged to the patient on that visit
	Treatment given	Memo	Indicates all the treatment given to the patient
	ClinicianCode	Text	Indicates the code of the Clinician who had treated/seen the patients
	Date of next visit	Date/Time	Indicates the date when the patient was supposed to visit the hospital
	AccountNo	Text	Indicates the account number of patient/family/company

This table stored details regarding each patient visit/ attendance at the hospital

Table 4.2: X-ray

Table	Attributes	Data types	Description
X-ray	Date of visit	Date/Time	Date when the patient visited the X-ray
	X-ray No.	Text	**Primary key** for this table and was a unique number allocated in the x-ray section for each x-ray investigation carried out
	PatientNo.	Text	Unique number allocated to each patient on the first day of attendance at the hospital
	TreatNo.	Text	Indicates the treatment number of the patient
	X-ray Investigation	Text	Indicates the x-ray investigation carried out
	No. of films taken	Number	Indicates the number of films used on the x-ray investigation

This table stored the details regarding the x-ray investigations taken by the patient

Table 4.3: Laboratory

Table	Attributes	Data types	Description
Laboratory	Date of visit	Date/Time	Date when the patient visited the Laboratory
	Lab. No.	Text	**Primary key** for this table and was a unique number allocated in the Laboratory section for each laboratory tests carried out
	PatientNo.	Text	Unique number allocated to each patient on the first day of attendance at the hospital
	TreatNo.	Text	Indicates the treatment number of the patient
	Lab. Test	Text	Indicates the laboratory test carried out
	Test results	Text	Indicates the results of the laboratory test conducted

This table stored the details regarding the laboratory tests conducted on patients

Table 4.4: Account Payment

Table	Attributes	Data types	Description
Account	AccountNo.	Text	**Primary key** for this table and it was a unique number allocated to each patient/ family and company to monitor the payments made to the hospital and account balances
	Date of payment	Date/Time	Date when payment was made to the account
	Amount paid	Currency	Indicates the amount which has been paid by the patient compared to the total bill

This table stored the accounts details regarding the payments and account balances on each patient /family/company

Table 4.5: Pharmacy

Table	Attributes	Data types	Description
Pharmacy	Date of visit	Date/Time	Date when the patient visited the Pharmacy
	PharmNo.	Text	**Primary key** for this table and it was a serial number allocated to each patient given drugs in the pharmacy section
	PatientNo.	Text	Unique number allocated to each patient on the first day of attendance at the hospital
	TreatNo.	Text	Indicates the treatment number of the patient
	DrugName and Amount	Text	Indicates the names and doses of drugs given to patients

This table stored the details regarding the drugs which have been disbursed to the patient

Table 4.6: Clinician

Table	Attributes	Data types	Description
Clinician	ClinicianCode	Text	Is the **primary key** and it indicates the unique code .
	ClinicianName	Text	Indicates the names of each Clinician who treats/sees patients.

This table stored the details of the clinicians who treat/see the patients

Table 4.7: Account Names Details

Table	Attributes	Data types	Description
Account	AccountNo.	Text	**Primary key** for this table and was a unique number allocated to each patient/ family and company to monitor the payments made to the hospital and account balances
	AccountName	Text	Indicates the account name of the patient/family/company

This table stored the accounts details regarding the payments and account balances on each patient /family/company.

4.4.1 Section Names and Codes:

Table 4.8: Shows Section Names and Codes

No.	Section Name	Section Code
1.	Treatment Section	BNHTRE01
2.	X-ray Section	BNHXRA02.
3.	Laboratory Section	BNHLAB03
4.	Accounts Section	BNHACC04
5.	Pharmacy Section	BNHPHA05

Table 4.9: Shows an example of patient numbering in the individual hospital sections

No.	Section Name	Patient Numbering
1.	Treatment Section	1st Patient – TRE0001/01/06 2nd P atient – TRE0002/01/06
2.	X-ray Section	1st Patient – XRA0001/01/06 2nd Patient – XRA0002/01/06
3.	Laboratory Section	1st Patient – LAB0001/01/06 2nd Patient – LAB0002/01/06
4.	Accounts Section	1st Patient – BNHACC0001 2nd Patient – BNHACC0002
5.	Pharmacy Section	1st Patient – PHA0001/01/06 2nd Patient – PHA0002/01/06

Table 4.10: Shows an Example of Patient Numbering During Patient Registration

No.	Period of patient visit	Patient Numbering
1.	- The first patient to register in the year 2006 - The second patient to register in the year 2006	- BNH/0001/2006 - BNH/0002/2006
2.	- The first patient to register in the year 2007 - The second patient to register in the year 2007	- BNH/0001/2007 - BNH/0002/2007

4.4.2 System Entity Relationship Diagram (ERD)

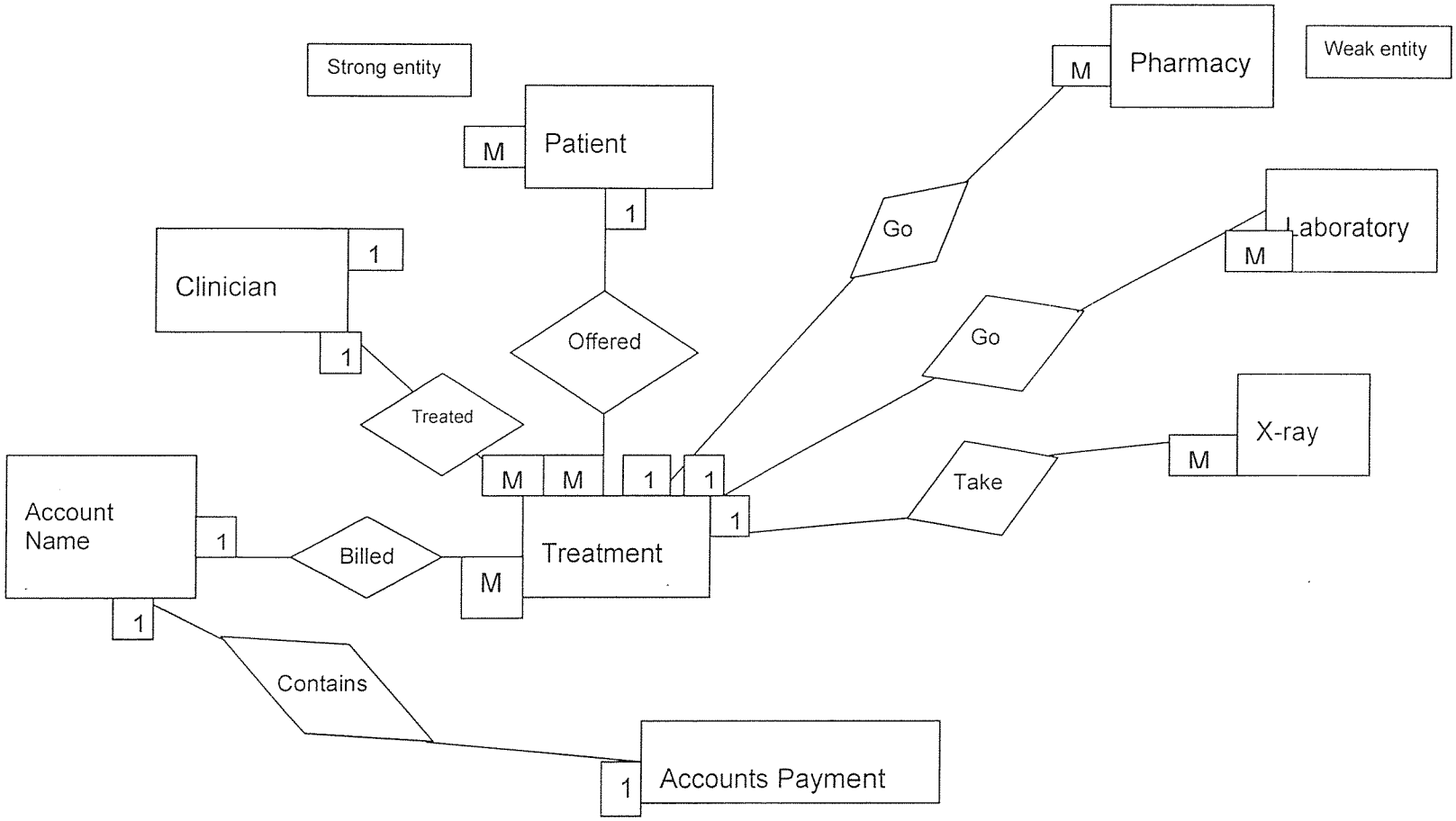


Figure 4.0: The entity relationship diagram (ERD) - this figure shows how the tables interlink with each other.

Chapter Five

5.0 Implementation

5.1 Introduction

Through the use of Graphical User Interfaces (GUI) the implementation of the BNH Database System was achieved. Menu screens, data entry forms and reports were also developed and then implemented. The uses of fourth generation tools which allow rapid development of applications were also applied

5.2 Software and Hardware Used

This involved finding out the nature and capacity of hardware and software requirements and tools required for the development of the database.

5.2.1 Software Requirements

1. Windows XP Operating System
   - Intel Pentium II (or compatible) 300 MHz or higher processor.
   - 128 MB (4GB maximum) of RAM.
   - 2GB of free hard disk space
   - Network Adapter
   - Ms. Access software version 2003
2. EPI INFO 3.3.2 Software

5.2.2 Hardware Requirements

1. A computer (monitor and system).
2. Other peripherals like mouse, keyboard.
3. USB Disk.

5.3 System Features

5.3.1 Desktop Shortcut for System Logon.

A shortcut was created on the desktop to allow the users to easily log on to the system.

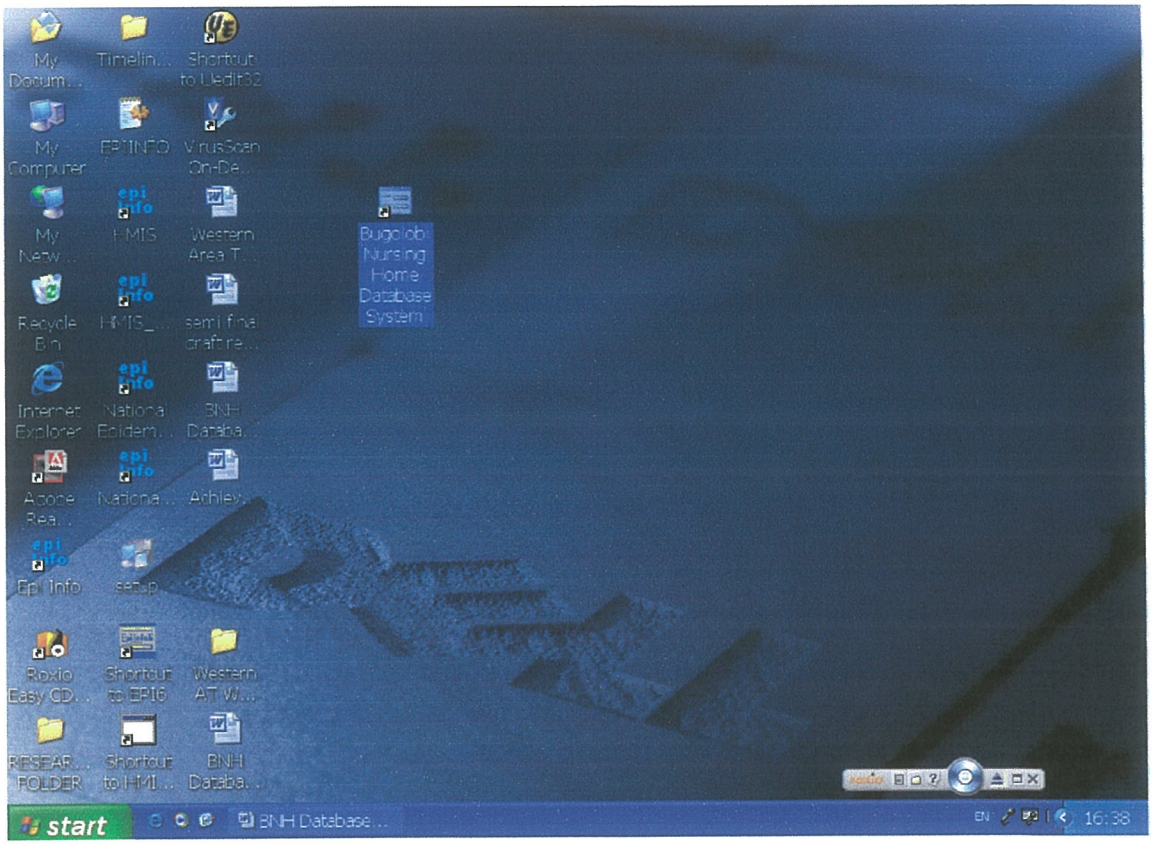


Figure 5.0: Desktop Shortcut for System Logon.

5.3.2 Log on Password

A system password was instituted which is always required for any user to first key in so as to fully have access to BNH Database System. This password was instituted in order to restrict unauthorised system users to have access to the system.

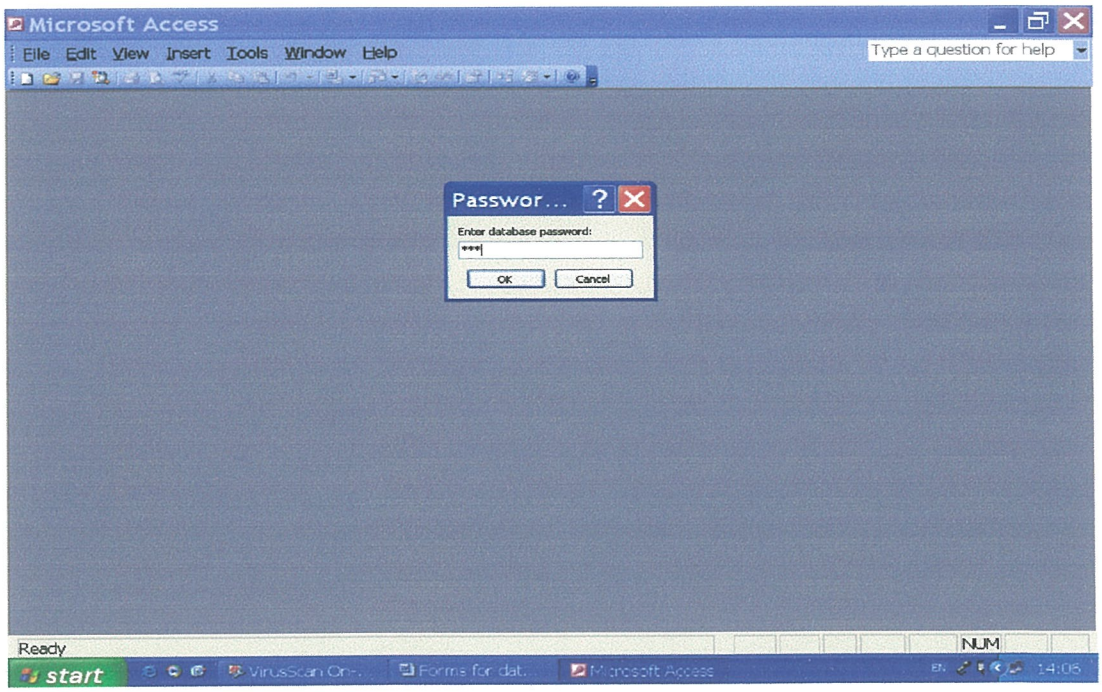


Figure 5.1: Log on Password for Security

5.3.3 Switch Board

The switchboards were developed and implemented to form main user interfaces to data entry forms and reports.

a. Main Switchboard

The main switchboard was set to be launched at start-up and thus serving as the only interface to other sub-switchboards, BNH Forms Sub-switchboard, BNH Query Sub-switchboard and BNH Reports Sub-Switchboard .

b. Sub-switchboards

Some items on the main switchboard led to sub-switchboards and these sub-switchboards include:

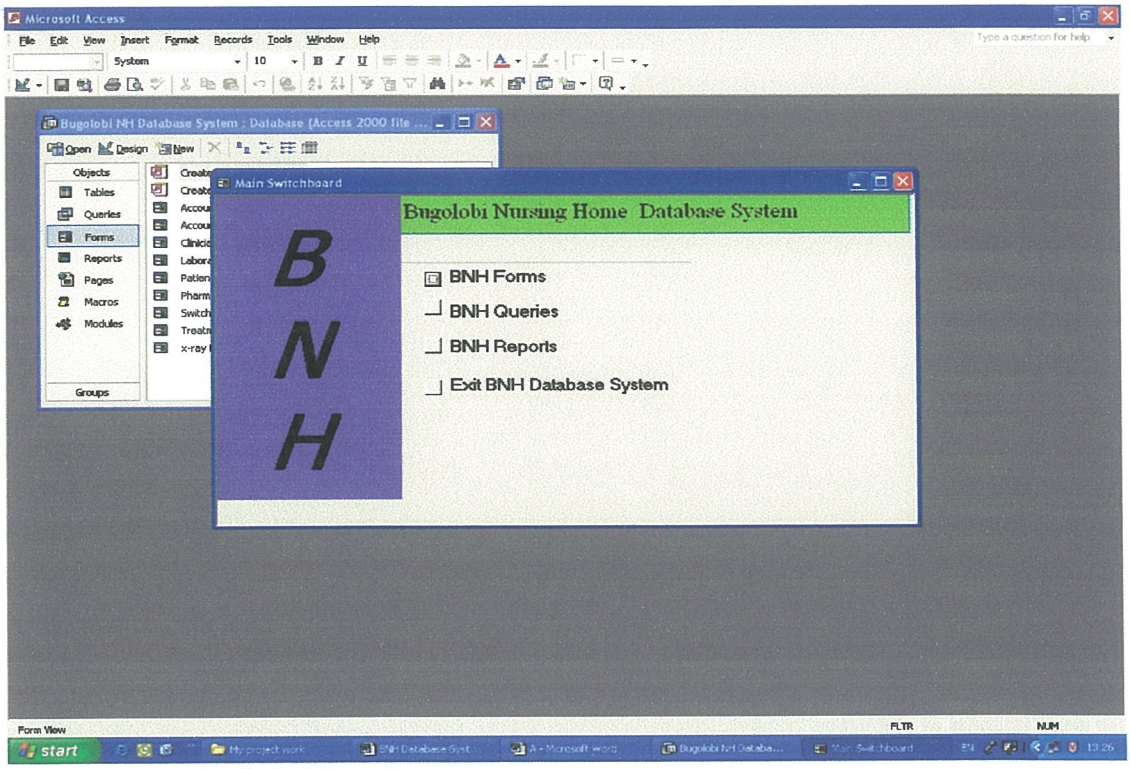


Figure 5.2: Main Switchboard

c. BNH Forms Sub-switchboard

BNH Forms Sub-switchboard enabled the user to access a number of patient forms, where data had to be entered when a patient visited the hospital. These forms included: Patient registration form, Patient treatment details form, Laboratory form, X-ray form, Pharmacy form, Accounts Names form, Accounts payment form and Clinician details form.

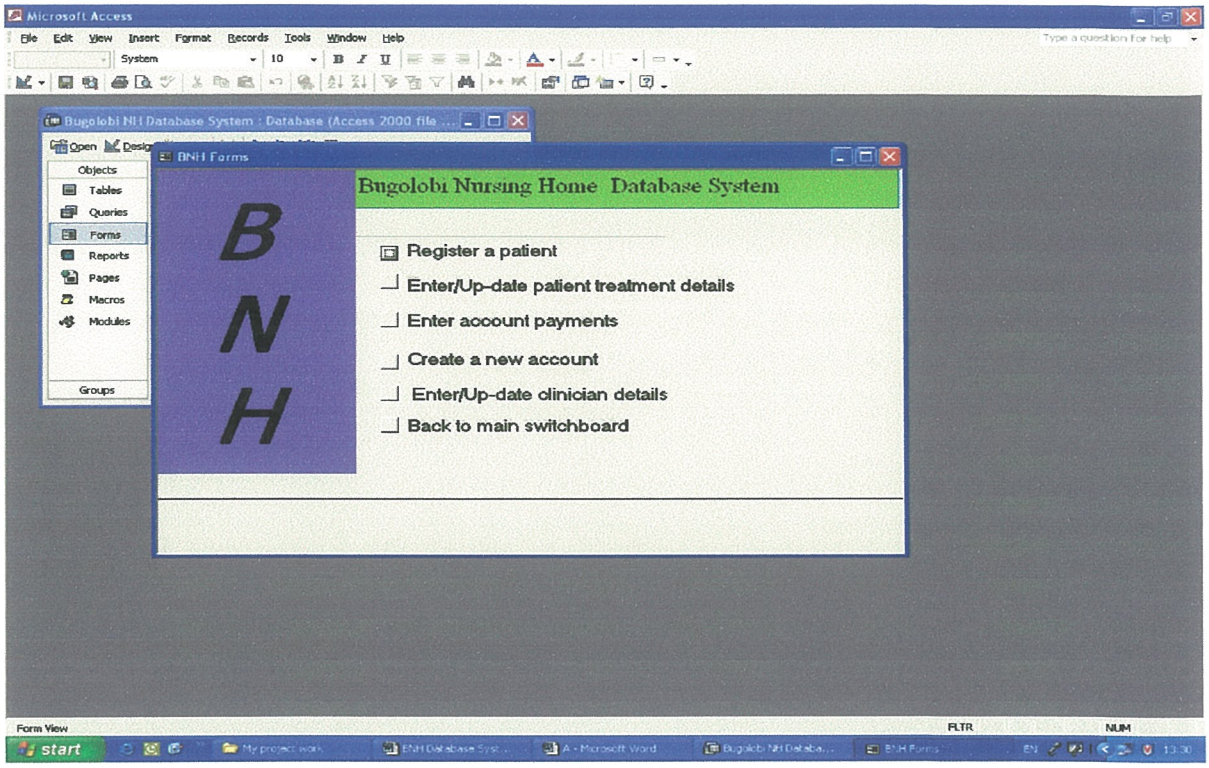


Figure 5.3: BNH Forms Sub-Switchboard

d. BNH Query Sub-switchboard

BNH Query Sub-switchboard enabled the user to run a number of queries; these queries helped the system users to come-up with different forms of analysis of the data entered in the database system. These queries included: Accounts balance query, Section workload analysis query and other queries as required by the user were also programmed on the system

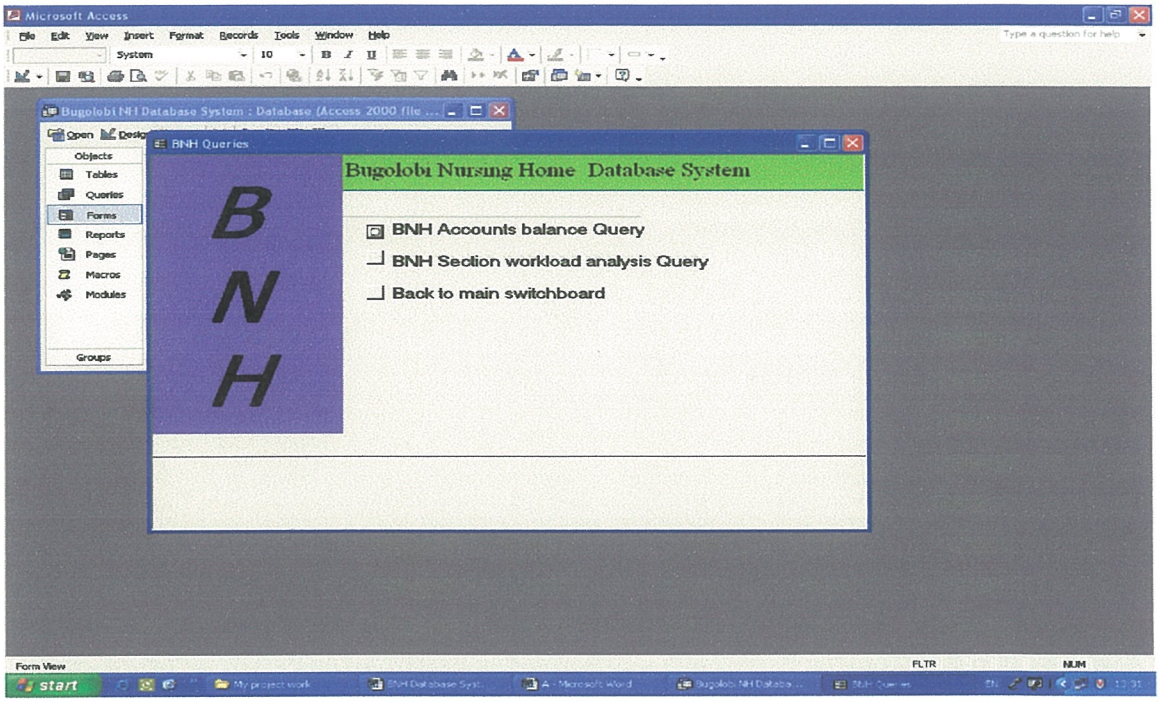


Figure 5.4: BNH Queries Sub-Switchboard

Note: When ever the system user is going to run a query from the system, the system prompts him/her to enter the start and end date of the period which the query should cover

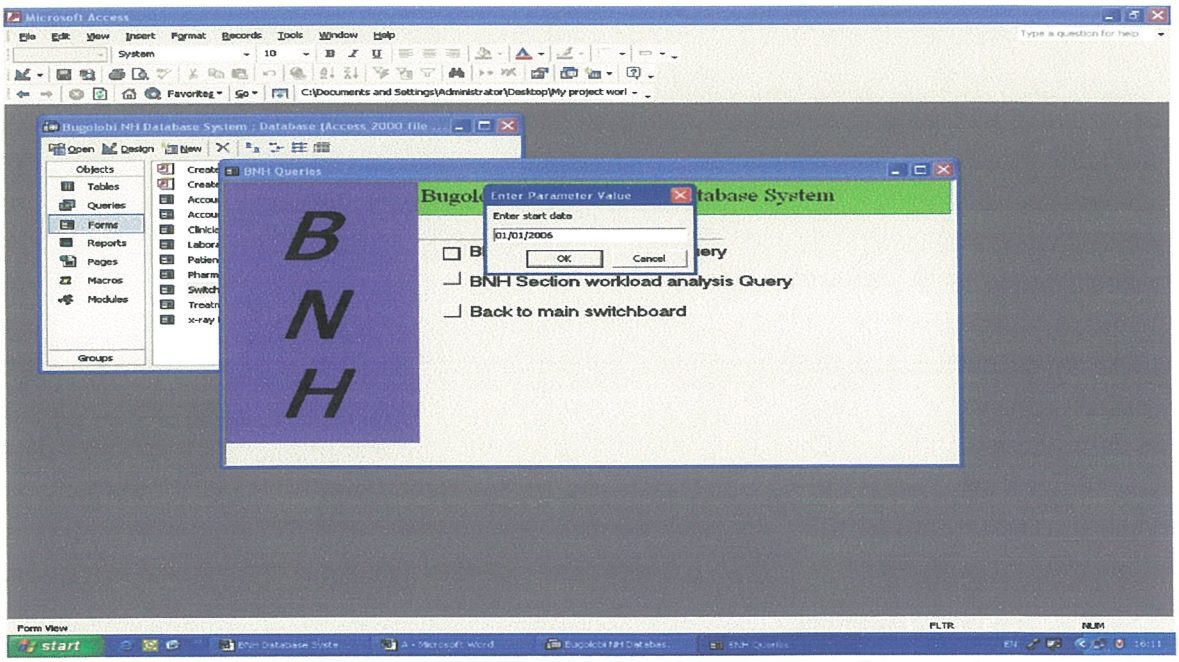


Figure 5.5: Prompt to enter start date required to run a query and a report

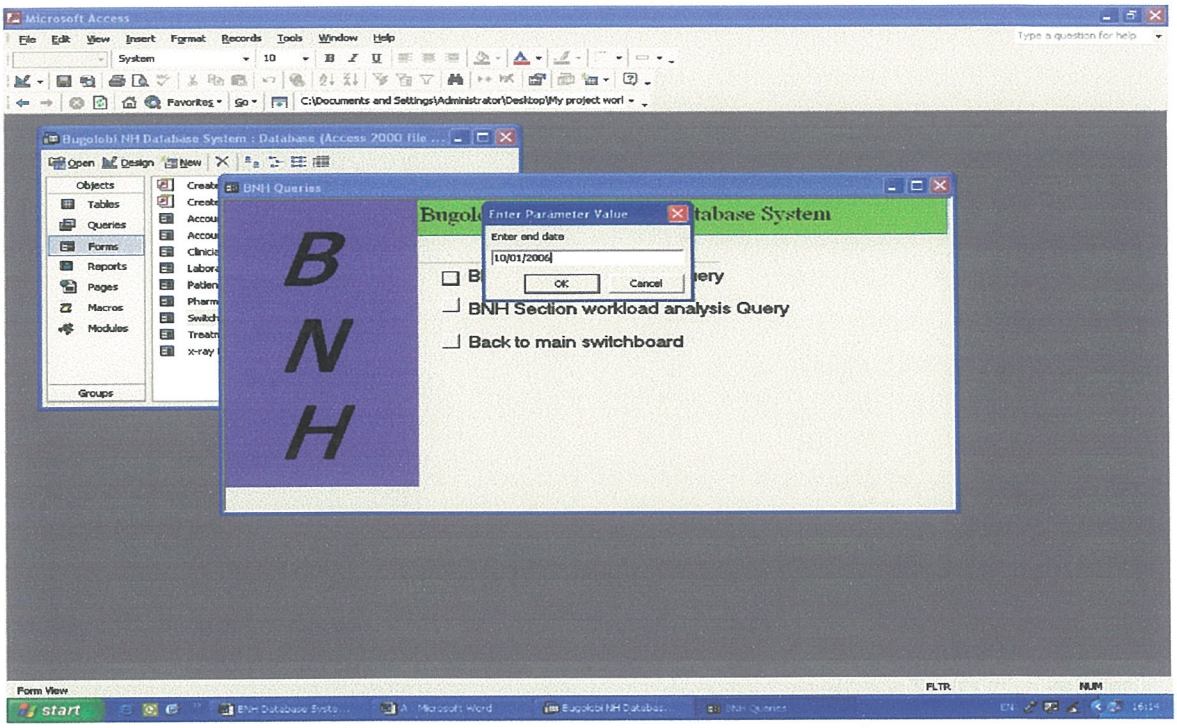


Figure 5.6: Prompt to enter end date required to run a query and report

e. BNH Report Sub-switchboard

BNH Report Sub-switchboard enabled the system users to generate reports from the system, some of the generic system report included: BNH accounts charges and payments report, BNH section workload analysis report and other customarised reports.

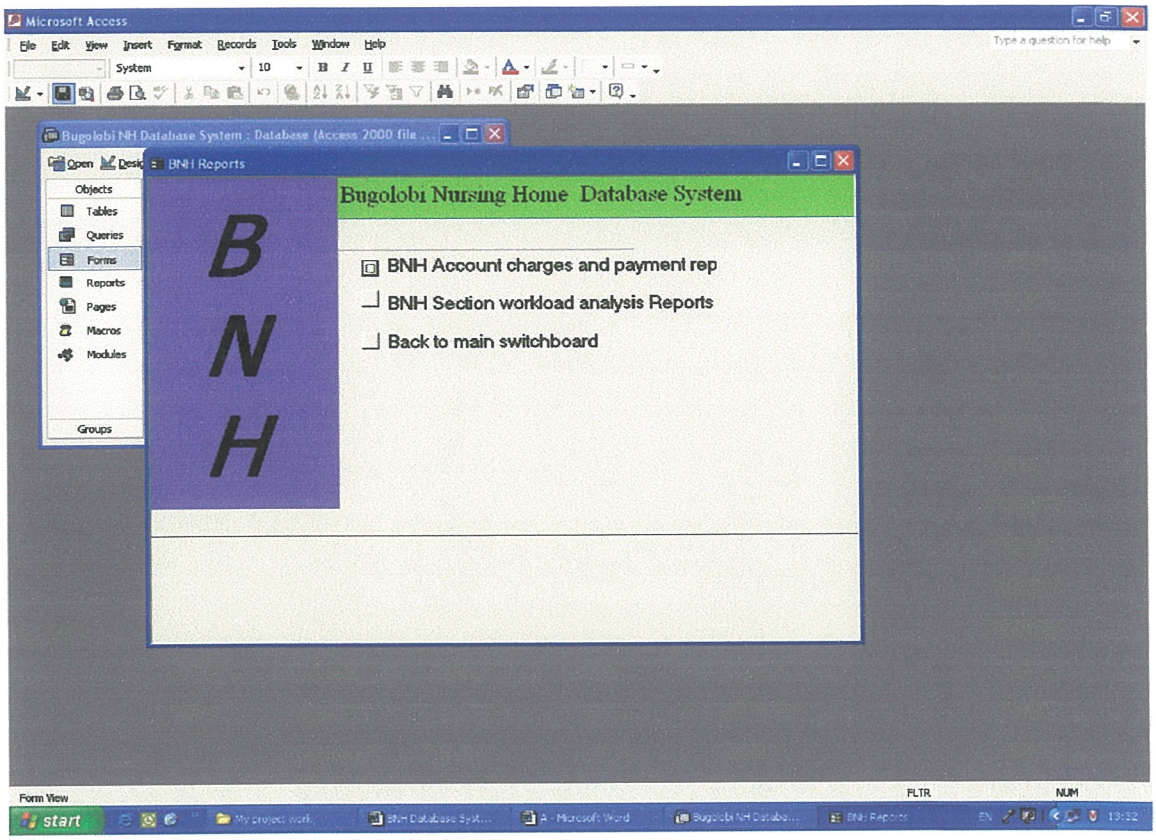


Figure 5.7: BNH Reports Sub-Switchboard

Note: When ever the system user is going to generate a report from the system it prompts him/her to enter the start and end date of the period which the report should cover.

5.3.4 Forms

Data entry forms were designed to capture data, enter it into the system, up-date it if necessary and also as a means of accessing the data already entered into the system. A number of forms were designed in line with the items on the BNH forms Sub-switchboard. These forms included

a. Patient Registration Form

This option enabled the system users to enter and up-date patient registration details, the form was accessed and data was entered during the time when the patient attended the hospital for the first time, patient details entered into the system during registration include Patient Number which was allocated to the patient during registration and was unique for each patient, patient's first name, last name, sex, date of birth, residential address, Company/Family which the patient was attached to, telephone contact, patient email, date of first visit, Account Number and account name.

Note: A patient was only registered once when he visits the hospital (on the first day he/she attends the hospital), patient details were only modified when changes occurred say change in residence, change in organisation where the patient works

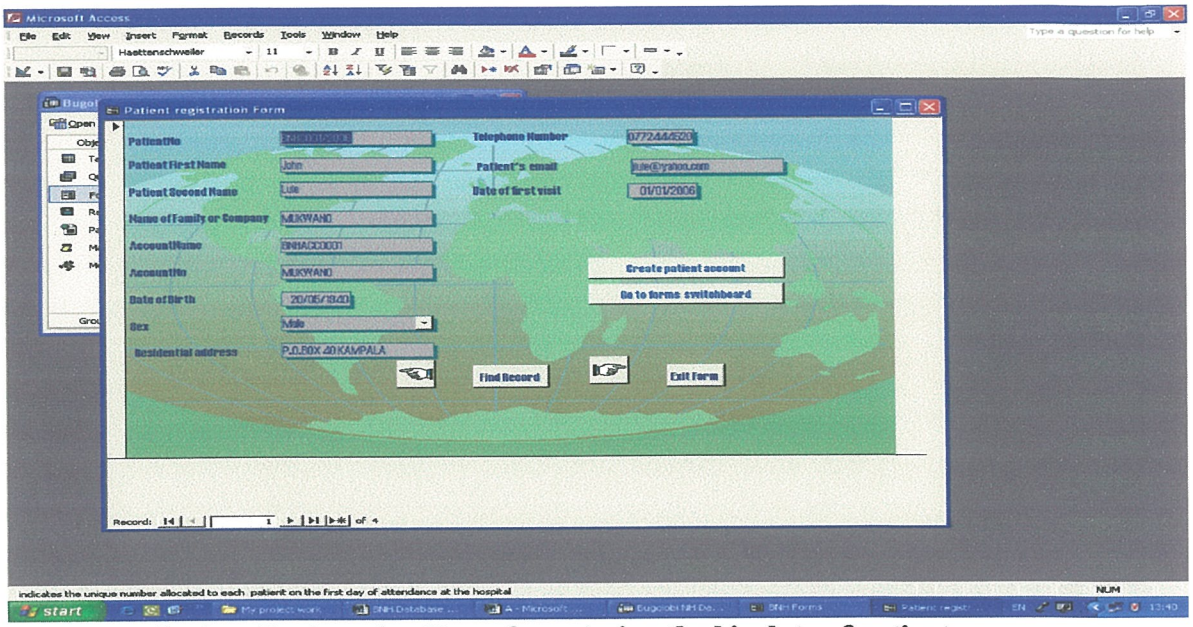


Figure 5.8: Patient Registration Form for entering the bio data of patients

2. Clinician's Details Form

This option enabled the user to enter and edit details regarding the clinicians who offered treatment to the patients at the hospital and it included details such as Clinician code and Clinician Names.

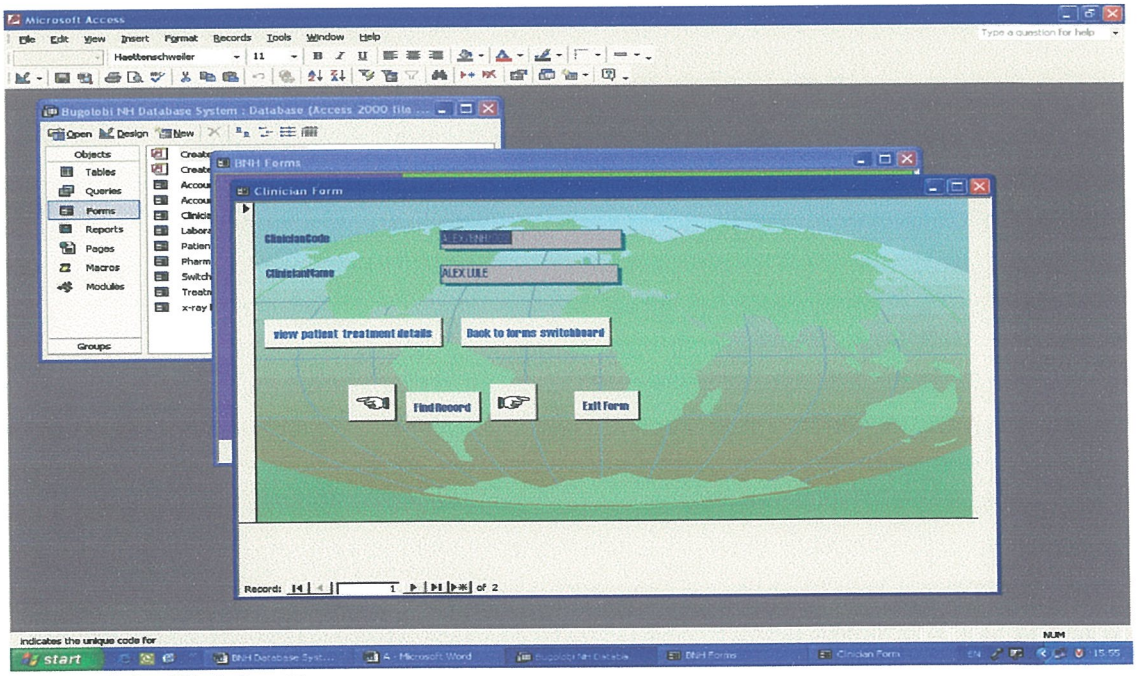


Figure 5.9: Clinician Form

3. Accounts Names Details

This enabled the user to add up-date and edit the account details regarding the patient/family and company account details; it included details such as account name and account number. All patients offered services at the hospital were charged standard fees and such charges were posted on individual patient accounts or a Company/Family account.

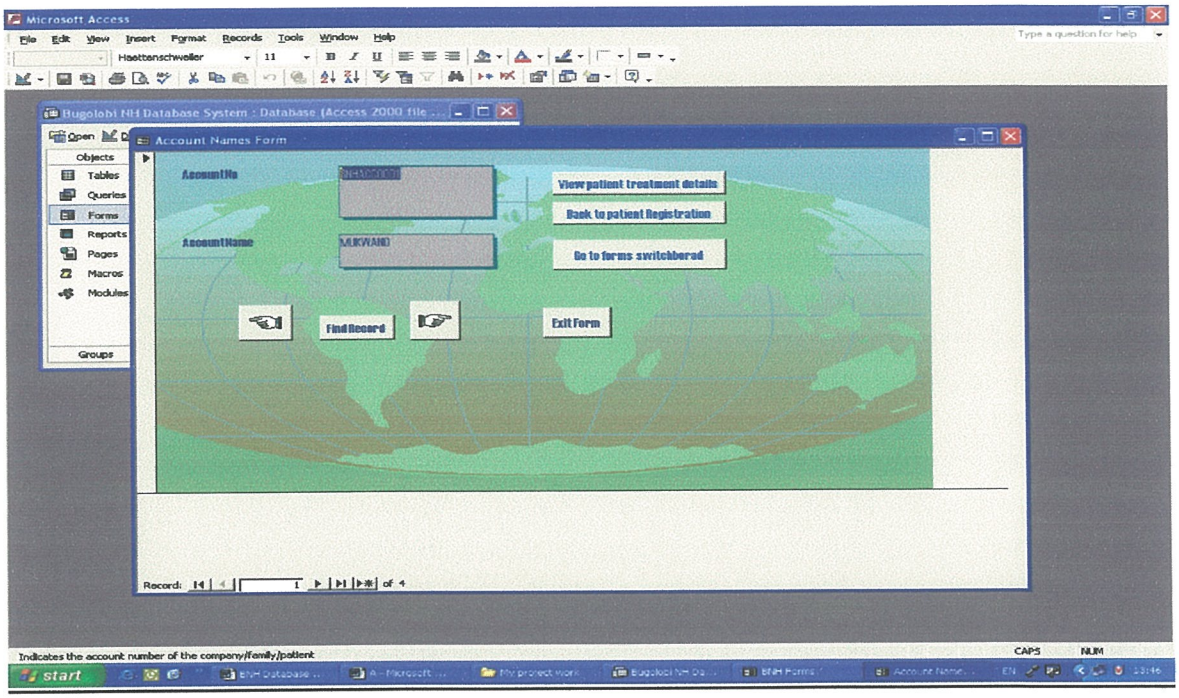


Figure 5.10: Account Names Form

4. Account Payment Form

This allowed the user to enter details regarding account payments made on individual patient accounts, Company accounts and or family accounts, details which were entered on this form include account number, date of payment and payment made.

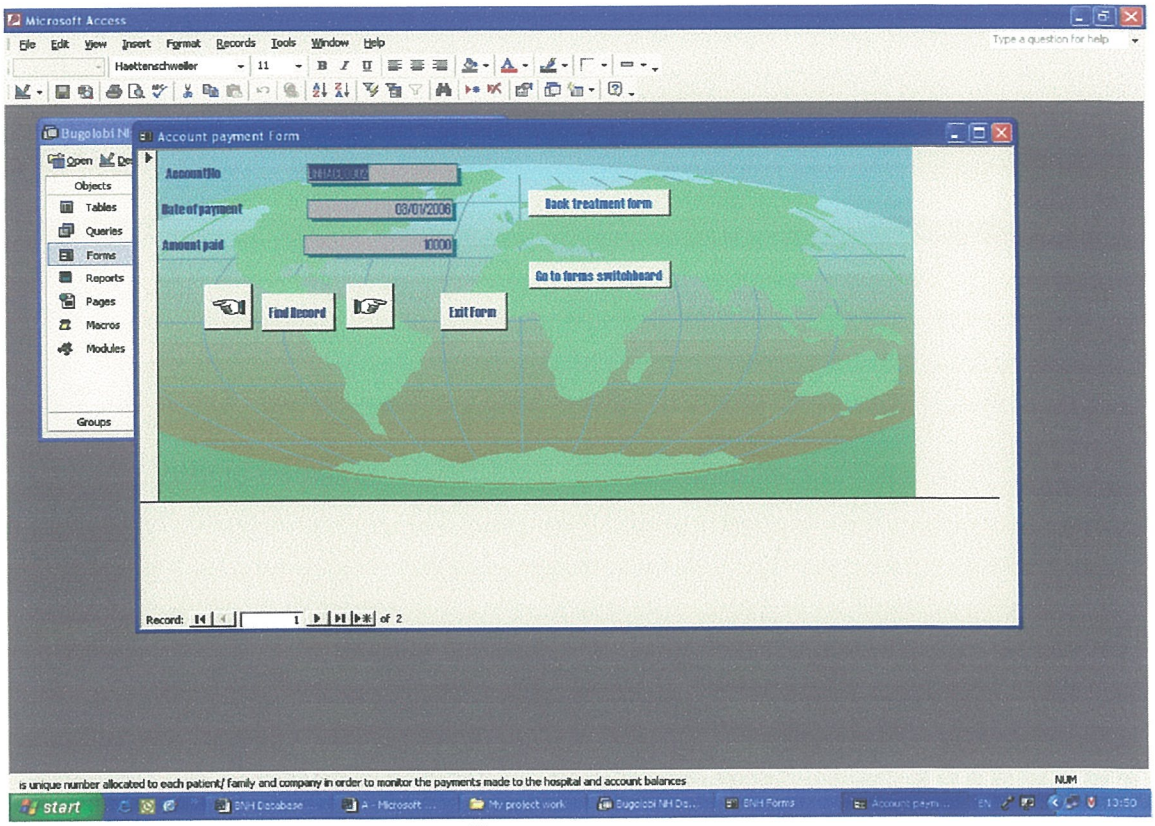


Figure 5.11: Account Payments Form

5. Patient Treatment Form

This option enabled the system users to add, up-date and even had access to patient treatment details, details entered in this form included patient treatment number, patient number, date of visit, diagnosis, visit number within the month, visit charge, treatment given, clinician code, date of next visit and account number. Data on this form was entered into the system whenever a patient comes for treatment at the hospital.

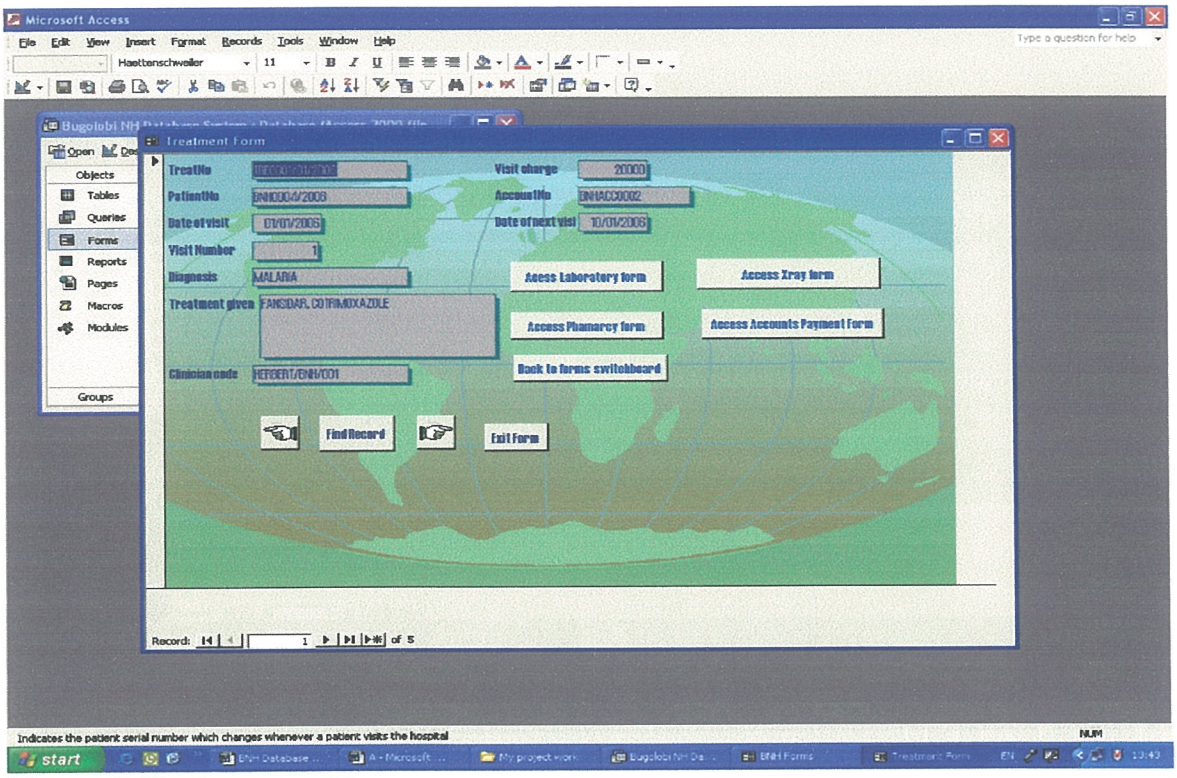


Figure 5.12: Treatment Form

This form contains links to various individual hospital section forms such as X-ray form, pharmacy form, laboratory form and also the accounts payment form

6. X-ray Form

This option enabled the user to add, edit and also have access to details of x-ray investigations taken by the patients, it contained details such as Treatment number, patient number, date of visit, x-ray number, x-ray investigation carried out and number of films used. Details entered in the x-ray form were only gathered from the patients who take x-rays at the hospital.

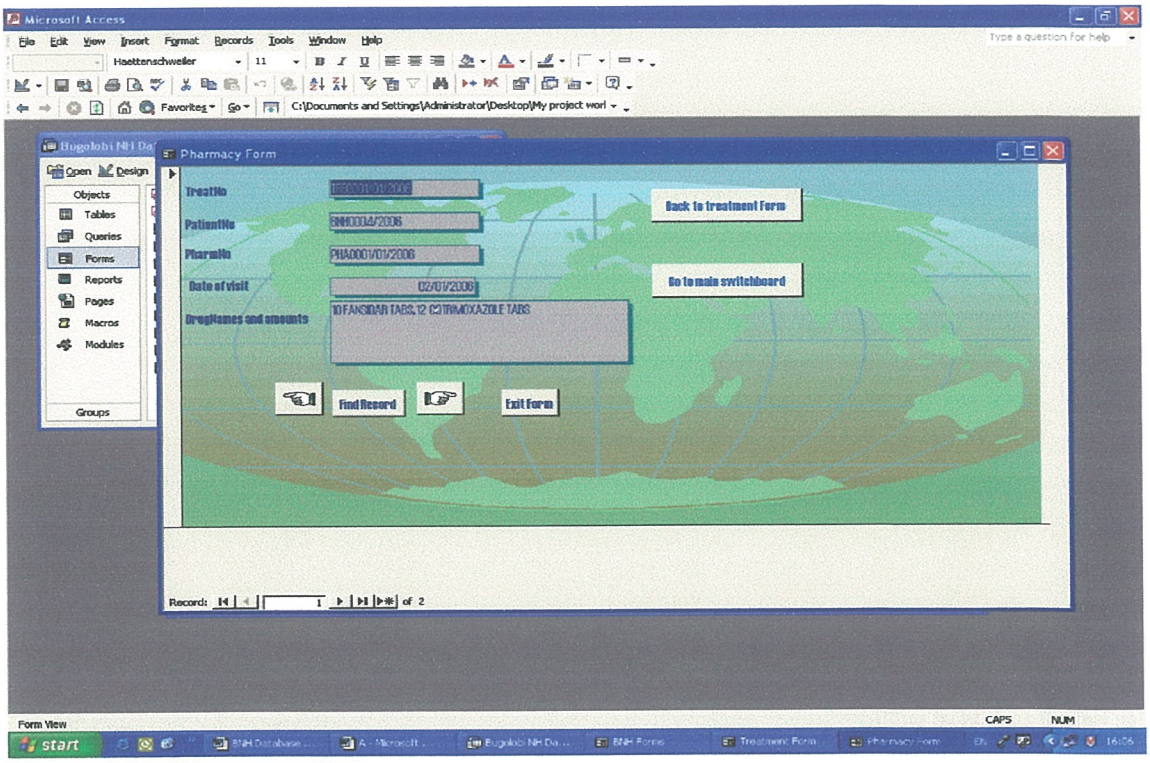


Figure 5.14: Pharmacy Form

8. Laboratory Form

This option enables the system users to add, up-date and even access laboratory details, details captured on this form include Treatment number, Patient number, Laboratory number, date of visit, laboratory test conducted and results of the test.

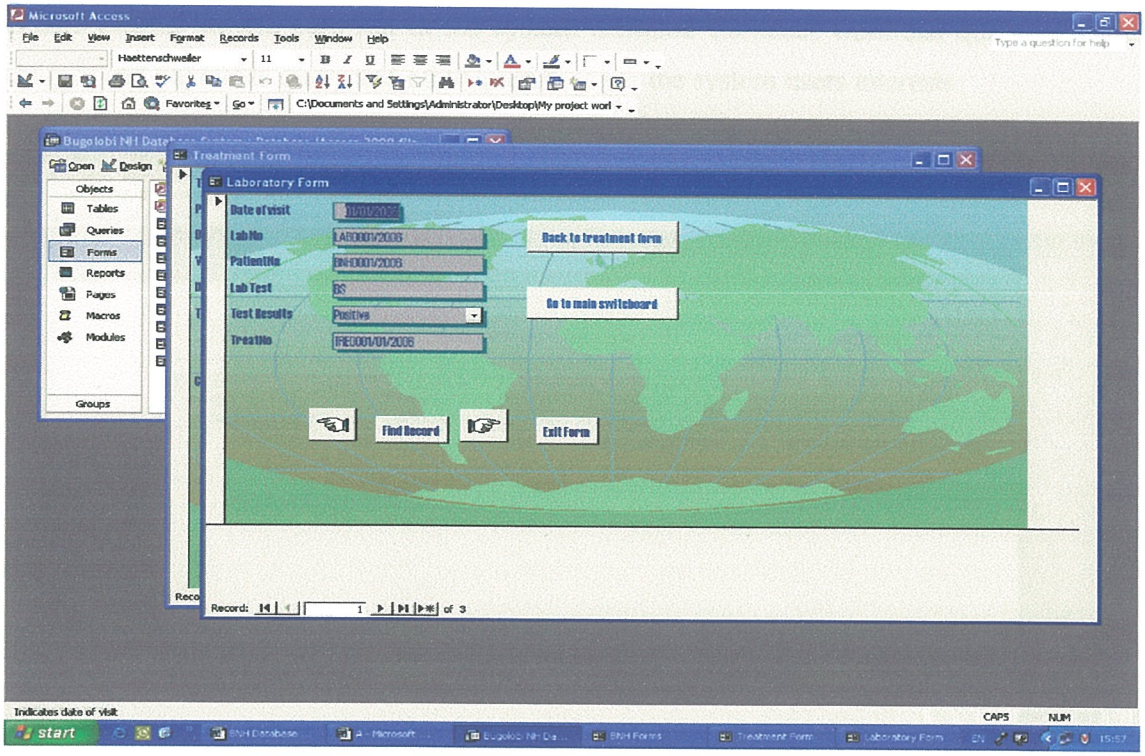


Figure 5.15: Laboratory Form

Note: All the forms discussed above had links to either the forms switchboard or main switchboard and some had links to the treatment form

5.4 Testing

For the purpose of the study, testing was done in order to demonstrate that BNH Database System prototype worked according to the specifications and that performance requirements appeared to be satisfactory.

Sample data was entered into the Database System and outputs reflected in form of queries and reports were produced as demonstrated below:

1. BNH Section workload analysis query for 01/01/2005

This option helped the system users to run a query in order to display details regarding the patients who visited each hospital section on particular clinic days and it also displayed the dates when the patients visited the hospital section. These details helped the management to understand the patient workload in each section and the management of the hospital based on such details to plan for the hospital as in terms of resources required in each section such resources included personnel, equipments and other resources.

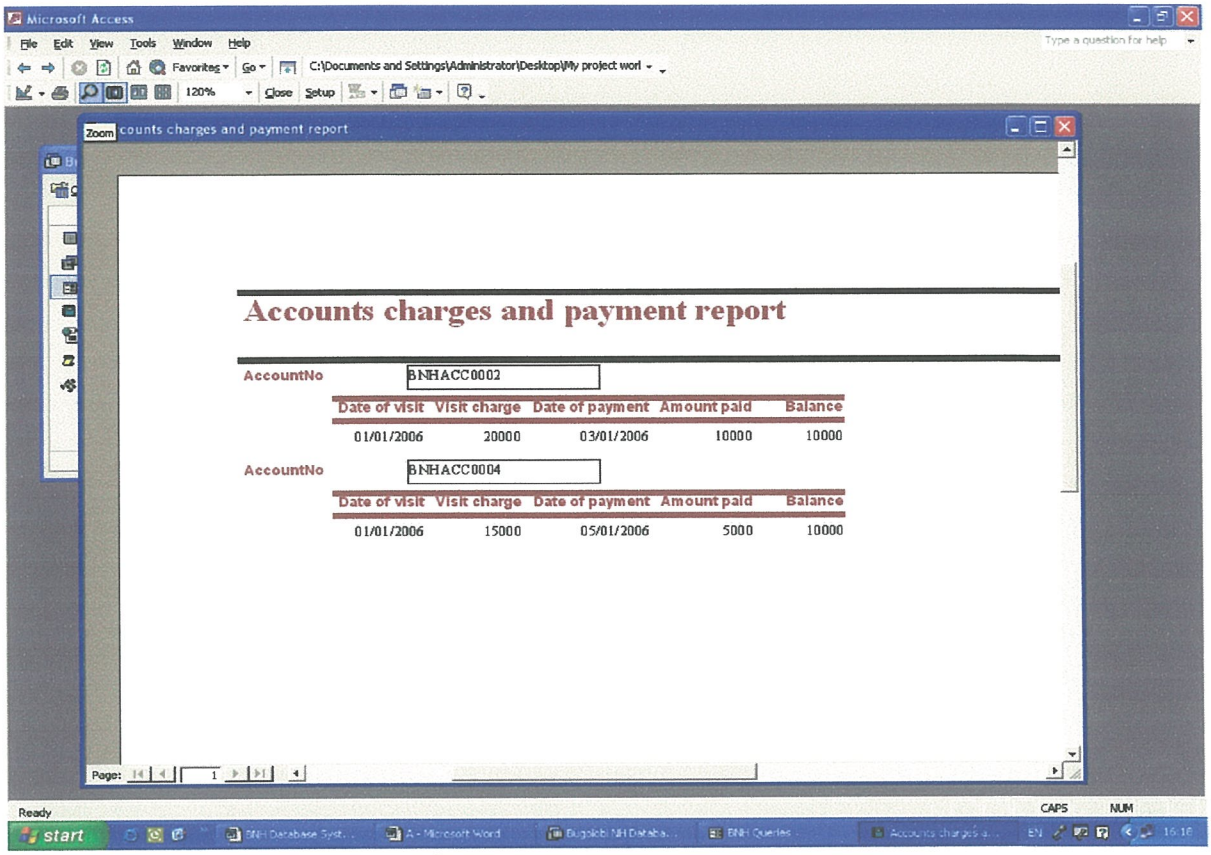


Figure 5.17: Account charges and payment report

Chapter Six

6.0 Discussion, Conclusion and Recommendations

6.1 Discussion

The prototype system demonstrated an effective operation and indeed the system managed to achieve the objectives of how a database management system enabled smooth and effective management of outpatient data in a hospital from a complete manual setting which had a number of weaknesses.

In order to generate the patient forms, reliance was based on the sample information relating to the patient records of BNH hospital for the period of January 2006. Other information concerning hospital sections, clinician details was also collected from the hospital and input into the system.

Date entry forms that capture each detail of the patient data allow automatic generation of reports on a periodic basis for example weekly, monthly and even annually according to the interest of the system users.

Based on the presentations and statements above, it was seen that the system had the capability of generating a number of automated queries and reports and in addition to that the report generator allowed the creation of specific management reports that were produced when required.

Looking at the objectives of the system and the outputs produced by the system, it was evidenced that the requirements had been achieved. The system was being implemented concurrently with the old system (manual system).

6.2 Limitations of the study.

1. Few staffs were sensitized on the importance and value of having reliable, accurate and timely information.
2. Most of the BNH staffs were found to be computer illiterate.
3. Limited funds to implement the project effectively e.g. funds to procure additional computers, server and to enable the installation of a network at the hospital, funds also required to train all the staff in computer skills.
4. Staffs were found to be so busy on the daily work schedules and did not get enough time to understand how the system works.
5. Limited time for the project work to enable the developer add additional features to the system and expand the system.

6.3 Recommendations.

1. Need for further programming to be carried out to enable the system cover all the hospital sections since currently the system covers only the Outpatient sections of the hospital.
2. There is only one computer at the hospital which was placed at the reception hence there is need to procure additional computers so that each section within the hospital has a modern computer to enable easy access of patient and individual section data.
3. Need to install a network to enable efficiency and effectiveness in access and regular up-dating of the data entered into the system.
4. Procurement of a good capacity server to enable back-up of data stored in the system and linkage between the computers and other peripheral devices.
5. Training of the entire staff and administration in computer skills and on how to use the database management system.

6.4 Conclusion

The stated objective of developing a database management system was to enable effective management of Outpatient information in BNH was achieved. A number of experiments on the system where carried out to some extent represent an objective conclusion to be drawn regarding the efficiency and the effectiveness of the overall hospital database management system encoded.

Appendices

Appendix A: Glossary

No.	Term	Definition
1.	Acronyms	Short forms for long word
2.	Attributes	Powerful features of the product
3.	Back-up	Support facility incase of failure
4.	Client	Refers to a person who attends the hospital to benefit from the services offered at the health unit (he/she may not be necessarily sick)
5.	Constraints	Limitations
6.	Data	Consist of facts, text, graphics, images, sound, and video segments that have meaning in the users' environment
7.	Database	A collection of information organized in such a way that a computer program can quickly select desired pieces of data. It can also be referred to as an electronic filing system.
8.	Database Application	Is an application program or set of related programs that is used to perform a series of database activities e.g. creating, reading, updating and deleting data
9.	Functional requirements	What the system can do
10.	Hard disk	Immovable storage space in the CPU
11.	Hospital	This refers to a place where people come for a number of health services such as treatment on several diseases, immunisation, laboratory tests, delivering etc
12.	Information	Is data that has been processed in such way that it can increase the knowledge of the person who uses it

13.	Inpatients	These are people who come for treatment (sick people) at the hospital and during the examinations they are found with severe illnesses and they are later admitted at the hospital to easy follow-up by the clinicians
14.	Input	Raw data
15.	Network	Group connection of computers
16.	Outpatients	These are people who come for treatment (sick people) at the hospital and after the treatment they go back to their respect homes hence do not remain at the hospital for continuous follow-up
17.	Output	End result
18.	Password	Secret key to log on
19.	Patient	Refers to a person who comes to the hospital when they are sick and they want to get treatment
20.	Processing	Manipulation
21.	Registration	This is a procedural requisite undertaken to ascertain the amount, stage, evidence of a happening. This is usually done by taking particulars of that item or of the person(s).
22.	Update	Make records as at current
23.	Validate	Confirmation of data

Appendix B: References

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18. Vowles, J. (2001). Electioneering Communications Database (2nd). MacMillian Reference, USA.

Appendix C: Source Code

1. Account Balances Form

```
Private Sub AccountNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Amount_paid_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Balance_BeforeUpdate (Cancel As Integer)
```

2. Account Name Details Form

```
Private Sub AccountName_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub AccountNo_BeforeUpdate(Cancel As Integer)

End SubEnd Sub
```

3. Clinician Form

```
Private Sub ClinicianCode_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub ClinicianName_BeforeUpdate(Cancel As Integer)

End Sub
```

4. Hospital Section Form

```
Private Sub SectionCode_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub SectionName_BeforeUpdate(Cancel As Integer)

End Sub
```

5. Laboratory Form

```
Private Sub Lab_No_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Lab_Test_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub PatientNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Test_Results_BeforeUpdate(Cancel As Integer)

End Sub
```

6. Patient Registration Form

```
Private Sub AccountName_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub AccountNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Date_of_Birth_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Date_of_first_visit_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Name_of_Family_or_Company_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Patient_First_Name_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Patient_s__email_BeforeUpdate(Cancel As Integer)
```

```
End Sub

Private Sub Patient_Second_Name_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub PatientNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Residential_address_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Sex_BeforeUpdate(Cancel As Integer)

End Sub
```

7. Pharmacy Form

```
Private Sub DrugNames_and_amounts_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub PatientNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub PharmNo_BeforeUpdate(Cancel As Integer)

End Sub
```

8. Treatment Form

```
Private Sub AccountNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub ClinicianCode_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Date_of_next_visit_BeforeUpdate(Cancel As Integer)

End Sub
```

```
Private Sub Date_of_visit_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Diagnosis_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub PatientNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Section_visited_1_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Section_visited_2_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Section_visited_3_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Section_visited_4_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Section_visited_5_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Serial_No_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Treatment_given_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub Visit_Number_BeforeUpdate(Cancel As Integer)

End Sub
```

9. Switchboard

```
Private Sub Form_Open(Cancel As Integer)
' Minimize the database window and initialize the form.

    ' Move to the switchboard page that is marked as the default.
    Me.Filter = "[ItemNumber] = 0 AND [Argument] = 'Default' "
    Me.FilterOn = True

End Sub

Private Sub Form_Current()
' Update the caption and fill in the list of options.

    Me.Caption = Nz(Me![ItemText], "")
    FillOptions

End Sub

Private Sub FillOptions()
' Fill in the options for this switchboard page.

    ' The number of buttons on the form.
    Const conNumButtons = 8

    Dim con As Object
    Dim rs As Object
    Dim stSql As String
    Dim intOption As Integer

    ' Set the focus to the first button on the form,
    ' and then hide all of the buttons on the form
    ' but the first.  You can't hide the field with the focus.
    Me![Option1].SetFocus
    For intOption = 2 To conNumButtons
        Me("Option" & intOption).Visible = False
        Me("OptionLabel" & intOption).Visible = False
    Next intOption

    ' Open the table of Switchboard Items, and find
    ' the first item for this Switchboard Page.
    Set con = Application.CurrentProject.Connection
    stSql = "SELECT * FROM [Switchboard Items]"
    stSql = stSql & " WHERE [ItemNumber] > 0 AND [SwitchboardID]=" &
Me![SwitchboardID]
    stSql = stSql & " ORDER BY [ItemNumber];"
```

```
    Set rs = CreateObject("ADODB.Recordset")
    rs.Open stSql, con, 1   ' 1 = adOpenKeyset

    ' If there are no options for this Switchboard Page,
    ' display a message.  Otherwise, fill the page with the items.
    If (rs.EOF) Then
        Me![OptionLabel1].Caption = "There are no items for this switchboard page"
    Else
        While (Not (rs.EOF))
            Me("Option" & rs![ItemNumber]).Visible = True
            Me("OptionLabel" & rs![ItemNumber]).Visible = True
            Me("OptionLabel" & rs![ItemNumber]).Caption = rs![ItemText]
            rs.MoveNext
        Wend
    End If

    ' Close the recordset and the database.
    rs.Close
    Set rs = Nothing
    Set con = Nothing

End Sub

Private Function HandleButtonClick(intBtn As Integer)
' This function is called when a button is clicked.
' intBtn indicates which button was clicked.

    ' Constants for the commands that can be executed.
    Const conCmdGotoSwitchboard = 1
    Const conCmdOpenFormAdd = 2
    Const conCmdOpenFormBrowse = 3
    Const conCmdOpenReport = 4
    Const conCmdCustomizeSwitchboard = 5
    Const conCmdExitApplication = 6
    Const conCmdRunMacro = 7
    Const conCmdRunCode = 8
    Const conCmdOpenPage = 9

    ' An error that is special cased.
    Const conErrDoCmdCancelled = 2501

    Dim con As Object
    Dim rs As Object
    Dim stSql As String

On Error GoTo HandleButtonClick_Err
```

```
    ' Find the item in the Switchboard Items table
    ' that corresponds to the button that was clicked.
    Set con = Application.CurrentProject.Connection
    Set rs = CreateObject("ADODB.Recordset")
    stSql = "SELECT * FROM [Switchboard Items] "
    stSql = stSql & "WHERE [SwitchboardID]=" & Me![SwitchboardID] & " AND
[ItemNumber]=" & intBtn
    rs.Open stSql, con, 1    ' 1 = adOpenKeyset

    ' If no item matches, report the error and exit the function.
    If (rs.EOF) Then
        MsgBox "There was an error reading the Switchboard Items table."
        rs.Close
        Set rs = Nothing
        Set con = Nothing
        Exit Function
    End If

    Select Case rs![Command]

        ' Go to another switchboard.
        Case conCmdGotoSwitchboard
            Me.Filter = "[ItemNumber] = 0 AND [SwitchboardID]=" & rs![Argument]

        ' Open a form in Add mode.
        Case conCmdOpenFormAdd
            DoCmd.OpenForm rs![Argument], , , , acAdd

        ' Open a form.
        Case conCmdOpenFormBrowse
            DoCmd.OpenForm rs![Argument]

        ' Open a report.
        Case conCmdOpenReport
            DoCmd.OpenReport rs![Argument], acPreview

        ' Customize the Switchboard.
        Case conCmdCustomizeSwitchboard
            ' Handle the case where the Switchboard Manager
            ' is not installed (e.g. Minimal Install).
            On Error Resume Next
            Application.Run "ACWZMAIN.sbm_Entry"
            If (Err <> 0) Then MsgBox "Command not available."
            On Error GoTo 0
            ' Update the form.
            Me.Filter = "[ItemNumber] = 0 AND [Argument] = 'Default' "
```

```
            Me.Caption = Nz(Me![ItemText], "")
            FillOptions

        ' Exit the application.
        Case conCmdExitApplication
            CloseCurrentDatabase

        ' Run a macro.
        Case conCmdRunMacro
            DoCmd.RunMacro rs![Argument]

        ' Run code.
        Case conCmdRunCode
            Application.Run rs![Argument]

        ' Open a Data Access Page
        Case conCmdOpenPage
            DoCmd.OpenDataAccessPage rs![Argument]

        ' Any other command is unrecognized.
        Case Else
            MsgBox "Unknown option."

    End Select

    ' Close the recordset and the database.
    rs.Close

HandleButtonClick_Exit:
On Error Resume Next
    Set rs = Nothing
    Set con = Nothing
    Exit Function

HandleButtonClick_Err:
    ' If the action was cancelled by the user for
    ' some reason, don't display an error message.
    ' Instead, resume on the next line.
    If (Err = conErrDoCmdCancelled) Then
        Resume Next
    Else
        MsgBox "There was an error executing the command.", vbCritical
        Resume HandleButtonClick_Exit
    End If

End Function
```

X-ray Form

```
Private Sub No_of_films_taken_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub PatientNo_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub X_ray_Investigation_BeforeUpdate(Cancel As Integer)

End Sub

Private Sub X_ray_No_BeforeUpdate(Cancel As Integer)

End Sub
```