

CHRISTEN SERVICE UNIVERSITY COLLEGE

DEPARTMENT OF COMPUTER SCIENCE



**THE AUTOMATION OF PATIENTS' RECORDS KEEPING SYSTEM FOR HEALTH
CLINICS.**

CASE STUDY GROUND: MATTER DEI CLINIC.

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DEDICATION

We wish to dedicate this project to our beloved families for their immense support in terms of prayers and encouragement when the going was tough.

Secondly, our appreciation goes to our respective churches for their spiritual guidance, material and financial support. May the good Lord shower his endless blessings on all who made this project a success.

ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to the Almighty God for the gift of life, wisdom and understanding he had given to us, and to our families for the love and support they had provided throughout our life.

Also to our project supervisor Mr. Phanael S.K. Asense whom we regard most. We thank him for the expertise and intelligence he has displayed while supervising this project. We believe this good work is a result of his good guidance and cooperation. We are grateful to you for doing your best in giving us part of your valuable time and also caring so much.

We also thank the staff of Matter Dei clinic for rendering us the needed attention during the Study and Analysis stage. They had been particularly helpful in providing the necessary data about the manual patient record keeping system.

ABSTRACT

Patient's record management systems in hospital/clinic today are necessary for optimum hospital/clinic administration. When handling patients, generating various health reports, patient details or data serves as a key factor for the flow of transactions in health centres and it is better when it is automated or computerized. Unfortunately the paper-based Record management system leads to delay and hence late release of reports and insecurity to records. This research project is aimed at automating all the records on patients and staff in health clinics. In order to achieve this goal, a thorough System Study was carried out. Information was gathered and analyzed about the current or existing system. Data flow diagrams and flowcharts were used to model the system.

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CHAPTER ONE

INTRODUCTION

1.0 Background Of Study

In today's modern age where computer has become a way of life, it is evident that a majority of the country's institutions still have not adapted to the use of high technology.(Quashigah, 2005). Particularly in most medical clinic facilities, daily clinic transactions are still done on paper. We all know that, modern clinics are now operating at great pace striving to serve as many patients as possible to the best of their abilities. But as the years rolled by, the number of patients has grown and various medical cases arise that the paper based method of managing patients' records, prescriptions, billing and appointment schedule, is no longer practicable. Hospitals deal with the life and health of their patients. Good medical care relies on well-trained doctors and nurses and on high-quality facilities and equipment. Good medical care also relies on good record keeping. Without accurate, comprehensive up-to-date and accessible patient case notes, medical personnel may not offer the best treatment or may in fact misdiagnose a condition, which can have serious consequences.

Now more than ever, people have become more health conscious and taking necessary steps to ensure that they have a sound body and mind – that is why everyday, many people come to clinics or health facilities for check-ups and treatments. The health of citizens is the wealth of a Nation,(Debnath, 2012).By using the cutting edge technologies,Patients' Record Keeping can be improved with efficient work flow and communication. Details of the Patients, their previous visits are totally not perceptible without a computer. Relevant piece of information are always stored in the computer and are available instantly in front of the user.

A medical clinic is primarily devoted to the diagnosis and care of patients. Available online at: www.linkedin.com/pub/ratul-debnath [accessed 12th November 2012]

Basically, patients spend a substantial amount of time in clinics waiting for services to be delivered by the doctor or a health professional. The degree to which the patients are satisfied with the care received is relative not only to the doctors' expertise in their field, but also to the quality of the clinic management. We all know that, as the number of patients continually increase, managing a clinic can also become increasingly difficult, especially if everything is done manually.

Though, there are very good hospital management systems or software that does records keeping, most of these clinics can't afford them and also, there are many complex functions which may not be needed by clinics. These functionalities that come with the system make it undesirable for use by the clinics. It is in view of this that, we hope to develop a software that is less costly but efficient and user friendly for clinics, particularly for Matter Dei Clinic. In lieu of this, we hope to develop a web-based application that will minimize lots of paper works and paper-based records keeping, therefore allowing doctors and staff ease in keeping track of patients, reducing patients' waiting time and increasing the number of patients served a system that is automated, user-friendly, time effective and efficient.

1.1 Problem Statement

As mentioned earlier, computers have become a way of life and it is also evidently clear that, majority of institutions in Ghana still have not adapted to the use of technology and efficient data management. Available online at: www.moh-ghana.org/UploadFile/Publication/Ghana-E-Health [Accessed 9th November, 2012].

Particularly, in most of clinic facilities, daily transactions are still done on paper. We all know that modern clinics are now operating at great pace striving to serve as many patients as possible to the best of their abilities. But as the years go by, the increasing number of patients and various medical cases that arise can no longer be dealt with or managed by paper-based methods of patients' records keeping, prescriptions, billing and schedule management. This project will look at improving the efficiency level of health clinics by computerising their existing way of records keeping.

1.2 Aim And Objectives

1.2.1 General Objective (s)

The general objective of this study is to design and develop a Web-based clinic patient records management solution for Mater Dei clinic that will help in expediting health care delivery and hence improving their efficiency level.

1.2.2 Specific Objective(s):

- (i) Studying the existing system – Mater Dei clinic's paper based record keeping and eliciting its bottlenecks.
- (ii) Model the existing system's processes. i.e. Mater Dei clinic's processes
- (iii) Analyzing and identify processes of the existing system that can be automated
- (iv) Model the proposed or "to-be" system that will;
 - a) allow doctor to retrieve complete patient history instantly
 - b) automate billing statement and official receipt
 - c) ensure effective records keeping and retrieval
 - d) speed up report and account generation procedure
 - e) ensure security regarding clinic information
- (v) Assess the efficiency level of the "to-be" system

1.3 Research Question

The main research question is:

“How will the computerization of the records keeping system impart on the efficiency of the health clinic”?

To answer the aforementioned questions, further sub-questions have been defined as follows:

- a) What is the current or existing system?
- b) What are the common problems encountered by the existing system?
- c) What are the possible solutions to the problems encountered by the current system?
- d) What is the difference between the existing system and the proposed system?

To achieve these objectives, the current system of Matter Dei is to be studied and setbacks in the current system elicited. To do this, various reports from departments and other vital sources will be reviewed to extract the required information.

The outcome of the literature review will serve as the basis to formulate key and relevant questions for interviewing the stakeholders of the system.

1.4 Research Design (Methodology)

The study encompasses both theoretical and analytical approach. The diagram (figure 1.1) depicts the roadmap to conducting interview, historical review and possible development of questionnaires for the existing system. The above will form the first phase. Literature review which is made-up of reviewing of various department reports, reading on related work and on the concept of efficiency will be done in parallel to frame vital questions for interviewing. Some heads of departments - possibly three in number-, some users and some selected patients will be interviewed. The output of the interview will serve as the basis for

understanding the existing system. In the event that questionnaires are required, department heads, users and patients shall be the target. Approximately twenty questions may be required. The questionnaires and the interviews are expected to portray the hold-ups in the system; how things are done in various sections, tools and procedures used, and whether there is a need for change.

Phase two, which is modeling and optimization will take five weeks. Analysis on the gathered data or information will be done in two weeks to create a model of the existing system. The remaining weeks in phase two will serve as a period for modeling the proposed system. In the last phase, Unified Modeling Language (UML) diagram will then be created for the proposed system to help explain user-system interaction. Stakeholders will then analyze the final design.

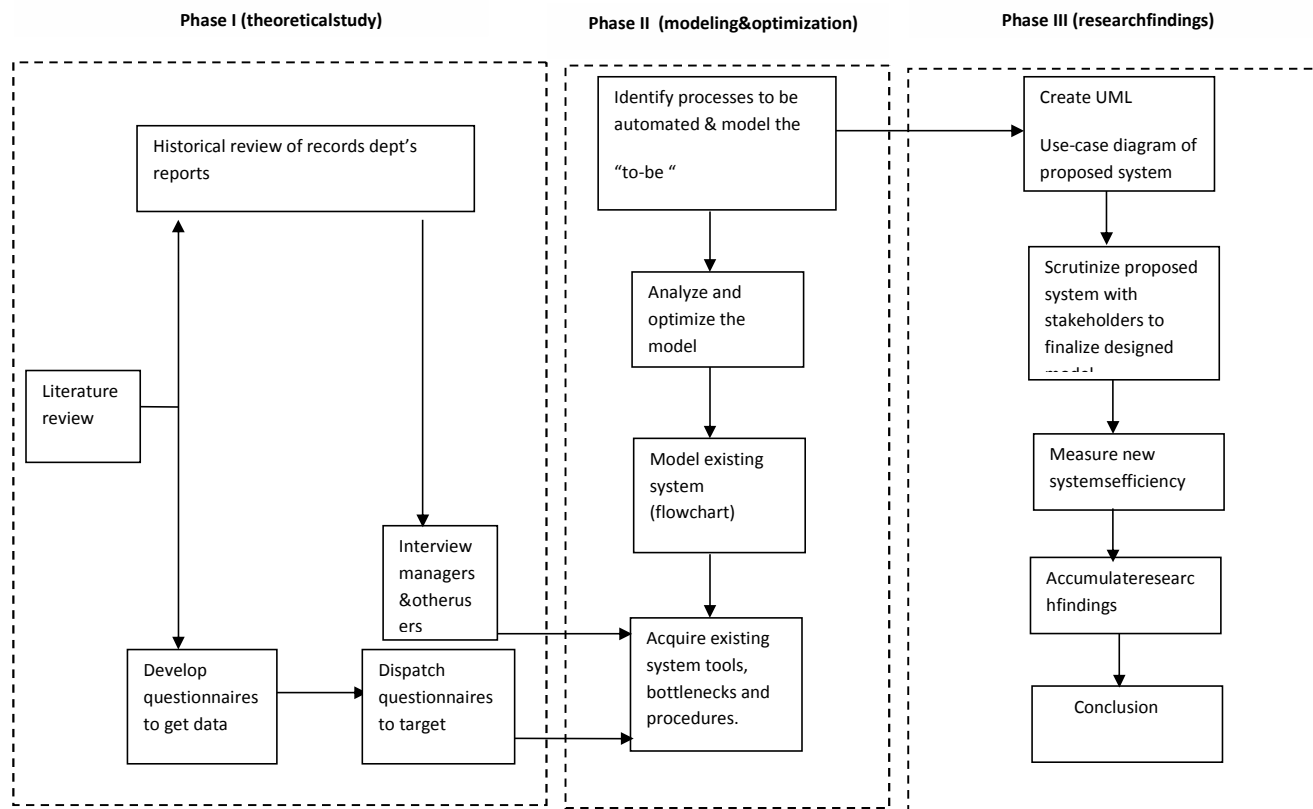


Figure 1.1 : A diagram on the Research Design

1.4.1 Tools for development

The software required for developing the *automation of patients' records keeping system for health clinics* will be;

SQLyog is a graphic user interface (GUI) tool for the relational database management system (RDBMS) MySQL. It has the following advantage over Microsoft SQL servers.

It shows the differences between tables, indexes, columns and routines of two databases, and generating scripts to bring them in Synchronization. Just by comparing the databases, it won't synchronize the databases. It does that, only when you click on EXECUTE ALL button before, it synchronizes. So, you can see the difference by clicking on COMPARE button.

Java Enterprise Edition (Java EE) is Oracle's enterprise Java computing platform. This platform provides an application programming interface (API) and runtime environment for developing and running enterprise software, including network and web services, and other large-scale, multi-tiered, scalable, reliable, and secure network applications.

XAMPP is designed to help webpage developers, programmers, and designers check and review their work using their computers even without connection to the web or internet. So, basically it can be used as stand-alone to stand as pages for the internet, even without connection to it. It can also be used to create and configure databases written in MySQL and/or SQLite.

GlassFish is an open source Java EE 5 application server. GlassFish is a robust, commercial, production quality, compatible application server that is free for development.

Report is a free, open source report designer for Jasper Reports and Jasper Reports Server. Create very sophisticated layouts containing charts, images, sub reports, crosstabs and much more. Access your data through Table Models, JavaBeans, Hibernate, character-separated values (CSV), and custom sources. Then publish your reports as Portable Document Format (PDF), Hypertext Markup Language (HTML), text, or Microsoft Office.

1.5 The Scope

In general, the focus of this study is directed towards the design and development of patient records management system for health clinics. The focus will be on the records unit and the consulting room modules ensuring that comprehensive information on patients are gotten and appointment are set. The research will also focus on reviewing the records department annual reports and conduct interview to know the existing system. This will throw light on their activities or processes and how they are interrelated or associated with each other. Information that will be obtained from the interviews and reports will be analyzed to know the existing systems hold-ups and hence a new system will be put forward. The study is largely dependent on the honesty, sincerity, and integrity of the respondents.

In the proposed system, a model will be made for the system, critically analyzing, optimizing and checking for possible automation of sections of the existing system. The records and consulting room modules will be the key areas for development. This is so because, from our observation, it is the point where most delays are seen and when these units are well automated, there will be great enhancement in health care delivery in health clinics.

1.6 Justification of Project

Socio-economic significance: In this study, the proposed system will inspire other students to develop effective and efficient systems for health clinics with the emphasis on reducing cost incurred by the clinics and also offering tailored services user – defined services.

Technological significance: The proposed system will introduce technology to the medical clinics that until now were still using the manual method of clinic management. The results of this study are beneficial to the following:

Clinic: The proposed system will simplify and automate everyday clinic tasks and can help optimize time spent with clients, thereby providing better service making it more profitable.

Doctors: The proposed system will make it easier for doctors to manage patient records and it will offer convenience when it comes to retrieving records.

Patients: Patients are the doctor's principal assets. And the reason why this study is conducted is to provide a solution to doctors' need to better serve their patients.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This century witnessed a giant leap in information technology. Computers are not only used to diagnose the illness or for doing surgery, but also they are used to increase efficiency in all fields. Clinical records are the most vital of clinical tools. Aggregated, they form a permanent account of individual considerations and the reasons for decisions. Even though, clinical records are essential for effective communication and good clinical care, they are often accorded low priority, poorly maintained and not readily available. Independent inquirers, health regulators and courts have repeatedly criticized the quality of records and the resulting failings of health care, available online at: www.studymode.com/essays/Local-And-Foreign-L [accessed 20th November 2012]. The work of every records department in hospitals/clinics then becomes paramount, ensuring a cut down in cost incurred on paper-based records keeping. The overwhelming nature of tasks handled by the records department and consulting unit each day has called for the use of information technology to lessen the burden by developing automated systems to assist in their operations. Available online at: www.rcgpinnovait.oxfordjournals.org/content, [accessed 20th November, 2012]

2.1 Literature Review on Related Areas

Paper-based records keeping are still by far the most common method of recording patient information for most hospitals and clinics. Majority of doctors still find their ease with pen and paper and couple with its low cost nature, it becomes hard to part with. However, as easy as they are for the doctor to record medical data at the point of care, they require a significant amount of

storage space compared to digital records. In Ghana, physical records are required to be held for a minimum of ten years. The costs of storage media, such as paper and film, per unit of information differ dramatically from that of electronic storage media. When paper records are stored in different locations, collating them to a single location for review by a health care provider is time consuming and complicated, whereas the process can be simplified with electronic records. This is particularly true in the case of person-centered records, which are impractical to maintain if not electronic (thus difficult to centralize or federate). When paper-based records are required from multiple locations, copying, faxing, and transporting costs are significant compared to duplication and transfer of digital records. Because of these issues, institutions are heavily promoting the adoption of electronic medical records keeping. Available online at: www.en.wikipedia.org/wiki/Electronic_medical_record [accessed on 10th April, 2013]

As organisations move to implement electronic medical record (EMR) systems, they are quickly discovering there is a tremendous amount of manual data entry, or many tasks that are repetitive in nature, which delay the benefits of an EMR system.

In addition to the massive amount of data populating the EMR, connections to the many different applications that consistently feed the electronic record are required. As a result, many hospitals and health organizations are beginning to appreciate that automation is an effective way to make that happen. Efficient workflow may be achieved by automating the time-consuming and error-prone manual tasks that keep staff away from more critical work. Automation software can speed the outcomes of manual tasks and ensure data accuracy.

In essence, the application becomes an electronic employee. Easy to use and cost-effective. Automation technology helps hospitals make a smooth transition to EMR systems.

Here are a few examples:

Integrating the kiosk with the EMR, the chief information officer (CIO) of a national chain of retail clinics headquartered in Tennessee found clinicians spending an inordinate amount of time manually entering patient registration information into the EMR. He made the strategic decision to use patient self-registration kiosks to expedite the registration process. By interfacing the kiosks with the EMR, the retail chain eliminated the need to manually enter registration data, such as patient demographic information. Automating the registration and data transfer process saved the organization hundreds of hours and thousands of dollars per month and ensured the accuracy of important patient data.

Paving the paperless way today, it is becoming more common for Information Technology (IT) structures to go paperless, transferring all medical paper notes, records and charts into EMRs. Citizens Memorial Healthcare (CMH), located in Bolivar, Mo., did just that.

CMH used to operate as a traditional rural hospital with regards to technology -- disparate systems and databases, no common patient identification, lack of clinical documentation systems, lack of continuity of patient care information across the delivery system and minimal IT standards. Now, CMH operates on a fully integrated, 100 percent paperless healthcare information system.

CMH automatically creates downtime reports for short- or long-term outages that help transition records from electronic to paper, providing instant access to pertinent patient information. CMH uses an automation tool that gathers and delivers important patient data to the hard drive once an

hour, 24 hours a day, unattended. The reports then get pushed to a central location where all departments can pick them up in case of a system failure. The reports are also pushed to each of CMH's long-term care facilities spread out over five counties. In addition, CMH has a second location where it stores the automation tool and transfers other important backup information in case of an extreme disaster. For CMH, automation technology has been very helpful in transitioning back to the paper records in the event of downtime so they can still tend to their patients' needs.

Hospitals and healthcare systems are constantly searching for new ways to update their IT structure in an effort to operate more efficiently improve patient care and manage rising costs.

By using automation technology, hospitals can enjoy streamlined workflow, reduced staff time and a smoother transition to and usage of their EMR system, (Mayer, 2008).

The idea that the use of computer in the workplace is a convenient tool for business transactions, started in the late twentieth century. Many companies started using computerized systems. Most of these companies started using these systems to save time and reduce costs, even though these computerized systems are rather expensive, in the long run they saved companies money. The companies saved money by making or purchasing a computerized system there by reducing paper usage and employee overtime. Since employee did not have to spend their time doing paper work, they could do their jobs faster and more efficient.

Available online at: www.megaessays.com/viewpaper[accessed 4thNovember, 2012]

The need has long existed for tools to streamline the job of information management for construction Professional. While manual, paper-based information flow on construction projects

still dominates, computers are increasingly becoming a central component of project information systems in several areas of construction management, such as scheduling, estimating well-established computer application, (Hodge and Hodgson, 1969)

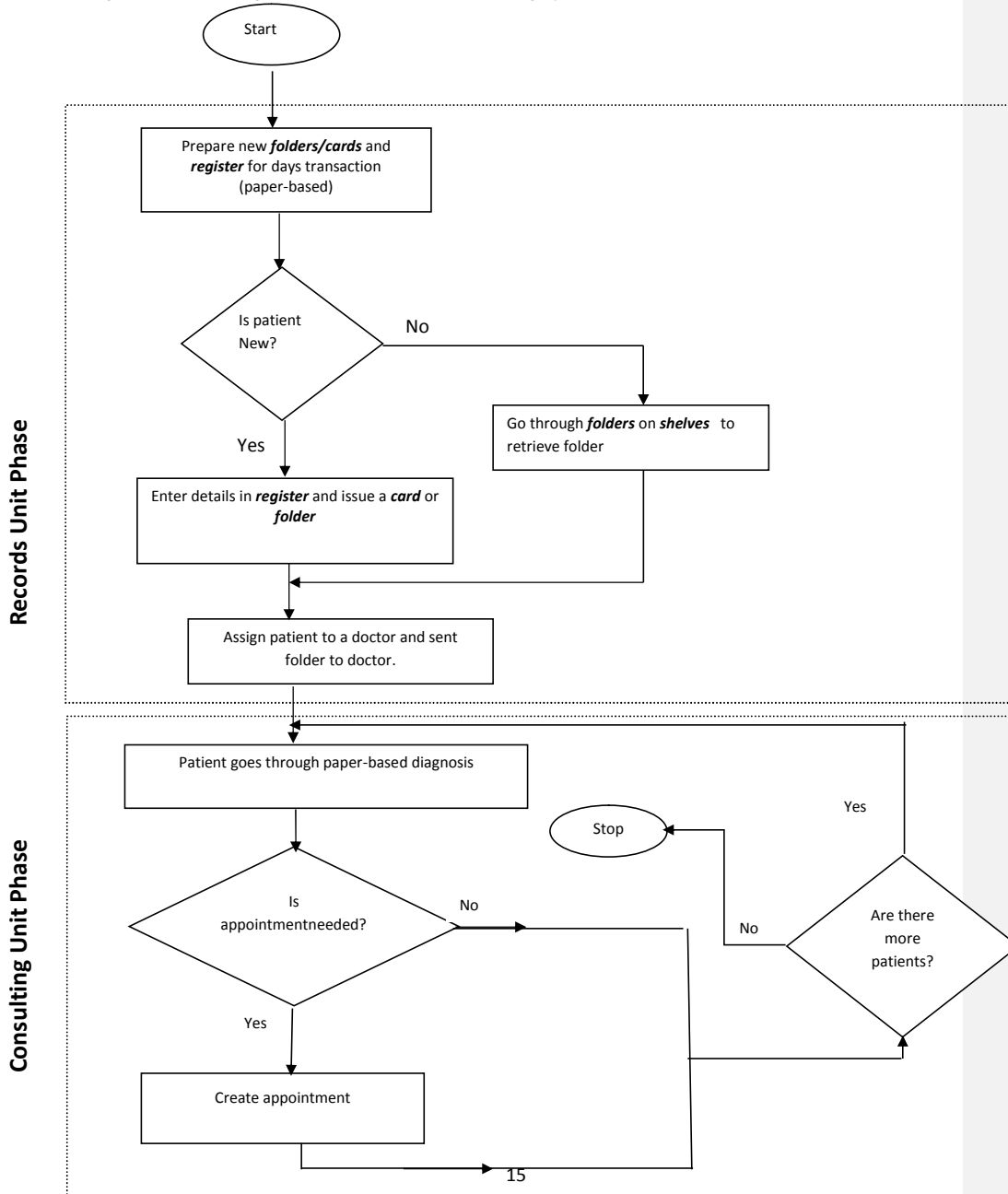
) The astronomical increase in patients' attendance at health institutions has led to the creation of large volumes of records, thereby confronting medical records managers with the challenges of managing these records. The problem is compounded when patients' medical records are maintained with manual records retrieval systems. At the Ridge Hospital, the manual medical records tracking system contributes immensely to the problem of missing patients' medical records and delays and long queues patients endure before receiving medical treatment,(Adjei and Tetteh, 2005).

Quite a number of automation of patient records keeping for hospitals/clinics have been developed throughout the world. Amongthem are the following:

-) LeonardoMD Renaissance
-) AthenaClinicals
-) AmazingCharts
-) Medios EHR

Almost all records department in hospitals/clinics have similar goals, i.e. to facilitate the storing and retrievals of patients records. But the workflow differ from organisation to organisation, thus, mediocrity software application won't work; yet, the existing software applications are still relevant and will be considered. Organizing the modules to modernized and fit the workflow of the organisation will make the difference.

Fig. 2.0 shows the general workflow in the existing system.



The existing system's workflow framework. Figure 2.0

From the review of existing systems, the following were some of the problems seen;

1. long queues and diffidently in queue management
2. missing patient files or document
3. poor diagnosis on the part of Doctors because of missing patient historical document or difficulty in retrieving them
4. Poorly designed electronic systems also brought delays in capturing patient data.
5. Systems designed for hospitals are too complex for clinics to manage and also are too expensive for the health clinics to bare.

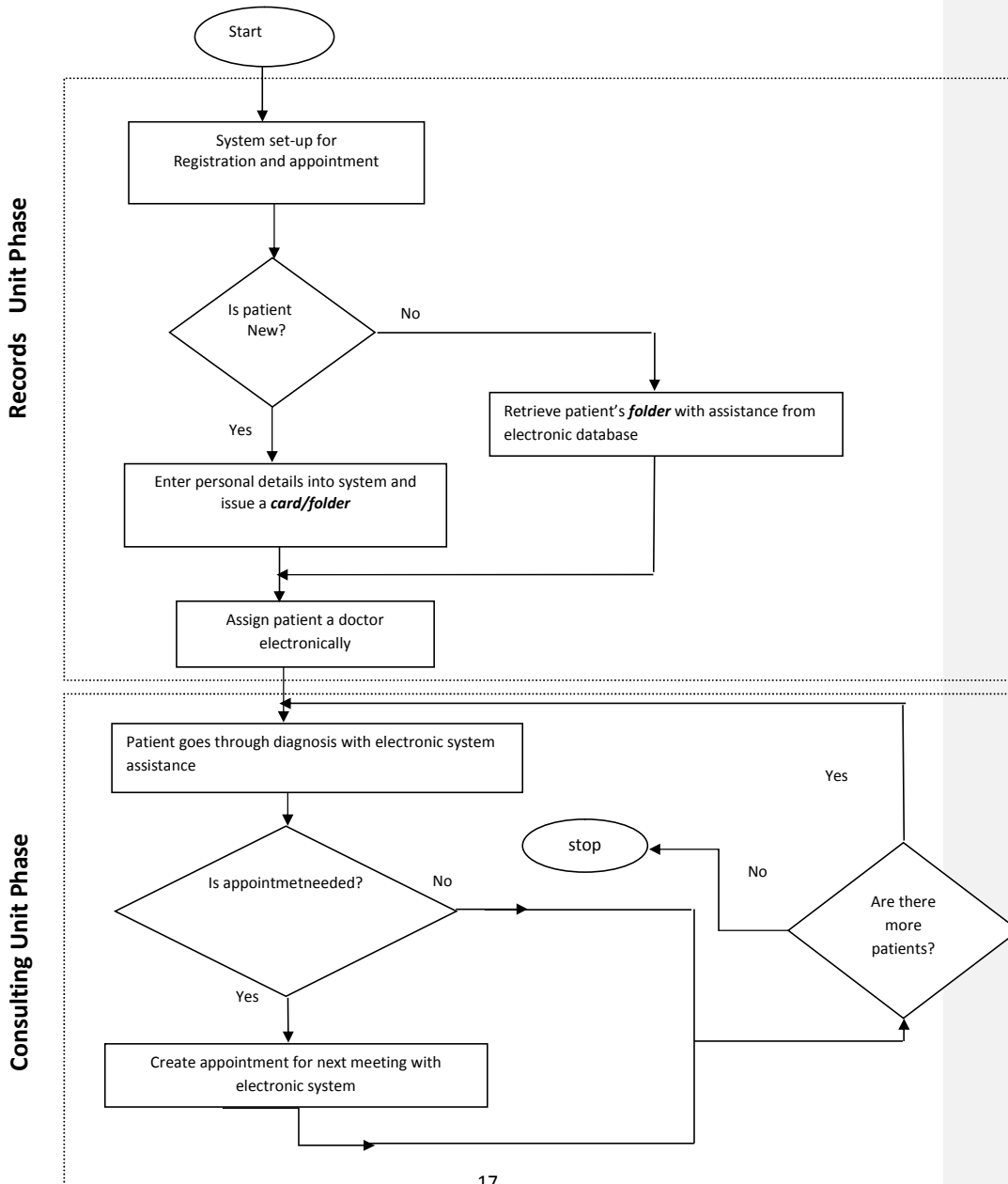
This project seeks to come out with a customized design that will be later developed into application software.

2.2 Proposed Solution

Objective: Proper electronic patient's record keeping may substantially improve health care quality and efficiency, but the available systems in the market are complex and their heterogeneity makes comparing and evaluating them a challenge. Our aim is to develop a conceptual framework for alternative designs that will be geared towards high cost reduction in both implementation and running and also offering tailored services that are user-friendly and easy to use.

Design: Based on a literature review, observation and interviews with Matter Dei Clinic, we identified distinct patient records keeping functional capabilities and developed a conceptual framework for implementing an electronic patient's records keeping systems.

Fig.2.1 shows the conceptual framework.



General proposed system's workflow framework. (Figure 2.1)

2.3 Conclusion

Patient's records keeping software are important to medical personal just as its importance or vitality is evidently clear in hospitals. In view of this, we want to help the clinics to enjoy such benefits but at the same time mitigating the implementation and running cost.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter will outline the description of methods chosen to achieve the objectives of the proposed system. It will go on to describe the techniques of data collection that will be employed in the research study of the proposed systems. The methods that will be applied to achieve the specific objectives are namely: historical review, Oral interviews, system analysis, system design, Data modeling. The tools that will be used to implement the system are SQLyog Enterprise, xampp, Netbeans 7.2, glassfish, iReport and technology used is Java EE.

3.1 Approaches for the Development

The system development life cycle (SDLC) that we chose to use was the iterative waterfall model. In this model, the system follows a series of events from the requirement definition, system and software design, implementation and unit testing, integration and system testing and operational maintenance. We will also use different aspects from other models like data flow diagrams (DFD) and entity relationship diagram (ERD). The ERD will be used to show the relationship between entities while the Data Flow Diagrams will be used to show the flow of data in the system.

Iterative waterfall model divides the system development lifecycle into phases. During each phase of the lifecycle, a set of well defined activities are carried out.

For instance, at the Analysis stage (analysis of requirements) will be specifically carried out in focus of the functionality of dataflow at Matter Dei clinic. The system and structured analysis will then be transformed into software design.

3.1.1 Data Collection Methods

We used the following methods during data collection: Observation and Interviewing as our research methods. Through this we were able to collect raw data on the AUTOMATION OF PATIENTS' RECORDS KEEPING SYSTEM FOR HEALTH CLINICS (APRK) at Matter Dei clinic where existing reports on the current system were obtained.

3.1.2 Observation

We went to the clinic and observed their daily transactions as regards their current system. It was clear as per our observation that, they were manually recording the patients' records as specified by the records head, doctors, pharmacist and cashier. A follow up was made to determine the time it took to carry out the patient's record keeping and retrieving. We observed the system's weaknesses and it was clear that, processes were prone to human errors.

3.1.3 Interviewing

With this, there were interactions between us and the staffs. Interviews were conducted with the medical superintendent and some other key employees to find out what difficulties they encountered with the existing system. These interviews were held to verify the information gathered during the literature review since there was room to search for further information using the interview.

3.2 Database Design

All the data used in the application was stored in MySQL database. The application software (ie. Front-end) connects to this database and requests some information as well as makes changes to

its content. A relational database management system (RDBMS) was employed during the design of the database. This makes it easy to avoid any redundancies in the way data is stored in the system. RDBMS also can provide a pictorial view of the database, how each table is related to the other; either one-to-one relation, many-to-one relation etc. Normalization was done when designing the database structured query language(SQL) and in most cases reaching the third Normal form.

Below is the schematic view of the database that also depicts the ERD diagram.

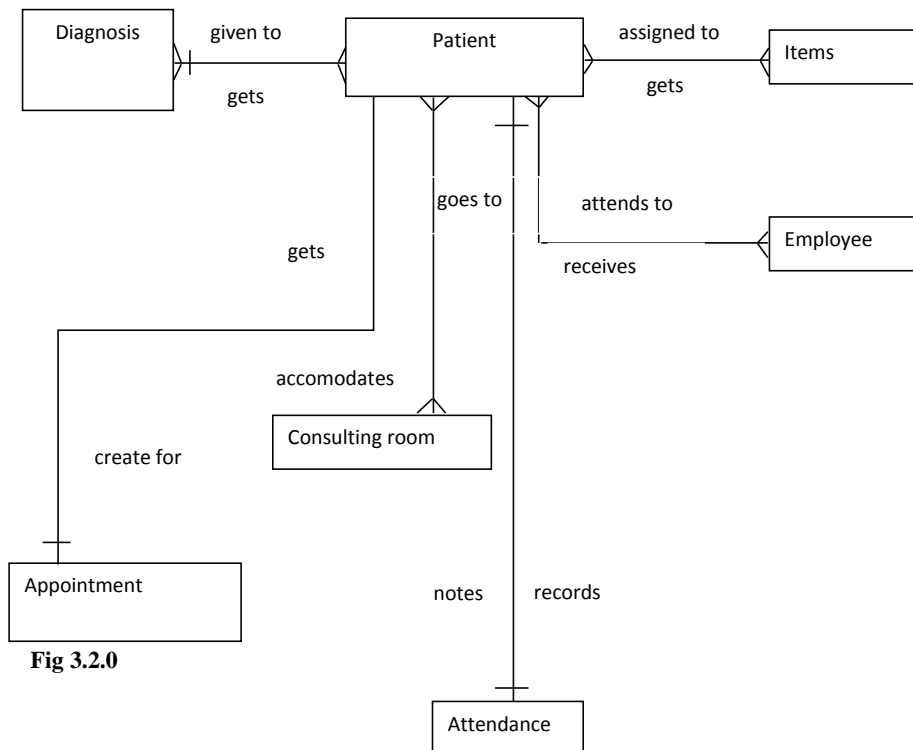


Fig 3.2.0

3.2.1 Database

To be able to develop a good database, a model of the entities and their corresponding correlations ought to be made. This will give a very good picture in the database design. This section outlines the modeling approach. Entity-Relation (E-R) Diagram and their corresponding entity integrity rules (i.e. Primary key field(s)):

Key entities.

#	Entity	Primary Key Field(s)
1	Patient	PatientID
2	Diagnosis	DiagnosisID
3	Appointment	AppointmentID
4	ConsultingRoom	ConsID
5	Items	ItemID
6	Attendance	AttendanceID
7	Employee	EmployeeID
8	PatientDiagnosis	PatientID, DiagnosisID
9	PatientConsulting	Patient ID, ConsID
10	Prescription	PatientID, ItemID

Table1 The entities 8 to 10 were defined from the *many-to-many relations* that existed in the E-R Diagram.

#	Entity	Primary Key Field(s)	Foreign Key Field(s)
1	Patient	PatientID	
2	Diagnosis	DiagnosisID	
3	Appointment	AppointmentID	
4	ConsultingRoom	ConsID	
5	Items	ItemID	
6	Attendance	AttendanceID	PatientID, ConsID
7	Employee	EmployeeID	
8	PatientDiagnosis	PatientID, DiagnosisID	PatientID, DiagnosisID
9	PatientConsulting	Patient ID, ConsID	Patient ID, ConsID
10	Prescription	PatientID, ItemID	PatientID, ItemID

Table 2 Entities of the Entity-Relation (E-R) Diagram and their corresponding referential integrity rules (i.e. Foreign key field(s)):

Assumptions

- i. all employees must have defined status
- ii. an employee can have only one status i.e. as a nurse, doctor etc
- iii. a patient can have only one appointment at a time i.e. after a visit
- iv. a patient may be referred to different consulting rooms in a session/day i.e. a visit
- v. a patient must have only one attendance per visit

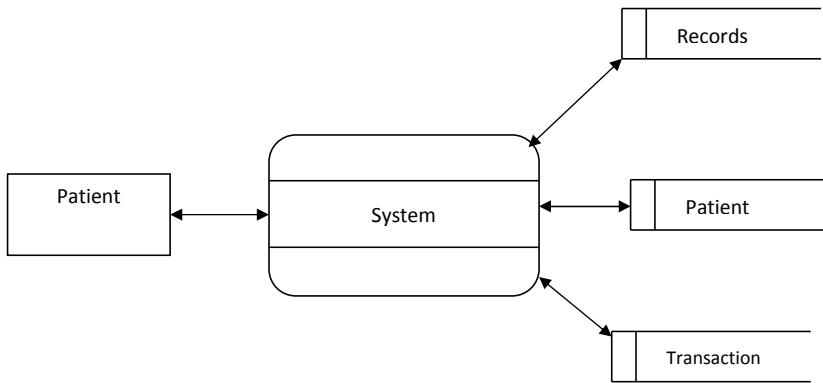


Figure 3.1 Context diagram of the system

Level 1 of DFD

Figure 3.1 Context diagram of the system

New Client (First Visit)

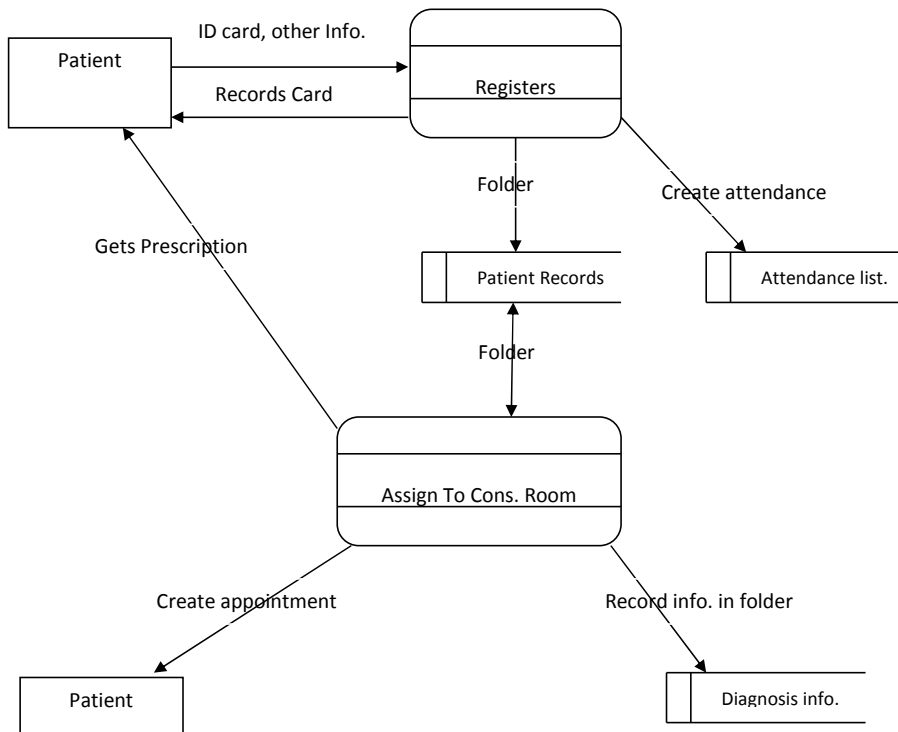


Figure 3.2 depicts how data flows on the first visit

Level 1 of DFD

Subsequent Visits

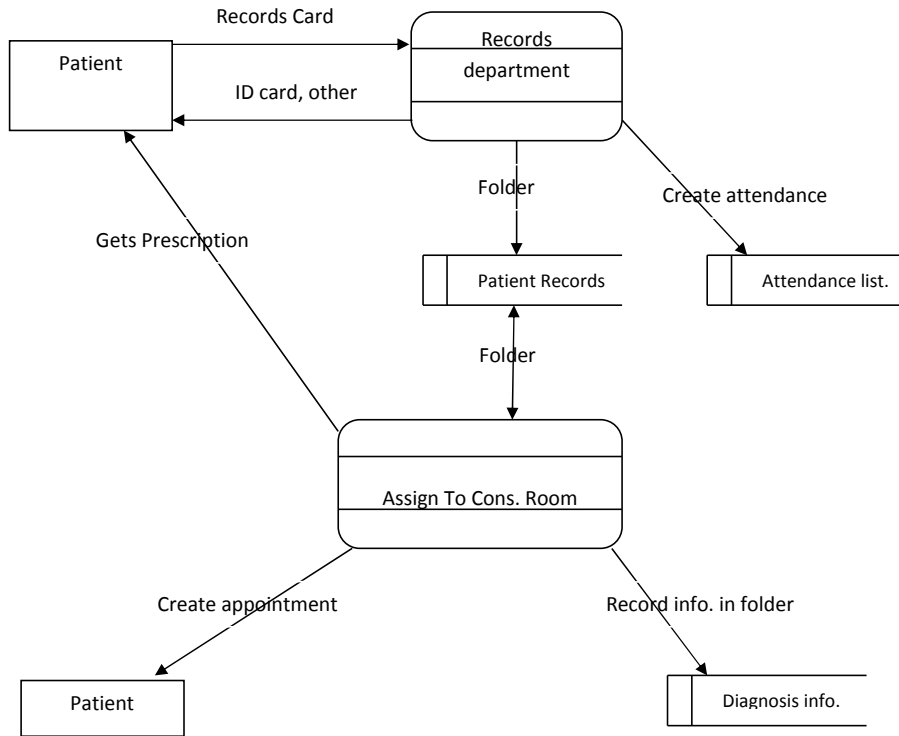


Figure 3.3 depicts how data flows in subsequent visits

3.3 Development Tools and Environment

3.3.1 Java Development Kit

The Java Development Kit (JDK) is an Oracle Corporation product aimed at Java developers. The JDK has as its primary components a collection of programming tools, including: java loader, java compiler applet viewer and java documentation generator. The JDK also comes with a complete Java Runtime Environment, usually called a private runtime, due to the fact that it is separated from the "regular" JRE and has extra contents. It consists of a Java Virtual Machine and all of the class libraries present in the production environment, as well as additional libraries only useful to developers, such as the internationalization libraries. Before one can run any java application, this software should be installed. This software was installed on the computer being used before any other Java related software could be installed.

3.3.2 Netbeans Integrated Development Environment (IDE)7.1.2

The NetBeans IDE is an integrated development environment available for Windows, Mac, Linux, and Solaris. NetBeans consists of an open-source IDE and an application platform that enable developers to rapidly create web, enterprise, desktop, and mobile applications using the Java platform, as well as JavaFX, PHP, JavaScript and Ajax, Ruby and Ruby on Rails, Groovy and Grails, and C/C++. The NetBeans project is supported by a vibrant developer community and offers extensive documentation and training resources as well as a diverse selection of third-party plug-ins. All the codes in the project were written in Java Enterprise Edition, which can be found on the Netbeans platform. Other processes such as compiling, testing and debugging were also done in Netbeans.

3.3.3 XamppServer

XamppServer is a Windows web development environment. It allows one to create web applications with Apache2, PHP and a MySQL database. This software enabled me to make queries from the database by acting as a virtual server for the database.

3.3.4 JavaScript

JavaScript is a prototype-based scripting language that is dynamic, weakly typed and has first-class functions. It is a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles. JavaScript was used for client side scripting and validating form components such as emails and textboxes.

3.3.5 Structured Query Language(SQL)

SQL is responsible for querying and editing information stored in a database management system. SQL language is subdivided into several language elements, including: clauses, expressions, predicates, queries and statements. SQL was used to write queries which retrieve questions, diseases, drugs and other items from the database. SQL also enabled me to write queries to create, delete, modify and update the contents of the database.

3.3.6 MySQL database system

All the data used in the application was stored in MySQL database. The system connects to this database and requests some information as well as makes changes to its content. The type of MySQL database used was SQLyog Enterprise.

3.3.7 JavaServer Faces (JSF)

JSF is a Java specification for building component-based user interfaces for web applications. It was formalized as a standard through the Java Community Process and is part of the Java Platform, Enterprise Edition. JavaServer Faces is based on a component-driven UI design model, using XML files called view templates or facelets views. Requests are processed by the FacesServlet, which loads the appropriate view template, builds a component tree, processes events, and renders the response, typically in the HTML language, to the client

CHAPTER FOUR
SYSTEM IMPLEMENTATION AND TESTING

4.0 Introduction

This chapter describes the implementation and evaluation processes conducted on the Automation of the patient's record keeping system. The system was transformed from user requirements into a workable product, ensuring that, tools, development platform, database management system used and levels of system users were thoroughly discussed. The purpose was to make sure that, the correct application and how testing is done is delivered to meet the end user's requirement(s).

4.1 Hard Components and Software Requirements

This segment describes the hardware components and software requirements needed for effective and efficient running of the system.

HARDWARE	MINIMUM SYSTEM REQUIREMENT
Processor	2.4 GHZ processor speed
Memory	128 MB RAM (256 MB Recommended)
Disk space	80 GB (including 20 GB for database Management system)
Display	800 x 600 colors (1024 x 768 High color- 16 bit Recommended)

Table 4.1 describes the hardware requirements for Automation of Patient's Record Keeping system.

SOFTWARE	MINIMUM SYSTEM REQUIRMENT
Operating System	Windows 2000 or later
Database management system	MYSQL
Run-time environment	Apache/tomcat5 server

Table 4.2 describes the software requirements for Automation of Patien's Record Keeping

4.2 Systems Testing

Testing was done after a complete installation of the system. This was done in two ways specifically Unit Testing and integration testing.

4.2.1 Test Plan

The purpose of Test Plan (TP) is designed to stipulate the scope, approach, resources, and schedule of all testing activities; to achieve the correct code and ensure all Functional and Design requirements are met. The plan will make out items to be tested, the features to be tested, the types of testing to be performed, and the personnel responsible for testing. Also included will be the resources and schedule required to complete the testing.

4.2.2 Unit Testing

Unit testing was done on individual modules of the system to ensure that, they are functional units. We carried out this by examining each unit. We checked to ensure that, each modele functions as required and that, it gathers the required data and other details and sends it to the database. Mistakes found were dealt with and the success of each individual unit gave us the edge to go ahead to carryout the integration testing.

4.2.3 Integration Testing

After the different modules had been put together to make a complete system, Integration test was aimed at, to ensure that the modules are well-matched and they can be integrated to form a complete working system. For example we tested to ensure that when a user is logged in, he/she is linked to the appropriate page, and also could access the required tables in the database.

4.3 System Interfaces

All the system interfaces as shown in this chapter were created in NetBean IDE using JSF and cascading style sheet.

Login Form for the Different Users

Only authorized users with the right user name and password have right to access the services to particular modules he or she intends to use. When wrong user name and password is used, the system rejects access to the services.



Figure 4.3 Login Form for the Different Users 31

Employees' information

The system administrator can add and update all staff details through this interface and can be access when ever the need arises.

The screenshot displays the 'Employee Registration' interface for 'MATTER-DEI CLINIC'. The header includes the clinic name and contact information. The main form area is titled 'Employee Registration' and contains several input fields: 'Employee Name', 'Telephone', 'Employee Type', 'Nationality', 'Marital Status', and 'Contact Person'. Below the form is a table with the following columns: 'Employee Name', 'Gender', 'Date of Birth', 'Marital Status', 'Nationality', 'Contact Person', 'Employee Type', and 'Action'. The table is currently empty.

Figure 4.4 Home page for employee registration

Patient Attendance

All information about patients will be recorded here by the front desk personal. For instance, first visitation and the subsequent once. The registration requires personal and relatives address and other vital information needed for future references.

The screenshot shows the MATTER-DEI CLINIC Patient Attendance web application. The header includes the clinic name, address (P. O. Box 2310, Kumasi), telephone (0322675894), email (matter-dei2@gmail.com), and a date stamp (30-May-2016). A sidebar on the left lists navigation options: Patient, Registration, Patient Attendance, Patient Appointment, Patient Home, Health Registration, Consulting Rooms, Employees, and User Account. The main content area is titled 'Patient Attendance' and contains a form for 'Selected Patient Information'. The form fields are as follows:

Field	Value
Patient Code	ewwer
Patient Name	ewwer
Gender	female
Date of Birth	7/1/07
Marital Status	
Age	5
Contact Person	
Contact Person Tel	
Relation To Patient	

Below the form, there are 'Vital Signs' (Temperature: 0.0, Blood Pressure: 0.0) and a 'Consulting Room' section with a dropdown menu set to 'SD, DCT, CNC' and a 'Referral Date' field. A 'Save' button and a 'Reset' button are also present. At the bottom, there is a search bar and a table with the following data:

Patient Code	Patient Name	Gender	Date of Birth	Marital Status	Residence	Contact Person	Relation	Action
ewwer	ewwer	female	04 Jul 2007					edit

Figure 4.5 Home page for patient visitation

Schema Designer

This interface depicts some of the entities used in the database and their corresponding fields

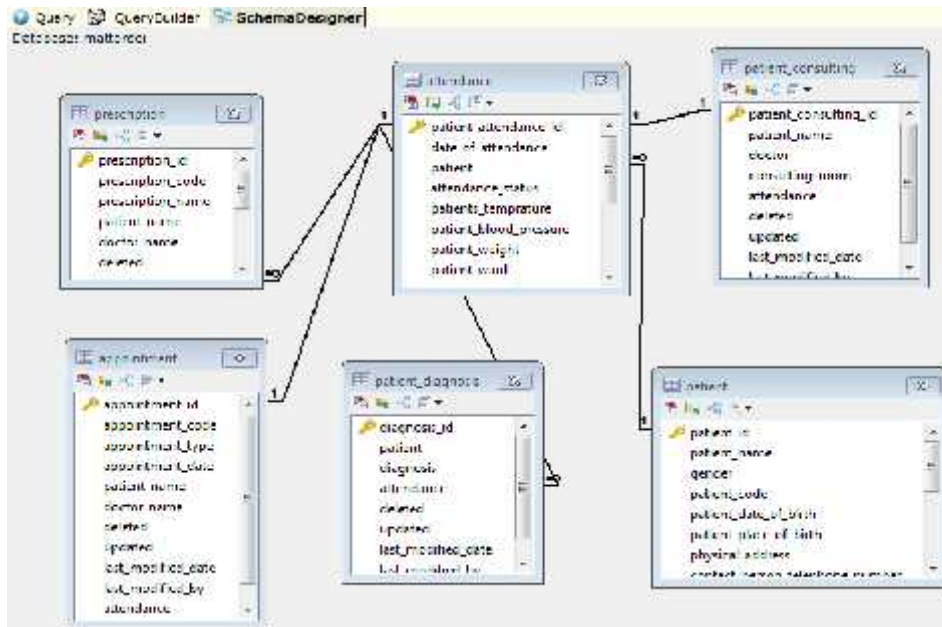


Figure 4.6 shows some entities and how they related

CHAPTER FIVE

SUMMARY, LIMITATIONS, RECOMMENDATION AND CONCLUSION

5.0 Introduction

This chapter describes/discusses the objectives of the system specified in the earlier chapters, limitations of the system, recommendation and conclusion of the system.

5.1 Summary

This project aims at bringing to light in-developingthe automation of patient's records keeping system for clinics. As discussed in the previous chapters; though, there are very good hospital management systems or ~~software that~~software that does records keeping, most of these clinics can't afford them, ~~and also~~Also, there are many complex functions which may not be needed by clinics. These functionalities that come with the systems make it undesirable for use by the clinics. It is in view of this that, we have developed a software that is less costly but is efficient and user friendly to be used in clinics, particularly Matter Dei Clinic

5.2 Limitation of the System

This section discusses some of the limitation of the system. Though there are some functionalities or models like bill generation, ward management, pharmacy stores management and drug dispensing, laboratory services, etc. Which could be added to the system, we felt this would make the system too complex for the clinics to manage and also too expensive on the otherhand. In view of these mentioned above, the system has been specifically trimmed to oversee the records and consulting room units only. Some of these areas forms the heart of their

operations. Problems Encountered during System Design: [includes](#). Limited time to finish up the work, access [tofor](#) needed data from the clinics [wasere](#) very difficult. [Relative to all these problems](#), ~~but~~ we were able to finish the essential part of the project.

5.3 Recommendations

During our interview sessions with some members of staff, it was obvious that they supported the idea of the automation of the records in the Out Patient Department (OPD). We deduced that, they were entertaining some fears as regards losing their jobs due to the introduction of the automation. We would recommend that, management of the clinic (Matter Die clinic) educates the staff on how this system will operate and how it will enhance their efforts.

For the efficient running of the clinic software application, users of the system need to be thoroughly educated about the use of their passwords and user names. Training of all the members of staff to be familiar with the system will have to be a great priority. Access to the server room should be physically guarded against unauthorized persons. The server room should be dust free and should be fully air-conditioned to about 15⁰C. This will prevent the server from overheating. Backup media like CDs, External Drive and Flush disks can be used for backups and storage of data to prevent data loss.

5.4 Conclusion

The primary reason for developing ~~automation-a computerized~~ patient' records keeping system is ~~to enhance clinics administrators to;~~

- ✓ allow a doctor to retrieve complete patient history instantly
- ✓ ensure effective records keeping and retrieval
- ✓ speed up report and account generation procedure
- ✓ Ensure security regarding clinic information.

Therefore, for this system to be more efficient and relevant to the clinic (Matter die clinic) the administrator/users should support the core or primary objectives of the system. This may involve training of the staffs on how to enter ~~data in~~ the right and relevant data in to the system and ~~the~~ management to keep updating the hardware and software requirements of the system.

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