

**A SECURE COMPUTERISED PATIENT DATA MANAGEMENT
SYSTEM FOR
NSAMBYA GENERAL CLINIC**

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BCS/41594/91/DF

**A RESEARCH REPORT SUBMITTED TO THE COLLEGE OF
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FULFILLMENT OF THE REQUIREMENTS FOR THE
AWARD OF THE DEGREE OF BACHELORS OF
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DECLARATION

MWANGIMA EVANS MWENDWA, declare that this work is my original work and has not been submitted or represented to any institution for the purpose of examination or fulfillment of any degree or any other academic award.

I further declare that the work has been done entirely by me except in case where my supervisor's advice was sought.

Signature.....

Date 12-07-2012



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APPROVAL

This is to certify that this research report entitled “a patient data management system” submitted in partial fulfillment of degree in computer science of Kampala international is under my supervision and guidance

Signature 

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Date 



DEDICATION

I dedicate this work to my beloved mother Maria Mwangima and my father Paul Mwangima who have helped me through God’s grace reach where I’ve reached. Thanks for your continuous support and may the almighty God bless you.

ACKNOWLEDGEMENTS

My special thanks goes to my mother Maria Mwangima for her tirelessly support in all ways to ensure my education is a success.

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LIST OF ACRONYMS

DMS	Patient data management system
MRD	Mentoring, Research & Development
IPD	inPatient Department
OPD	outpatient department
DLC	System Development Life Cycle
COM	Component Object Model
DCOM	Distributed Component Object Model
CID	atomic, consistent, isolated, durable
LTP	On-Line Transaction Processing
LAP	On-Line Analytical Processing
DOI	Identity
NSI	American national standards institute
ODBC	Open Database Connectivity
JDBC	Java Database Connectivity
ETL	Extract, Transform and Load

ABSTRACT

Patient Data Management Systems over the years have played an important role in the development of health institutions in first world countries. However this role has failed to be very effective in Africa especially in third world countries. Therefore the purpose of this study was focused at designing and implementing a computerized patient data management system.

The study targeted Nsambya General Clinic and health institutions in particular. The research instrument was interviews because of it flexibility in the discussion of the matters that were raised by the researcher. Observation was also be used to supplement the interviews.

The data collected was analyzed and presented in form of tables, graphs and charts for the purpose of interpretation and recommendations.

CHAPTER ONE

INTRODUCTION

Background of the problem

Healthcare is a very important part of our society and it is imperative for healthcare providers to do their jobs in an efficient and effective manner. Each day hundreds of thousands of patients enter healthcare facilities challenging the administration to attend to them smoothly. The employees have to manage and integrate clinical, financial and operational information that grows with the practice. Previously, this data was organized manually, which was time consuming and failed to deliver the desired level of efficiency. Most professionally run hospitals and clinics now rely on hospital management systems that help them manage all their medical and administrative information.

A patient data management system is essentially a computer system that can manage all the information about patients to allow health care providers to do their jobs effectively. These systems have been around since they were first introduced in the 1960s and have evolved with time and the modernization of healthcare facilities. The computers were not as fast in those days and they were not able to provide information in real time as they do today. The staff used them primarily for managing patient data and hospital inventory. All this has changed now, and today there are hospital management systems which include the integration of all clinical, financial and administrative applications.

Modern patient data management systems include many applications addressing the needs of various departments in a hospital. They manage the data related to the patients. The hospitals that have adopted patient data management systems have access to quick and reliable information including patients' records illustrating details about their demographics, gender, age etc. They receive important information pertaining to diet of patients, and the distribution of medications. With this information they can monitor drug usage in the facility and improve its effectiveness. Many hospitals have as many as 200 different systems combined into their hospital management systems.

Statement of the problem

are the various jobs that needed to be done in Nsambya general clinic by the operational staff. These works were done on papers. The work was done as follows:-Information about Patients was by just writing the Patients name, age and gender. Whenever the Patient came up his information was stored freshly. Bills were generated by recording price for each facility provided to it on a separate sheet and at last they all are summed up.

osis information to patients was generally recorded on the document, which contains Patient information. It was destroyed after some time period to decrease the paper load in the office. Immunization records of children were maintained in pre-formatted sheets, which were kept in a file. Information about various diseases was not kept as any document. Doctors themselves do this job by remembering various medicines. All this work was done manually by the receptionist and other operational staff and lot of papers were needed to be handled and taken care of. Doctors had to remember various medicines available for diagnosis and sometimes miss better alternatives as they do not remember them at that time.

The purpose of the patient data management system was to computerize the Front Office Management of Hospital to develop software which was user friendly, simple, fast, and cost effective. It dealt with the collection of patient's information, diagnosis details, etc. Traditionally, it was done manually.

The main function of the system was to register and store patient details and doctors' details and retrieve these details as and when required, and also to manipulate these details accordingly. System input contains patient details, diagnosis details; while system output is displaying these details on to the screen.

Purpose of the study

Purpose of this system was the automation of a patient data Management. The system was to maintain one level of user, the administrator level (user level). The system was to help in maintaining patient details, by recording incoming patient's details, and also diagnosis of patients from doctors. Giving Prescription, Precautions and Diet advice according to patient's diagnosis or ailments.

System was also to Provide and maintain all kinds of tests for a patient.

System was also to offer Billing and Report generation.

Objectives of the study

Main objectives

Create, test and develop a powerful, flexible and easy to use system that will be designed to deliver conceivable benefits to hospitals and clinics by enhancing information integrity through reduction of transcription errors and also reduction of duplication of information entries.

Specific objectives

To investigate existing problems in information system of Nsambya general clinic

To design a system that will allow Recording of information about the Patients that come to the hospital, and also information related to treatment given to Patients.

To develop a system that will help in generating bills for patients.

To test a system that will keep information about various medicines available to cure patients.

Significance of the study

Study was to not only be of significance to Nsambya general clinic but also to the public in faster and efficient access to hospital services, to the government it was to help reduce the cost of the hospital as the cost of managing the hospital will be reduced.

The System was to enable hospitals or Nursing Homes to serve the rapidly growing number of health care consumers in a cost-effective manner

The system was to help us to deliver on what we have obtained from our course and also give us exposure in wide variety of system development techniques.

The system was to help to improve the response time to the demands of patient care because it automates the process of collecting, collating and retrieving patient information

ie scope of the study

research study was carried out at Nsambya general clinic. It focused on a patient data management system for the hospital.

study targeted the management of the hospital, the reception employees as well as the doctors in hospital.

study was carried out in the year 2012 and covered a span of four months period.

stification of the study

Information plays a vital role in every organization for decision making and it has become one of the top investments in the corporate world today. It's the responsibility of the patient data management system to foster the achievement of the above.

A patient data management system is a significant tool for integrating multiple data sources enabling healthcare providers to access complete patients medical records that simplifies their work of diagnosing diseases correctly to avoid duplicative risky or expensive tests and to design effective treatment plans while taking into account many complicating factors.

CHAPTER TWO

LITERATURE REVIEW

Introduction

Patient data management system (PDMS) is the practice of maintenance and care of health records in hospitals, health clinics.

Due to the widespread computerization of health records and other information sources, including financial administration functions and health human resources information, health informatics and information technology are being increasingly utilized in information management practices in the health care sector.

Development and management of information technology tools assists executives and the general workforce in performing any tasks related to the processing of information. Patient data management systems and business systems are especially useful in the collation of business data and the generation of reports to be used as tools for decision making.

Managing data in health care organizations

Managing data in health care organizations like clinics has become a challenge as a result of health care managers having considerable differences in objectives, concerns, priorities and constraints. The planning, management and delivery of health care services included the manipulation of large amounts of patient data and the corresponding technologies have become increasingly embedded in aspects of patient care. Data has been seen as one of the most valuable assets of an organization and can assist in decision making and significantly improve the value of any organization.

Before digital information systems, businesses have relied on paper-based data management regarding financial management in order to make important business decisions. Most of the reports that are created are delayed; these have come as a result of extracting data from operational systems and collating with various sources of data to come up with them. The delay in the business insight because of the reports that are created have led to limited analytical capabilities that required the Information Technology

nel to create another series of reports and the traditional method of turning data into knowledge relied on the manual analysis and interpretation.

In the past few decades Executives or physicians used to gather data into patient care organizations' databases in the need of making informed health care decisions (Henderson, 1995).

The role of data in creating strategic decisions for patient care organizations is crucial. However data does not create decisions, the presence of quality is necessary for information to be useful in the making of high level decisions.

Quality is a generic term that means quality of service, measured by a focus on patient needs and a more accurate response to inquiries and problems (Tayi et al., 1998). Managing data quality throughout patient care organizations requires an enterprise approach based on standards since it solves the problem of bad data that would cost businesses as much as 10 to 20 percent of an enterprise's total budget through lost revenue (English, 1999).

Decisions are only as good as the data on which they are based. This implies that improving results means improving the quality of data. Data quality has become increasingly important to many patient care organizations. The issue of data quality concerns arises when one wants to correct errors in a single data source, or when one wants to integrate data coming from multiple sources into a single data source such as a data warehouse.

One of the greatest challenges that have faced organizations and individuals is to turn their rapidly growing data stores into accessible and actionable knowledge. Many organizations have become data rich but poor in information since they have been unable to extract knowledge from the raw data sources for example many companies have gathered significant numbers of large and heterogeneous databases and the need to analyze data and apply the knowledge extracted in order to develop new business or organization strategies and opportunities is lacking (Catherine et al., 2001). Henderson (1996) explained that the traditional method of turning data into knowledge relied on the manual analysis and interpretation for example in the health-care industry, it is been common for analysts to periodically analyze current trends and changes in health-care data, say, on a quarterly

specialists provide a report detailing the analysis to the sponsoring health-care or organization; reports have become the basis for future decision making and planning for health-care management. As many organizations have acquired large volumes of data repositories in this competitive world, this form of manual analysis of data has become impractical in many institutional settings that have been found slow, expensive, and highly subjective. Most automated systems are not a tool for daily work that is to say they are focused on daily registration. All the data which has been in use to keep the organization running, operational data has been in storage in these legacy systems. A lot of information has been hidden in these legacy systems.

There has been a growing need to do more with the data of an organization than to use them for operational management only. Surajit (1996) observed that systems that acted as operational databases are finely tuned to support known OLTP workloads, trying to execute complex OLAP queries against the operational databases would result in unacceptable performance. He further explained that operational support required data that would be missing from the operational databases for example identifying standing trends or making prediction required historical data. The extraction of information is done directly from the legacy systems because they were not built to answer questions that are analytical in nature.

Types of patient data management systems

Operational data management systems take care of services provided by the hospital. Rate of services is calculated by rules of hospital. They consider panel, Night Charges, Emergency charges, Age of patient and other parameters while calculating the rate of services for a particular patient. (acsonnet, 2012)

There are three types of patient data management systems:

Patient management

Each patient treated in hospital is given a unique Patient ID which is useful in tracking visits of patients. All patients' data is useful for MRD purposes.

OPD management

Registration When a patient comes to the reception desk, a new registration number is automatically allotted to him. His personal details like Name, Age, Sex, Address etc. and the services provided are fed into the software.

Billing or Collection Billing of all OPD patients with complete details of Patient Information, Services provided like Consultation, Laboratory, X-ray, Ultrasound, Medicines, Procedures etc. along with Payment details.

IPD management

Registration when a patient comes to the reception desk for admission, A Separate new registration number is automatically allotted to him. His personal details along with the details of admission, Room, Consultant, Surgeon, Diet, etc. and the Advance Payment made are fed into the software. The Software will record all this information and print the related documents.

Billing On-line billing of all IPD patients with details of Patient Information, Services provided on a daily basis like Room rent, Operation, Delivery, Oxygen & Other Gases, Consultation, Nursing charges, Laboratory tests, X-ray, Ultrasound, Medicines, and Procedures etc.

Collection, Collection of part payment along / Full Payment details/ Refunds/Credit Notes. This information will provide the data for all PDMS reports.

Developing Data management systems

Developing the data management systems required a process called Systems development life cycle (SDLC), or Software development process (wikipedia, 2010)

It is a process of creating, and the models and methodologies that people use to develop these systems.

The System Development Life Cycle framework provides a sequence of activities for system analysts and developers to follow. It consists of a set of steps or phases in which each phase of the cycle uses the results of the previous one.

systems Development Life Cycle (SDLC) adheres to important phases that are essential for developers, such as planning, analysis, design, and implementation, and are explained below. A number of system development life cycle (SDLC) models have been created: waterfall, fountain, spiral, build and fix, rapid prototyping, incremental, and synchronize and stabilize. The oldest and the best known, is the waterfall model: a sequence of stages in which the output of each becomes the input for the next. These stages can be characterized and divided up in different ways including the following:

Preliminary analysis: The objective of phase 1 is to conduct a preliminary analysis, propose alternative solutions, describe costs and benefits and submit a preliminary plan with recommendations.

Conduct the preliminary analysis: in this step, there is need to find out the clinic's objectives and the nature and scope of the problem under study.

Systems analysis, requirements definition: Defines project goals into defined functions and operation of the intended application. Analyzes end-user information needs.

Systems design: Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudo code and other documentation.

Development: write the real code is.

Integration and testing: Brings all the pieces together into a special testing environment, then checks for errors, bugs and interoperability.

Acceptance, installation, deployment: The final stage of initial development, where the software is put into production and runs actual business.

Maintenance: What happens during the rest of the software's life: changes, correction, additions, and moves to a different computing platform and more. This is often the longest of the stages.

Benefits of Patient Data Management Systems

Electronic data Management systems have changed the dynamics of running hospitals and clinics significantly.

of the advantages of patient data management systems are:

Better Planning and Control

It has to be designed and managed in such way that it aggregates information, monitors the company's activities and operations and enhances communication and collaboration among employees. This ensures better planning for all activities and better ways to measure performance, manage resources and facilitate compliance with industry and government regulations. Control helps forecasting, preparing accurate budgets and providing the tools and vital information to employees, management and business partners.

Aid Decision Making

The purpose of PDMS is to generate synthesized and processed information from computerized automated and certain manual systems. Studying information of patients in the system can assist managers when making decisions about the clinic that are concerned with improving equipment's and accessories. This helps as they know which equipment's are necessary than others.

Improve Patient Care

Properly implemented PDMS can improve quality of patient care by increasing the timeliness and accuracy of records. PDMS provides simplified access to patient records and other administrative information for those who need it. It also sets a standard for patient care, making it more consistent across the board. In many cases, patients can also use the system to better educate themselves about diseases and conditions as well as treatments and outcomes.

Improve Cost Control

Increased standardization of Patients Data management systems improves cost control by increasing efficiency and productivity. Personnel costs and inventory levels can be reduced through avoidance of duplications and repetitions. PDMS can also help eliminate confusion and delays caused by incomplete or missing records. These systems provide a managerial tool for decision making because they offer the functionality of assembling various types of data into usable

s. Data can be collected and categorized so that managers can analyze such information as patient lists, bed occupancy rates and statistics categorized by doctors.

Increased Security

Data management systems are secured databases of administrative and patient information that can be easily accessed only by those who need the information. PDMS links departments without compromising the security of the information involved. For example, pathology, radiology and administrative offices each have access to the pieces of a patient's information that are necessary to performing their individual job functions without allowing access to information that is not clinically relevant to that function.

Disadvantages of Patient Data Management Systems

Depending on organization deployment, usage and extraneous factors, some disadvantages related to Patient Data Management Systems can come to the fore. Allocation of budgets for PDMS upgrades, modifications and other revisions can be quite tricky at times. If budgets are not allocated uniformly over immediate requirements, key functionalities might get affected and benefits might not be realized consistently. Integration issues with legacy systems can affect the quality of output and vital business intelligence reports.

Constant Monitoring Issues

Changes in management, exits or departures of department managers and other senior executives has a significant effect on the working and monitoring of certain organization practices including PDMS systems. Since PDMS is a critical component of a clinic's patient management strategy and allied systems, constant monitoring is necessary to ensure its effectiveness. Quality of inputs into PDMS systems has to be monitored; otherwise consistency in the quality of data and information generated gets affected. Managers are not able to direct business, operational and decision-making activities with the required time flexibility.

DMS development tools

Programming tool or software development tool is a program or application that software developers use to create, debug, maintain, or otherwise support other programs and applications. Programming tool or programming software is a sub-category of system software but sometimes it is as a separate category of software along with application and system software.

In project the tools for creating Interface will be:

- Visual basic
- MySQL

Visual basic

Visual Basic is a third-generation event-driven programming language and integrated development environment from Microsoft for its COM programming model first released in 1991. Visual Basic is designed to be relatively easy to learn and use. Visual Basic was derived from BASIC and enables the application development of graphical user interface applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects. Scripting languages such as VBA and VBScript are syntactically similar to Visual Basic, but perform differently.

A programmer can put together an application using the components provided with Visual Basic. Programs written in Visual Basic can also use the Windows API, but doing so requires external API declarations. Though the program has received criticism for its perceived faults, from 1993 Visual Basic was a runaway commercial success, and many companies offered third party extensions greatly extending its functionality.

Advantages of Visual basic

There are quite a number of reasons why we might use of Visual Basic:

The structure of the Basic programming language is very simple, particularly as to the executable code.

VB is not only a language but primarily an integrated, interactive development environment.

The Visual basic integrated development environment has been highly optimized to support rapid application development. It is particularly easy to develop graphical user interfaces and to connect them to handler functions provided by the application.

The graphical user interface of the Visual basic integrated development environment provides intuitively appealing views for the management of the program structure in the large and the various types of entities (classes, modules, procedures, forms, and others).

Visual basic provides a comprehensive interactive and context-sensitive online help system.

When editing program texts the "IntelliSense" technology informs you in a little popup window about the types of constructs that may be entered at the current cursor location.

Visual basic is a component integration language which is attuned to Microsoft's Component Object Model.

Component Object Model components can be written in different languages and then integrated using Visual basic.

Interfaces of Component Object Model components can be easily called remotely via Distributed Component Object Model (DCOM), which makes it easy to construct distributed applications.

Component Object Model components can be embedded in or linked to your application's user interface and also into stored documents.

There is a wealth of readily available Component Object Model components for many different purposes.

Disadvantages of Visual basic

Visual basic is a proprietary programming language written by Microsoft, so programs written in Visual basic cannot, easily, be transferred to other operating systems.

There are some, fairly minor disadvantages compared with C. C has better declaration of arrays – it's possible to initialize an array of structures in C at declaration time: this is impossible in VB.

Visual Basic is powerful language, but it's not suit for programming really sophisticated games.

It's much slower than other languages.

MySQL

MySQL is the world's most used relational database management system that runs as a server providing multi-user access to a number of databases. It is named after co-founder Michael Widenius' pet cat, My. The SQL phrase stands for Structured Query Language.

The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and operated by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation.

1 Reasons to use MySQL

Scalability and Flexibility

The MySQL database server provides the ultimate in scalability, sporting the capacity to handle both small embedded applications with a footprint of only one megabyte to running massive data warehouses holding terabytes of information. Platform flexibility is a stalwart feature of MySQL with versions of Linux, UNIX, and Windows being supported. And, of course, the open source nature of MySQL allows complete customization for those wanting to add unique requirements to the database.

High Performance

The unique storage-engine architecture allows database professionals to configure the MySQL database specifically for particular applications, with the end result being amazing performance results. Whether the intended application is a high-speed transactional processing system or a high-volume database that services a billion queries a day, MySQL can meet the most demanding performance requirements of any system. With high-speed load utilities, distinctive memory caches, full text search, and other performance-enhancing mechanisms, MySQL offers all the right ammunition for mission-critical business systems.

High Availability

solid reliability and constant availability are hallmarks of MySQL, with customers relying on MySQL to guarantee around-the-clock uptime. MySQL offers a variety of high-availability options including high-speed master slave replication configurations, to specialized Cluster servers offering automatic failover, to third party vendors offering unique high-availability solutions for the MySQL database server.

Robust Transactional Support

MySQL offers one of the most powerful transactional database engines on the market. Features include complete ACID (atomic, consistent, isolated, durable) transaction support, unlimited row-level locking, distributed transaction capability, and multi-version transaction support where readers don't block writers and vice-versa. Full data integrity is also assured through server-enforced primary key integrity, specialized transaction isolation levels, and instant deadlock detection.

Web and Data Warehouse Strengths

MySQL is the de-facto standard for high-traffic web sites because of its high-performance query engine, tremendously fast data inserts capability, and strong support for specialized web functions including full text searches. These same strengths also apply to data warehousing environments where MySQL scales up into the terabyte range for either single servers or scale-out architectures. Other features like main memory tables, B-tree and hash indexes, and compressed archive tables that reduce storage requirements by up to eighty-percent make MySQL a strong standout for both web and business intelligence applications.

Strong Data Protection

Protecting the data assets of corporations is the number one job of database professionals. MySQL offers exceptional security features that ensure absolute data protection. In terms of database authentication, MySQL provides powerful mechanisms for ensuring only authorized users have entry to the database server, with the ability to block users down to the client machine level being possible. SSL support is also provided to ensure safe and secure connections. A granular object privilege framework is present so that users only see the data they should, and powerful data encryption and decryption functions ensure that sensitive data is protected from unauthorized access.

ng. Finally, backup and recovery utilities provided through MySQL and third party software
rs allow for complete logical and physical backup as well as full and point-in-time recovery.

Comprehensive Application Development

of the reasons MySQL is the world's most popular open source database is that it provides
prehensive support for every application development need. Within the database, support can be
for stored procedures, triggers, functions, views, cursors, ANSI-standard SQL, and more. For
lded applications, plug-in libraries are available to embed MySQL database support into nearly
application. MySQL also provides connectors and drivers (ODBC, JDBC, etc.) that allow all
of applications to make use of MySQL as a preferred data management server. It doesn't matter
PHP, Perl, Java, Visual Basic, or .NET. MySQL offers application developers everything they
o be successful in building database-driven information systems.

Management Ease

MySQL offers exceptional quick-start capability with the average time from software download to
ation completion being less than fifteen minutes. This rule holds true whether the platform is
soft Windows, Linux, Macintosh, or UNIX. Once installed, self-management features like
atic space expansion, auto-restart, and dynamic configuration changes take much of the burden
eady overworked database administrators. MySQL also provides a complete suite of graphical
ement and migration tools that allow a DBA to manage, troubleshoot, and control the operation
y MySQL servers from a single workstation. Many third party software vendor tools are also
ole for MySQL that handle tasks ranging from data design and ETL, to complete database
istration, job management, and performance monitoring.

Open Source Freedom and 24 hours 7 days a week Support

corporations are hesitant to fully commit to open source software because they believe they
et the type of support or professional service safety nets they currently rely on with proprietary
re to ensure the overall success of their key applications. The questions of indemnification
up often as well. These worries can be put to rest with MySQL as complete around-the-clock
t as well as indemnification is available through MySQL Enterprise. MySQL is not a typical
ource project as all the software is owned and supported by Oracle, and because of this, a

the cost and support model are available that provides a unique combination of open source software and trusted software with support.

Lowest Total Cost of Ownership

Migrating current database-driven applications to MySQL, or using MySQL for new development projects, corporations are realizing cost savings that many times stretch into seven figures. Enabled through the use of the MySQL database server and scale-out architectures that utilize cost commodity hardware, corporations are finding that they can achieve amazing levels of reliability and performance, all at a cost that is far less than those offered by proprietary and scale-up vendors. In addition, the reliability and easy maintainability of MySQL means that database administrators don't waste time troubleshooting performance or downtime issues, but instead can concentrate on making a positive impact on higher level tasks that involve the business side of data.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

In this chapter we are going to talk about the target population for this system, the means of getting information (research techniques and data collection tools), the sample selected, development methodology as the analyzing techniques.

Target population

The study is concentrated on institutions more presumably health institutions that administer patients. Health institutions include Hospitals, clinics, health departments, health insurance companies, and facilities that provide health care or maintenance of health records.

Data collection tools

Following tools were used for collecting data.

- Interview

- Observation

Interview

The interview was in form of face to face.

This method was flexible for gathering information about the area of study as it enhanced faster results and the researcher can be able to rephrase the questions to probe further information or even explanations to interviewees.

Observation

The researcher was also to rely on observation as it was an important tool to use in the research. This can be done through observing the existing developmental structures such as schools, hospitals, schemes market structures and their numbers and functionality altogether.

method was either to eliminate or reduce the biasing effect of interviewers. This made the data collected to be more objective and generally more accurate.

Analysis specifications

Analysis of specifications or requirements analysis from the obtained requirements through data collection tools was as follows:

Specifications for the system were divided into the following:

- Functional requirements
- Non-functional requirements
- System models

Functional requirements

Functional requirements were the requirements that defined a function of the system or its component. A function was described as a set of inputs, the behavior, and outputs of the system.

- Add records
- Delete record
- Edit record
- Update record

Non-Functional requirements

Non-functional requirements were the Constraints on the services or functions offered by the system such as timing constraints or constraints on the development process, standards.

- Here the system should be:
 - Having good way to protect the records or Authorization
 - User friendly
 - Efficient in using system resources like memory and Processor time and all other system resources
 - Fast to respond to request that is being efficient and having a good performance.

System Models

n models are the requirements that come from the application domain of the system and that
t the characteristics of that domain.

/stem model comprised of the requirements that came from Nsambya general clinic.

Development method

velopment method or system development methodology is a framework that is used to structure,
and control the process of developing an information system.

methodologies can be categorized as Agile Methodology example SCRUM and Non Agile
dology example Waterfall Model.

Agile Development method

software development is a group of software development methods based on iterative and
mental development, where requirements and solutions evolve through collaboration between
ganizing, cross-functional teams. It promotes adaptive planning, evolutionary development and
y, a time-boxed iterative approach, and encourages rapid and flexible response to change. It is
eptual framework that promotes foreseen interactions throughout the development cycle.

Scrum methodology

is an iterative and incremental agile software development method for managing software
.s and product or application development.

contains sets of methods and predefined roles. The main roles in Scrum are:

The "Scrum Master", who ensures the process is followed, removes impediments, and protects
the Development Team from disruption

The "Product Owner", who represents the stakeholders and the business

The "Development Team", a cross-functional, self-organizing team who do the actual
analysis, design, implementation, testing, etc.

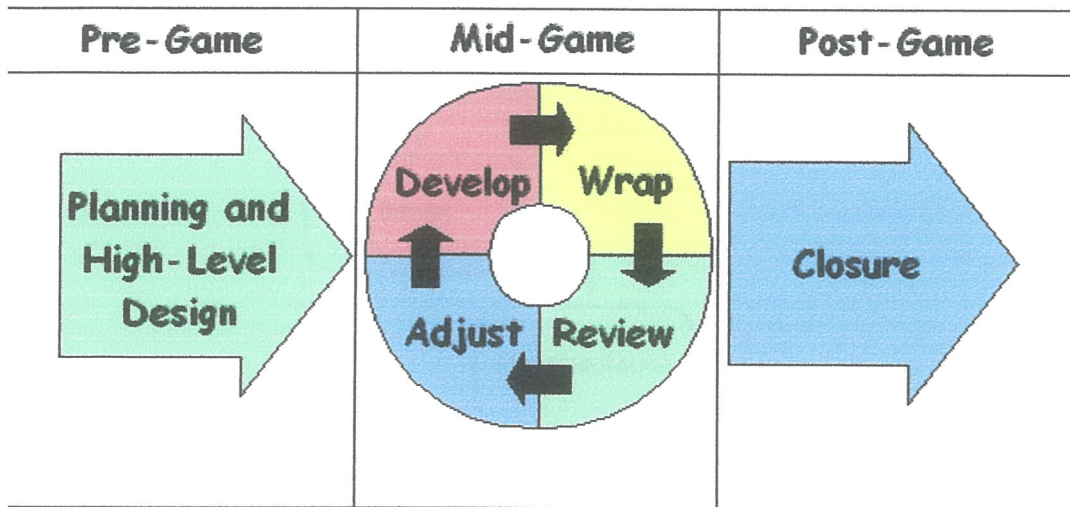


Figure 1: Scrum Development Methodology

Waterfall method

Waterfall model is a sequential development approach, in which development is seen as flowing downwards (like a waterfall) through the phases of requirements analysis, design, implementation, testing (validation), integration, and maintenance. The first formal description of the model is often cited as an article published by Winston W. Royce in 1970 although Royce did not use the term "waterfall" in this article.

Basic principles are:

- It is divided into sequential phases, with some overlap and splash back acceptable between phases.

- Focus is on planning, time schedules, target dates, budgets and implementation of an entire project at one time.

- Control is maintained over the life of the project via extensive written documentation, formal reviews, and approval signoff by the user and information technology management occurring at the end of most phases before beginning the next phase.

Waterfall model is a traditional engineering approach applied to software engineering. It has been widely blamed for several large-scale government projects running over budget, over time and sometimes failing to deliver on requirements due to the Big Design Up Front approach. Except when actually required, the Waterfall model has been largely superseded by more flexible and agile methodologies developed specifically for software development.

Advantages of Waterfall method

One question that must be bothering you now is that with so many advantages at hand, what could be possible disadvantages of the waterfall model? Here are a few:

Ironically, the biggest disadvantage of the waterfall model is one of its greatest advantages. You cannot go back a step; if the design phase has gone wrong, things can get very complicated in the implementation phase.

Often, the client is not very clear of what he exactly wants from the software. Any changes that he mentions in between may cause a lot of confusion.

Small changes or errors that arise in the completed software may cause a lot of problems.

Another major disadvantage of the waterfall model is that, until the final stage of the development cycle is complete, a working model of the software does not lie in the hands of the client. Thus, he is hardly in a position to inform the developers, if what has been designed is exactly what he had asked for.

System Development Application

Following applications are going to be used when developing the system:

Visual studio

Wamp server

Visual studio

Microsoft Visual Studio is an integrated development environment from Microsoft. It is used to develop console and graphical user interface applications along with Windows Forms applications, websites, web applications, and web services in both native code together with managed code for all systems supported by Microsoft Windows, Windows Mobile, Windows CE, .NET Framework, Compact Framework and Microsoft Silverlight.

Visual Studio includes a code editor supporting IntelliSense as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other tools include a forms designer for building Graphical user interface applications, web server, class designer, and database schema designer. It accepts plug-ins that enhance the functionality at almost every level—including adding support for source-control systems (like Team Foundation and Visual SourceSafe) and adding new toolsets like editors and visual designers for

n-specific languages or toolsets for other aspects of the software development lifecycle (like the Foundation Server client: Team Explorer).

l Studio supports different programming languages by means of language services, which allow ide editor and debugger to support nearly any programming language, provided a language-specific service exists. Built-in languages include C/C++ VB, C# and F# (as of Visual Studio 2010).

rt for other languages such as M, Python, and Ruby among others is available via language es installed separately. It also supports XML/XSLT, HTML/XHTML, JavaScript and CSS. dual language-specific versions of Visual Studio also exist which provide more limited ige services to the user: Microsoft Visual Basic, Visual J#, Visual C#, and Visual C++.

Wamp server

Ps are packages of independently-created programs installed on computers that use a Microsoft ows operating system.

P is an acronym formed from the initials of the operating system Microsoft Windows and the al components of the package: Apache, MySQL and one of PHP, Perl or Python. Apache is a erver. MySQL is an open-source database. PHP is a scripting language that can manipulate ation held in a database and generate web pages dynamically each time content is requested by /ser. Other programs may also be included in a package, such as phpMyAdmin which provides hical user interface for the MySQL database manager, or the alternative scripting languages r or Perl.

ts of Wamp server

It is free.

Easy to learn and use.

Provides the easiest way to deploy scripts that has to be interpreted in the server side.

CHAPTER 4

SYSTEM ANALYSIS DESIGN AND DEVELOPMENT

Data presentation and analysis

Data collected was inspected, cleaned and analyzed with the goal of highlighting useful information, drawing conclusions and supporting decision making.

To analyze the data collected, Microsoft excel was applied so as to statistically so as to statistically analyze the data as it was collected, whereby, cross-tabulation was used and frequencies applied to confirm the opinion of interviewees and checking the validity of the questionnaires.

Number of people Interviewed

TYPE OF USER	NUMBER OF PEOPLE
ADMINISTRATIVE STAFF	7
TECHNICAL STAFF	5
MANAGEMENTS	8
TOTAL	20

Findings from the study have been presented in tables below together with corresponding graphs for further analysis.

Figure 3: Response on the efficiency of the System

	NUMBER OF PEOPLE		
	EFFICIENT	LESS EFFICIENT	VERY EFFICIENT
OPERATIONAL STAFF	5	2	0
DOCTORS	4	1	0
PATIENTS	8	0	0
TOTAL	17	3	0

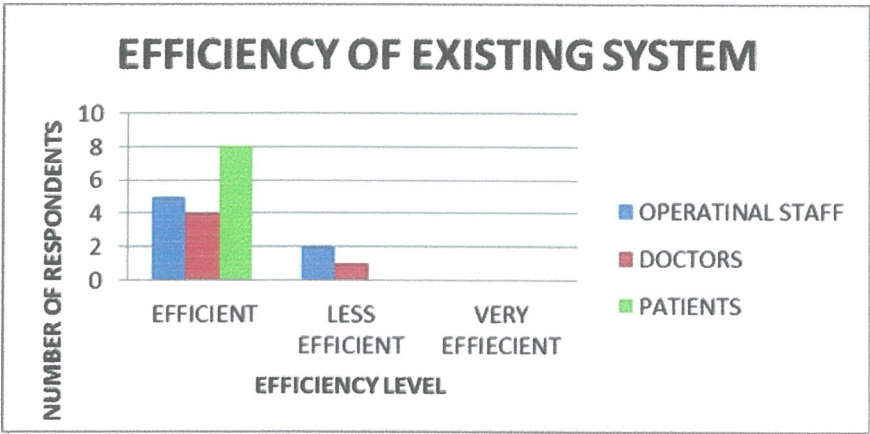


Figure 3: The Efficiency of the existing System

response to the Use of the System

	NUMBER OF PEOPLE		
	EASY	VER EASY	DIFFICULT
Operational staff	4	1	0
Doctors	3	2	0
Patients	Not applicable	Not applicable	Not applicable
TOTAL	7	3	0

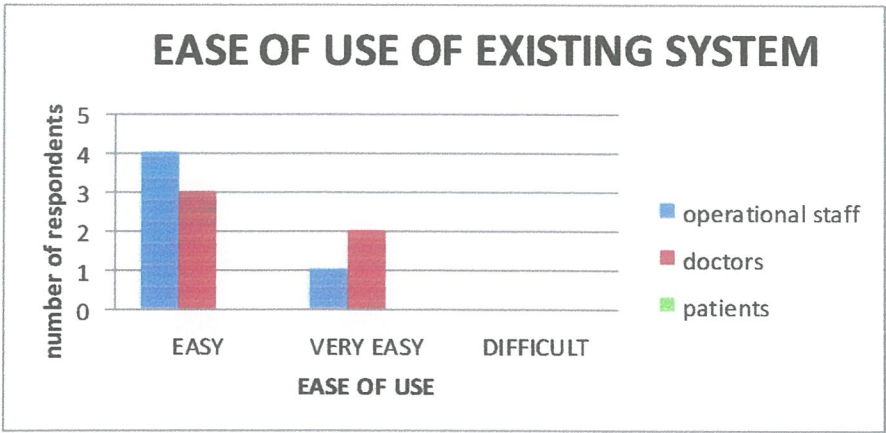


Figure 4: Ease of the Existing System

system specification analysis and requirements

specifies the functionality of the system and the constraints under which it operates. System specification is intended to establish the services that are required from the system and the constraints on the system's operation and development.

System requirements.

were the requirements for the system as whole rather than of its components. The required qualities included performance, reliability, usability, safety and security.

Success or failure of a system is often dependent on the system requirements and this was taken into great consideration by the researcher.

proposed system was a Patient data management system and can be used on any personal computer running on windows XP operating systems or above. The computer running the system must at least have a minimum of 1.00GHZ of CPU speed, 2GB of free hard disk space and 128MB RAM or higher for better performance. A screen resolution of 1024 x 800 is also recommended.

User requirements for the new system

were the statements in natural language plus diagrams of what services the system was required to provide and the constraints under which it must operate.

The system will meet the following requirements:

- Updating records.

- Deleting any records.

- Editing and refreshing records.

- Adding records that will be stored in the system's database.

- Searching for relevant records.

- Printing patients invoices.

- Printing receipts.

- Printing list of all patients admitted and discharged from the hospital.

- Printing treatment details of patients.

Security requirements

specify system behavior that was disallowed rather than behavior that was expected of the system. The following security checks were observed:

Unauthorized users should not be allowed to access the database, this can be enhanced by use of passwords and user names, relevant information should be made available to the relevant people and security measure such as antivirus software to prevent damage to the software by viruses.

Functional requirements

were the statements of services the system should provide, how the system should react to particular inputs and how the system should behave in particular situations. They explain what the system should do:

The system will track and keep patients data when they enter the system until they are discharged.

The system will print out receipts and invoices to each and every patient.

The system will be able to print the patients admitted in the hospital and also the patients discharged from the hospital.

Non-functional requirements

were the constraints or functions offered by the system. They include timing constraints, constraints on the development process, standards and so on. The following were expected of the new system:

The system was designed to be user friendly through the various buttons and simple forms by which the user interacts, data integrity is ensured through the use of validation rules. Access to the system is controlled through the use of passwords, need to enter the correct password to access the system. If the user enters an incorrect password, the system alerts the user if he performs actions that are considered invalid such as entering invalid data and the user is warned before performing actions that can be dangerous for example deleting a record.

Strengths and weaknesses of the current system

Strengths

Since the system being paper based, the following was achieved:

Easy retrieval by staff, Storage of the data received, security was maintained even though at a low level, data was shared by different units and data was updated quarterly.

Weaknesses

The system was also faced with the following setbacks:

High demand for storage space for paperwork of which the space could be used to accommodate other activities such as offices. There was a lot of inaccurate data capture and recording resulting into the passing of wrong information. There was less productivity because staffs spend a lot of time going from place to place in search of data to be analyzed. Due to involvement of a lot of staff work, there were errors resulting into inaccuracy of patient's data. Retrieval of information was

tedious and time consuming it was therefore necessary to automate the system in order to overcome the shortcomings associated with the current system.

the proposed system

The proposed system seeks to overcome the shortcomings associated with the old system by ensuring that the weaknesses of the old system are solved in the new system.

Benefits of the proposed system

Following are the benefits of the new system:

- Elimination of data duplication leading to improved data consistency.

- The proposed system will offer increased security of the system by the use of passwords when accessing the system.

- It will print patient's invoices every time the patient's billing is done and receipts every time payment is done.

- The proposed system will help increase efficiency and effectiveness of the clinic's services to the patients.

System design

Logical and physical designs of the new system were developed by the researcher. Entity relationship diagrams and data flow diagrams were put into consideration. The diagram will serve to facilitate the users' understanding of the new system.

Logical design

It was concerned with the conversion of logical records structures of a data model supported by a case management system identifying entities and their matching attributes and the relationship determining the attributes domain. It involved the use of entity relations diagrams.

Diagram

Entity Relationship Diagram (ERD) is part of system development that provides an understanding of the logical data requirement of a system independent of the system's organization and process. It reflects a static view of the relationship between different entities in the database.

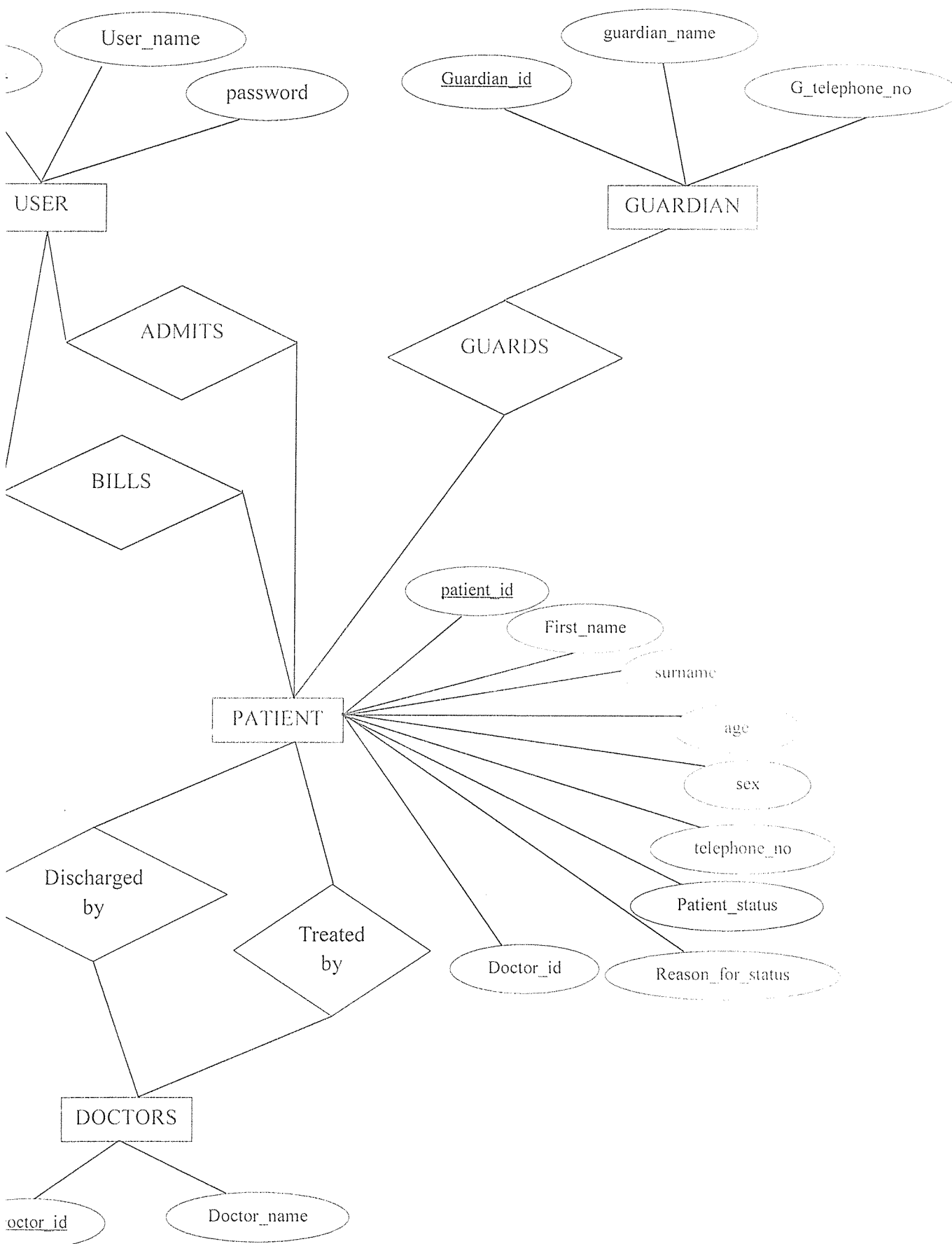


Figure 5: ERD Diagram for the System

Physical design

Physical design shows not only what a system does, but also how the system was physically and logically implemented. It transforms the logical design material into real computer work and describes how the logical structure is to be physically implemented on the target system.

Physical design was the last stage of the design process. Its major objective was to implement the database as a set of stored records, files, indexes and other data structures that will provide adequate performance and ensure database integrity, security and recoverability.

Physical database design must be performed carefully since decisions made on this stage have a significant impact on data accessibility, response time, security, user friendliness and similar factors.

Following were the major inputs to physical design:

- Logical data structures that were developed during the logical design like the relational data models.
- User processing requirements that were identified during requirements definition including size and frequency of use of the database.
- Characteristics of the database management system (DBMS) and other components of the computing environment.

Activities involved in the physical database design

Volume and usage analysis: The size and usage patterns are estimated. Estimates of the database are used to select physical storage devices and estimate the storage costs.

Distribution strategy: There are different distribution strategies. In this research a centralized approach was used.

Organization: This is a technique for arranging the record or files on a secondary storage device.

Following were put into consideration: constraints including physical characteristics of the secondary storage devices, available operating system and file management software and user needs regarding storing and accessing data

The selected file system for the new system was influenced by the following factors:

- Fast data access and retrieval
- Efficient use of storage space
- Protection from failures or data loss
- Minimizing the need for reorganization
- The ability to accommodate growth
- Security from unauthorized use

Database structure design

on the analysis of the user requirements other information such as the kind of details stored a student, the kind of details generated and the privilege levels required; the researcher came up the following database structure.

atabase consisted of 6 tables, each related to the other tables. The field names and data types are below.

Admission Database Table

Column	Type	Links to
admission_id	int(10)	
admission_date	datetime	
patient_id	int(10)	patient -> patient_id

Patient Database Table

Column	Type	Links to
patient_id	int(10)	
patient_name	varchar(25)	
patient_address	varchar(25)	
patient_age	int(10)	
patient_gender	varchar(25)	
patient_phone_no	int(20)	
patient_status	varchar(25)	

Column	Type	Links to
i_for_status	varchar(100)	
r_id	int(10)	doctors -> doctor_id

: Billing Database Table

Column	Type	Links to
id	int(10)	
t_id	int(10)	patient -> patient_id
_date	Date	
_of_stay	int(10)	
s_charges	int(30)	
ent_charges	int(30)	
charges	int(30)	
al_charges	int(30)	
	int(50)	
	int(30)	
nt	int(30)	
al	int(100)	

: User Database Table

Column	Type	Default
<u>id</u>	int(10)	
name	varchar(30)	
word	varchar(50)	

Discharge Database Table

Column	Type	Links to
<u>discharge_id</u>	int(10)	
discharge_date	date	
discharge_notes	varchar(50)	
patient_id	int(10)	patient -> patient_id

Payment Database Table

Column	Type	Links to
<u>payment_id</u>	int(10)	
amount_to_be_paid	int(50)	
amount_paid	int(50)	
balance	int(50)	
patient_id	int(10)	patient -> patient_id

: Medicine Database Table

Column	Type	Links to
<u>medicine_id</u>	int(10)	
medicine_name	varchar(25)	
expiry_date	date	
price	int(30)	

Column	Type	Links to
	int(30)	
	int(30)	
t_id	int(10)	patient -> patient_id
osis	varchar(50)	
ent	varchar(50)	

1: Doctors Database Table

Column	Type
<u>id</u>	int(10)
_name	varchar(50)

2: Guardian Database Table

Column	Type
<u>an_id</u>	int(10)
an_name	varchar(25)
ephone_no	int(20)

veloped system
SH SCREEN:

ystem begins by showing a splash screen, which signifies the launch of the application. The screen contains the application name, version and copyright information

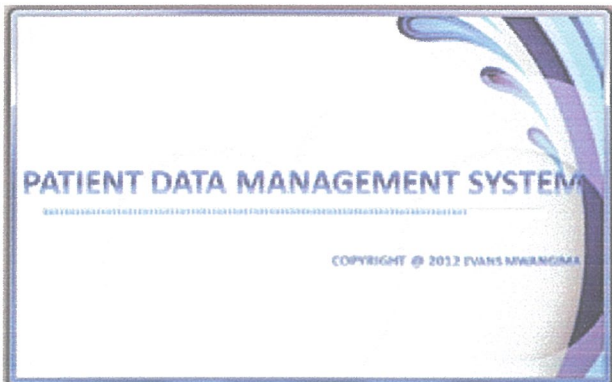


Figure 6: Splash Screen for the System

N FORM:

screen comes after the splash screen and is used for data security purpose. The login screen is for authentication purpose. The login screen asks the user to enter the username and password.

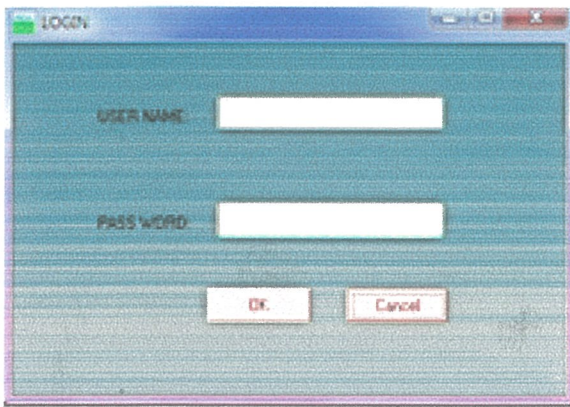


Figure 7: login form

I FORM OF PATIENT DATA MANGEMENT SYSTEM:

Following screen is the main screen of my Patient Data Management System. From here the user perform the desired operations. Actually it is a menu-based screen so user can perform operations selecting then from the menu or submenu. Depending on the type of user, that is whether he or she

min” or “user”. If the user is not an administrator then change password in the menu is not
d.

ain form also displays “welcome administrator” or “welcome user” depending on who is
1 in.

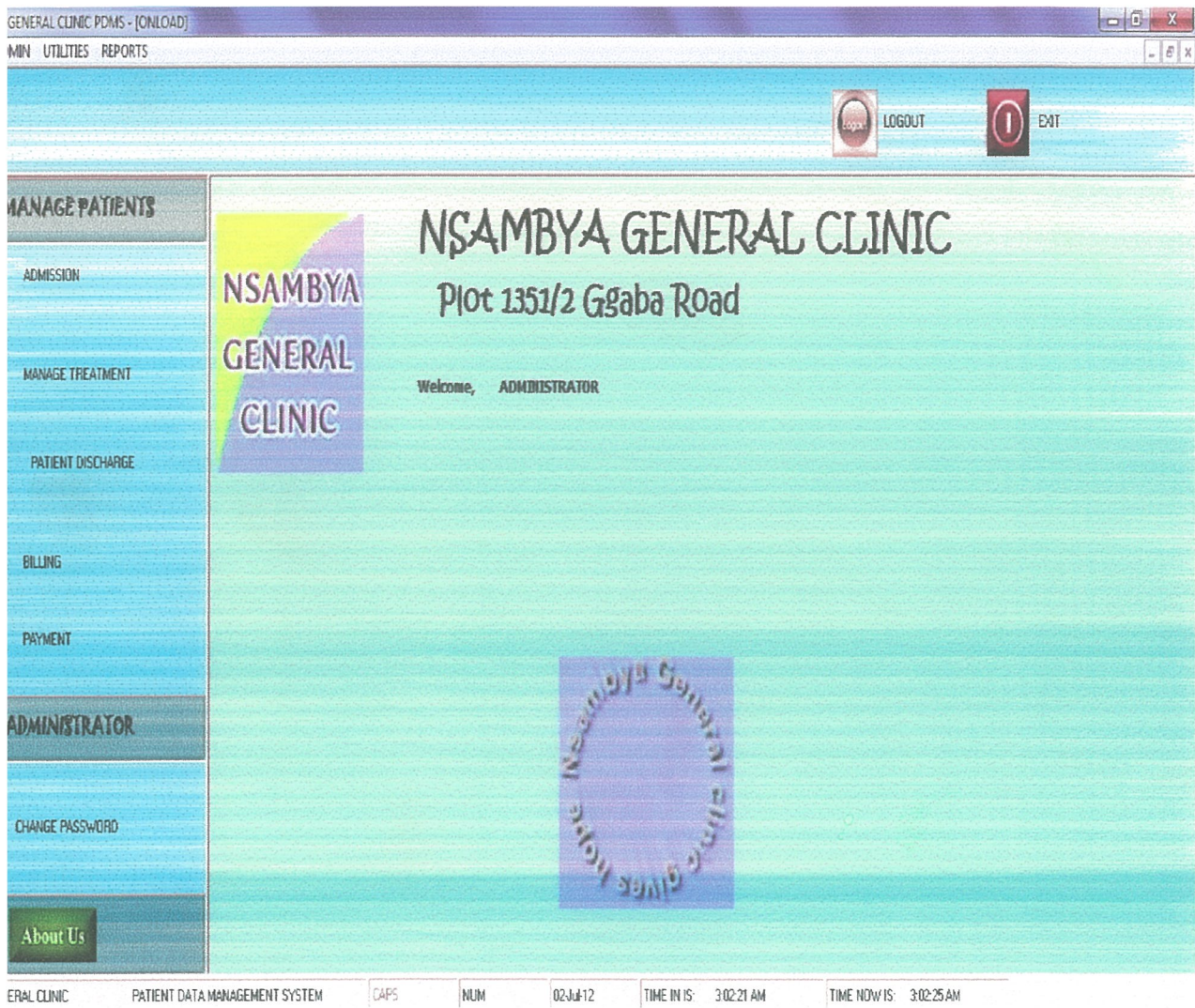


Figure 8: Main Form for the System

ADMISSION FORM:

Following form is used to admit a patient to the patient data management system. This form is
to show the information of patient, guardian and referred and assigned doctor information. This
is also used to process according to user’s choice admission information. In this form ADD

SAVE, CLOSE, FIRST, NEXT, PREVIOUS, AND LAST following operations can be med.

GENERAL CLINIC PDMS - [ADMISSION]

ADMIN UTILITIES REPORTS

LOGOUT EXIT

MANAGE PATIENTS

ADMISSION

MANAGE TREATMENT

PATIENT DISCHARGE

BILLING

PAYMENT

ADMINISTRATOR

CHANGE PASSWORD

About Us

ADMISSION

ADMISSION OF A PATIENT

ADMISSION ID: 1001

PATIENT ID: 2001

FIRST NAME: ROBIN

SURNAME: VANPERSIE

AGE: 28

SEX: MALE

TELEPHONE NUMBER: 723876453

GUARDIAN ID: 3001

GUARDIAN NAME: TRACY NDUKU

TELEPHONE NUMBER: 147483647

ADMISSION DATE: 28-Jun-12 12:30:00 PM

PATIENT STATUS: AILMENT

REASON: NONE

REFERRED DOCTOR ID: 4001

First Previous Next Last

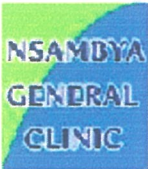
Add New Save Close

NSAMBYA GENERAL CLINIC PATIENT DATA MANAGEMENT SYSTEM CAPS NUM 02-Jun-12 TIME IN IS: 3:02:21 AM TIME NOW IS: 3:04:37 AM

Figure 9: Admission Form

PRINT:

is used to display the patient's receipt. This information can also be printed out.



Nsambya General Clinic,
Plot 1351/2 Ggaba Road,
Nsambya, Kampala,
P.O.Box 8596
Kampala, Uganda

nsambyageneralclinic@yahoo.com Tel: +256 (0)414286231 Fax: +256 (0)414 287 100

Date: 06-Jul-12
Time: 7:12:57 PM

RECEIPT

BILLING DETAILS

RECEIPT ID:	7001
PATIENT ID:	2001
FIRST NAME:	ROBIN
SURNAME:	VANPERSIE
DOCTORS CHARGES:	25000
TREATMENT CHARGES:	1000
ROOM CHARGES:	40000
HOSPITAL CHARGES:	40000

PAYMENT

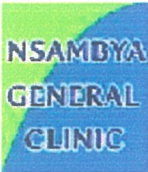
TOTAL:	106000
V.A.T:	12720
DISCOUNT:	5300
NET TOTAL:	113420
AMOUNT TO BE PAID:	113420
AMOUNT PAID:	115000
BALANCE:	1580

THANK YOU FOR VISITING NSAMBYA GENERAL CLINIC

Figure 10: Receipt Report

DICE:

s used to display the patient’s invoice. This information can also be printed out.



Nsambya General Clinic,
Plot 1351/2 Ggaba Road,
Nsambya, Kampala,
P.O.Box 8596
Kampala, Uganda

nsambyageneralclinic@yahoo.com

Tel: +256 (0)414266231

Fax: +256 (0)414 267 100

DATE: 06-Jul-12

TIME: 7:03:55 PM

INVOICE	
PATIENT DETAILS	CHARGES
BILLING ID: 6001	DOCTORS CHARGES: 25000
PATIENT ID: 2001	TREATMENT CHARGES: 1000
ADMISSION ID: 1001	ROOM CHARGES: 40000
FIRST NAME: ROBIN	HOSPITAL CHARGES: 40000
SURNAME: VANPERSE	
ADMISSION DATE: 28-Jun-12 12:30:00	TOTAL: 106000
TODAYS DATE: 02-Jul-12	V.A.T: 12720
LENGTH OF STAY OF DAYS: 4	DISCOUNT: 5300
	NET TOTAL: 113420

THANK YOU FOR VISITING NSAMBYA GENERAL CLINIC

Figure 11: Invoice Report

Program testing

was intended to ensure that the system is consistent and conforms to its specifications and that the system meets the expectations of the users. The testing process was proceeded in stages where testing was carried out incrementally with the system implementation. The following were the stages involved:

Unit testing: individual components were tested to ensure that they operate correctly. In this case, each form was tested independent of the other forms to ensure that it was working as required.

System testing: each form was tested to ensure that there were no errors while interfacing with other forms. This was concentrate on the detection of module interface errors by testing of these interfaces. The database was also tested separately to ensure that the table relationships were consistent.

Integration testing: the sub-systems were integrated to make up the systems. The whole system was then tested. This process was concerned with finding errors that result from manipulated interactions between the various sub systems. In addition, it was concerned with validating that the system meets functional and non-functional requirements and testing the emergent system properties.

Acceptance testing: this was the final stage in the testing process before the system was accepted for operational use. The system was tested with data supplied by the system users rather than simulated data. Acceptance test was to reveal errors and omissions in the system requirements definition or expectations.

User training, operation and testing

Training

Implementation of the new system would involve training individuals who will use the final system. The deliverable of the new system implementation and project implementation is the operational system that will enter the operation and support stage.

Training would involve: helping the user understand the applications user interface, performing data entry and retrieval, explaining the actions or events that would cause the application to fail, highlighting the strengths and limitations of the application as far as data entry,

and retrieval is concerned. An explanation on how to generate and print reports would also be needed.

Operation and support

Operation and support stage comes when the system is operating. System support is the ongoing technical support for users as well as the maintenance required to fix any errors, omissions or new requirements that may arise.

System support consists of the following activities:

Assisting the users: regardless of how well the users have been trained and how good the user documentation is, users will eventually require additional assistance because unanticipated problems may arise or new users added in the organization.

Fixing software defects or bugs: software defects are errors that may have not been detected in the testing phase.

Recovering the system: a system failure may result in a program “crash” or loss of data. Human error or hardware or software failure may have caused this. The researcher may be called in to provide technical assistance which may include restoring the system files and database.

Adapting the system to new requirements: new requirements may include business problems, new user requirements, new technical problems or new technology requirements which will need to be adapted into the new system.

CHAPTER 5

DISCUSSION RECOMMENDATION AND CONCLUSION

Discussion

After the research conducted, the researcher came up with the following conclusions and recommendations based on the research objectives of this study, which are stated below:

The researcher carried out a detailed study of the case study with an aim of learning how the current system works; identifying its' current weaknesses and strengths. Data gathered was analyzed, and a report document was developed and a customized application suiting the case study was developed to solve the problems and shortcomings of the current system.

A new system was developed and implemented using visual studio 6 (visual basic, package and deployment wizard, visual C++) and Wamp server (MySQL). Security of the new enhanced system was enhanced by use of passwords.

The new system was characterized by improving and simplified data collection, storage and update. Data is stored in a central location (that is the database) making it easier to backup and restore in case of system failure.

There is a significant improvement on data reporting; both in terms of accuracy and speed of generating reports. It will be possible to generate reports based on accurate information and keep track of patients' and their associate data. The system will however not be available online or in network environments.

Conclusion

The patients data management system is designed to respond to the needs of Nsambya general clinic to provide an efficient and reliable way to keep track of patients' and their data and reduce redundancy and inconsistency.

system has been developed with scalability in mind and can be updated to meet changing requirements. Additional modules can also be integrated to enhance its functionality.

The system has been pre-tested to remove any bugs that may cause the system to perform abnormally. Added data validation routines have been incorporated to curb expectations that may result in a crash and unexpected termination of the program. Such errors result in loss and corruption of data. Exhaustive testing needs to be carried out to isolate any bugs that may have not been captured during the initial phase.

recommendations

It is recommended that the system be implemented in a computer running windows 2000, windows vista or windows7, free hard disk space at least up to 2gb and ram size 256MB and

when the system is in use, it should run alongside manual files in order to prevent unexpected assessments, that is, parallel conversion should be adopted for the new system once in conversion

The system should run concurrently with the manual file system until a point where the system has been certified to run effectively and reliably.

areas for further research

The current operation is a day to day, week to week, month to month and year to year execution of automation systems business processes and applications programs. For the patient data management system to be more comprehensive, the system is open to improvements and enhancements. Research should be done in the area of networking so that the database can be made available online or on a network to support multiple concurrent users.

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APPENDICES

APPENDIX I: INTERVIEW QUESTIONNAIRE

1) For how long have you been operating in Nsambya General Clinic?

2) In which category are you?

- ☐ DOCTOR
☐ OPERATIONAL STAFF
☐ PATIENT

3) Are you conversant with computers?

☐ YES ☐ NO

4) What are the challenges you face when managing patients?

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

5) What is the efficiency of the current system?

☐ EFFICIENT ☐ LESS EFFICIENT ☐ VERY EFFICIENT

6) Do you think you are flexible enough to accommodate a new system in case one was introduced?

.....

.....

7) What is the ease of use of the existing system?

.....

EASY

.....

VERY EASY

.....

DIFFICULT

8) What areas would you like to see improved in managing patients?

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APPENDIX II: TIME FRAME

NAME	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
E 1 osal ig)						
E 2 rch ing)						
E 3 m n)						
E 4 rt ig)						

PENDIX III: BUDGET

er	Description	Cost
	Printing and binding	100,000
	Airtime	20,000
	transport	30,000
	Internet services	50,000
	Consultations	10,000
		210,000