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Patient Records Management System in Magomeni Hospital

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ABSTRACT

The Patients Records Management System has been designed to help so many Health Centers in Tanzania that need to computerize their operations to improve services delivered to their customers and increase the productivity of the entire organization. This system seeks to provide hospital employees with a new state-of-the-art, simple-to-use software since every basic concept, method and procedure has been explained fully in a precise clear language that is understood by many, and that is systematic and procedural. The project design work was done using a well-researched methodology according to the nature of the problem stated and the requirements or needs which are intended to be met, which avails the user with important illustrative information and content. In some cases, more efforts were done to describe more about the situation. For college and university students this work should prepare students for the use of computer and computer-based designed projects in problem-solving such as designing systems for institutions and various organs and inspire them to take more advance courses in computer studies.

Keywords: Patients, Health Centres, Customers, Organization, Hospital employees.

INTRODUCTION

The health care industry all over the world faces the challenge of improving the quality of health care and reducing costs [1-4]. To meet this challenge, health care providers are employing new technologies, consolidating costly and specialist services, changing institutional structures and improving their Information Systems. The quality of care at any hospital depends upon how well patients' health care, planning and administrative functions work together [5-10]. A hospital Information System supports the quality of care by providing a fast, accurate and easy way to enter, store and retrieve data thus freeing the hospital staff from many time-consuming tasks. Main aim for undertaking this project is to take up the challenge to develop a computerized information system to help the hospital to effectively register its patients, ease the process of registration for the registration clerks, minimize the errors and duplication of patients' records, propose a better way of storing and retrieving patient's data among other issues [11-14]. The system shall be referred to as the Patients Records Management System – (PRMS) Magomeni hospital is a public owned health center located three kilometers from town along Old Bagamoyo road Dar es salaam, the coastal region in the shore of Indian ocean Tanzania. The institution was established in 1953 by Karimjee and started operating in 1959, it was then taken by the government under the ministry of health Tanzania. The institute offers the following services; post-natal and pre-natal health center, volunteer counseling and testing center (VCT), maternity services, child immunization, health education and counseling, it is a twenty-four hours, full patient hospital center that manages its operations in shifts. This is done by the shifting sequence of nurses and doctors [15-17]. It operates by first registering the patients before directed to the examination room, those who have files are first directed to the records room, the process is manual and consumes a lot of time considering that many patients are served daily by the hospital [18-19]. Dar es salaam contains a population of 5 to 7 million people. It's the business centre for many activities and businessmen, recently facing the problem of overpopulation which often causes frequent eruption of epidemic diseases such as cholera, tuberculosis and malaria due to overcrowding and congestion

of houses [1]. The hospital seeks to develop into a centre of excellence in service provision, education, training, research, development, and transfer of cost-effective technology and management information systems suitable for the health sector in Dar es Salaam and neighbouring regions in general.

Statement of Problem

The system which is in place of record keeping at Magomeni Hospital is mainly through the use of a manual filing system which has the patients records stored in files and a partially automated system, file based which deals with records of the patients being not sufficient and effective as many patients are attended daily. Due to the large volume of data that is required to be stored, processed, analyzed and also shared among staff, members of this organization face a lot of weaknesses in their daily activities such as delaying of in processing of information, some information is always lost due to poor security of the system and all these contributed to a high level of operational cost in ability to make timely and accurate decision, hence hinders the organization to meet its needs. All this is because of the fact that, the centre uses manual systems in keeping the records so there is a need to develop a more efficient computerized system which will be able to perform analysis, storage and produce a report in a given time.

Aim

The main objective of the project is to design a system that will capture patients' information and store records in the database.

Specific objectives

- To investigate the present problems with the patient information system and develop a database system which will provide a centralized management information system that will reduce duplication errors and double registration.
- To build a system that will be able to compete in the market with other organizations or hospitals or other NGOs that provide similar services like what the hospital is offering.
- To implement and maintain the system to meet requirements according to the increasing needs of the organization operation and improve productivity.

Research questions

Will the system allow the application to share data with other programs?

i. Is it possible to build the system that can run over a network?
ii. Will the program allow the user to access data from the database?
iii. Is it possible to build a secure program in such a way that available data is viewed by only the authorized user?

METHODOLOGY

Target population

The data collection technique targeted on senior managers, middle managers, low level managers and patients. This is because the categorized managers plus patients were the ones who could give out complete information which was useful for the establishment of the new system and knowing more weaknesses of the current system.

Sample selection

The research used the following people according to their position at work, hospital director as a senior manager who gave the information about strategic objectives, policies and organization structure. The nurses and ward attendants about the operation of business procedures as a middle manager. Secretaries and receptionists gave information about day to day activities of the organization as low-level managers. Also research got information from patients about problems facing them such as file missing or loss, inconsistencies etc.

Data collection technique

The research is used the most appropriate data collection techniques to collect data from the organization.

i. Interview, the project used this technique to collect data from senior and middle managers so as to get additional strategic information about the organization, patients could give information about the problems they always face.
ii. Questionnaire, the research chose this technique to collect information from the secretaries and receptionist about the difficulties facing them due to the current system.
iii. Observation, was done to gather information within an organization so as to get data which were not found through questionnaire and interview techniques also to verify data which were already found from interview and questionnaire techniques.

Development methodology

To achieve the above objectives, the project used the system development life cycle (SDLC) methodology which has five phases: preliminary investigation, problem analysis phase (extracting the requirements), system design phase (first step in developing new software), implementation phase (coding) and the maintenance phase (enhancing the software). Preliminary investigation helped the researcher to study why the system to be built was and defining its requirements. It also helped the researcher to carry out an investigation to establish what the current system did, what problems were and chose the requirements for the system. In carrying out an investigation, information about the current system was collected by recording the problems and requirements described by the users of the current system. Problem analysis, in this phase the researcher performed activities such as problems identifications, analysis and even predicting potential problems that could arise in the future. The deliverables of this phase gave the researcher a picture on how the system was supposed to be built and guide the developers' work. Analysis was carried out to establish the current system in detail in order to find out, the difficulties and problems of the system, the user requirements, the inputs to the system and the outputs generated. After the system analysis, led to the starting activities on designing, which exactly determined how the system was to operate in terms of process data, hardware and user interface. This specified how the system was to be implemented and presentations of the new system, ease of capturing data and output formats. Implementation, it was probably the most resource, costly and time consuming phase. Here is when the physical system was validated and finally installed. It also included activities such as user training and system maintenance [2]. And then I came with the concept of implementing the new system which improved the quality of service, utilization of resources, faster access to management's information and reduction of expenditure.

Development tools

Microsoft visual basic and Ms Access are the tools which were used in developing the new system. Visual basic is a programming environment that is, a program specifically designed to facilitate the creation of new program, would be used to create user interface. Ms Access used in creating the new system particularly the database system and managing the application's data. SPSS statistical software, data analysis tool was used in analyzing the data obtained from the results of interview. This tool assists in presenting the data by drawing a graphs such as histogram, bar charts or pie graph [3].
Other development tools included the hardware tools such as,

i. Pentium 4 of 3.20 GHz processor.
ii. Minimum of 256MB of RAM.
iii. 40GB or higher storage memory hard disk.
iv. Windows XP operating system.

Current system

The institution was using manual system in keeping its records; paper based and file based systems. The following were the weaknesses of the current system.

- The current system takes too much time to process the records.
- There is no security and confidentiality of records which are stored.
- High use of space due to bulk folders at the receptions and office inside while the health center is expanding and hence it may become difficult to handle all of the documents produced.

Project size and structure

The project covered the automation of records and information storing. It focused on the receiving of patients' details and all necessary particulars required and store them for later or further use when needed at any time. Also could produce a report about a particular patient admitted at the hospital. The project included the computer that is a single computer or network of computers

Experience with development methodology

System development life cycle (SDLC) is the methodology which will be used in developing the new system [4]. The researcher did not have much experience with the methodology but was confident to use the methodology because he had studied and understood the methodology well. With connection to SDLC visual basic programming language was used by the researcher to build up a program and user interfaces, Ms Access to create database system and to run the application developed.

Economic feasibility

The new system has many benefits to the institution, for example after the study and implementation the system is able to accommodate huge amount of patient records compared to the current system [5]. Additionally, the new system proved the following benefits.

- A high level of automation and accuracy.
- The ability to keep records of patients and fast retrieval when needed, a real time access.
- Hiding the database from the user in such a way that the database will be seen by only the database administrator and each user is restricted from seeing data or information not correspond to his/her privileges given by the system.

Cost of building the system

In building the new system the researcher incurred much expenses in travelling to and from the application area, buying the requirements for new system such as hardware and software, subsistence, stationeries and research assistants [6].

Risk assessment

The researcher was not familiar with the application area, this could lead to get wrong information or data during data collection therefore researcher made use of organization reports and current system's documents to study the current system so as to minimize the problem. As the time for creation of new system was short forced the researcher to skip some of the steps in developing the system hence could affect the system development [7]. It was therefore a worth thing that to come up with the computerized information system which could be able to accommodate large number of patients attended daily by registering them, keep their records, track their medical history and status, by transforming the current system into a more automated, secured and controlled record keeping which is reliable and effective.

RESULTS

Results from observation

The system which is in place of record keeping at application area was found to be mainly through the use of a manual filing system which has the patients records stored in files, which are kept in drawers and a partially automated system, file based which deals with records of the patients being not sufficient and effective as many patients are attended daily.

Data analysis from interview

The Table below show the statistical values obtained from the interview

Number	**F**
1-4	3
5-8	2
9-12	7
13-16	3
17-20	5
	∑f=20

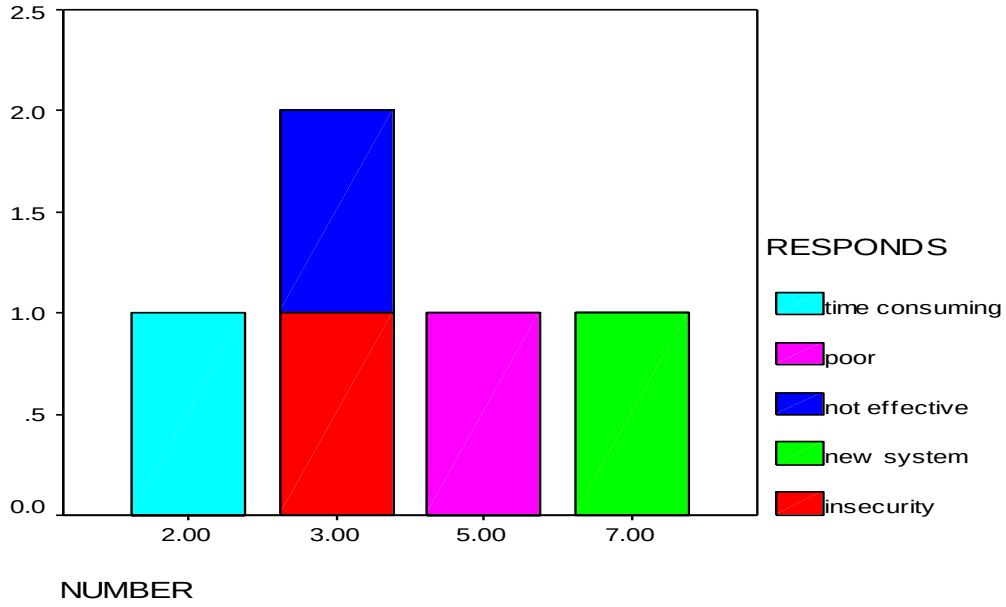
Table 1: Data representation table

Frequency value represents the number of people responded to the suggestions, comments and conclusions as per questions which they were posed by the interviewer.

The bar graph below illustrates the analysis of the data from the interview.

The graph of responds against the number of interviewee.

Figure 1: Bar chart



The responds are shown by the coloured bars, red represents those people who concluded that the existing system was totally insecured in terms of security and confidentiality, blue colour is the respond to the conlusion that the current procedures of record keeping is not effective and has a lot of drawbacks, army green accepted the idea of introducing new system to cut out the poor record keeping, pink represents those who agreed it to be poor and truth that it is time consuming in accessing the records is shown by the light blue.

Requirements analysis

This phase described the functions of the Magomeni hospital patients' records management system, involved visiting the organization and interacting with the employees of the concerned offices to come up with the system requirements and form a basis for the software development. The system constraints and services were established in this stage and planning was underway basing on the fact gathered.

Hardware and software requirements

Since the system was transformed from manual and paper based to automated system, the following hardware and software were recommended to be used for the introduced system.

Item	Specification	Benefits
PC	Pentium IV,3.20Ghz processor cd-drive, 256 MB RAM, 80 GB HD	Fast, performance and better access to data, use of CDs, large storage space
Printer	Black with colored cartridge inkjet printer	More timely reports
UPS	220-240 Volts, 4A	For power stability and storage to keep PC working , even during power losses ,prevention of data loss
OS	Windows XP SP2	Managing the hardware and software interface, compatible with many applications.
Ms Access	Ms Access 2002-2003	Data storage
Application developer	Visual basic 6.0	Interface design and packaging

Table 2: Hardware and software requirements

Functional requirements

System requirements which specified the main functions a system component could be capable of performing. These software requirements defined behaviors of the system that was the fundamental process in which software and hardware components of the system performed on inputs to produce outputs.

The software was able to;

i. To register, store records of the patients at the hospital.
ii. To navigate through the records, add, deleting and searching of the records.
iii. Allow access of information by authorized persons only through the use of username and secret characters as passwords.
iv. To produce report s when needed weekly or monthly on registration for outpatients and inpatients, payments reports and employees' details.
v. To compute and displaying the total patient's bill charges on service offered to him or her.

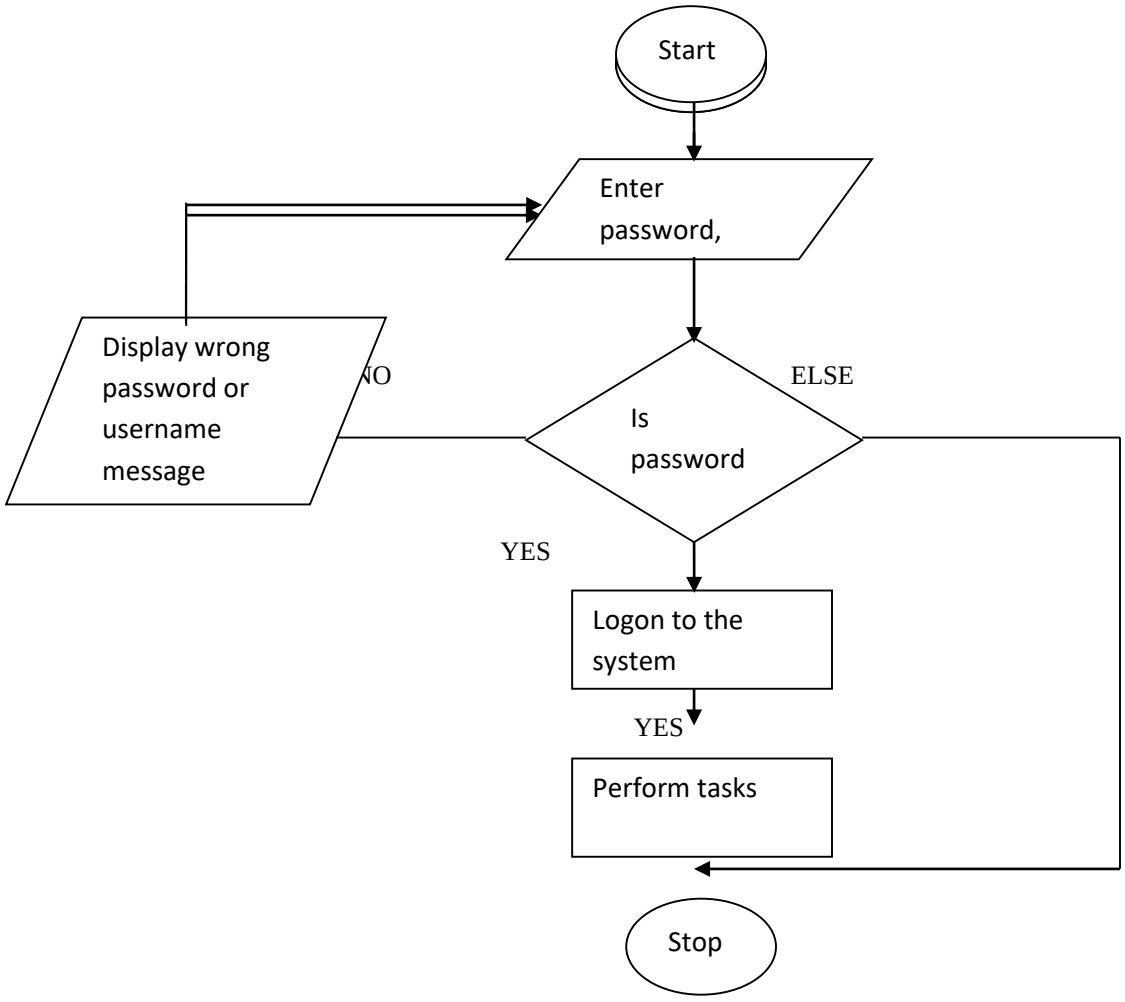
Non-functional requirements

A software requirement that described not what the software did, but how the software could do it, as software performance requirements, software quality attributes. The non-functional software requirements included the response time, language standard used by the system, data integrity through validation rules, efficient and ease usability of the system, the choice of colour.

Security requirements and feature of the system

The flow chart below illustrates the flow of security procedures to enter and use the system.

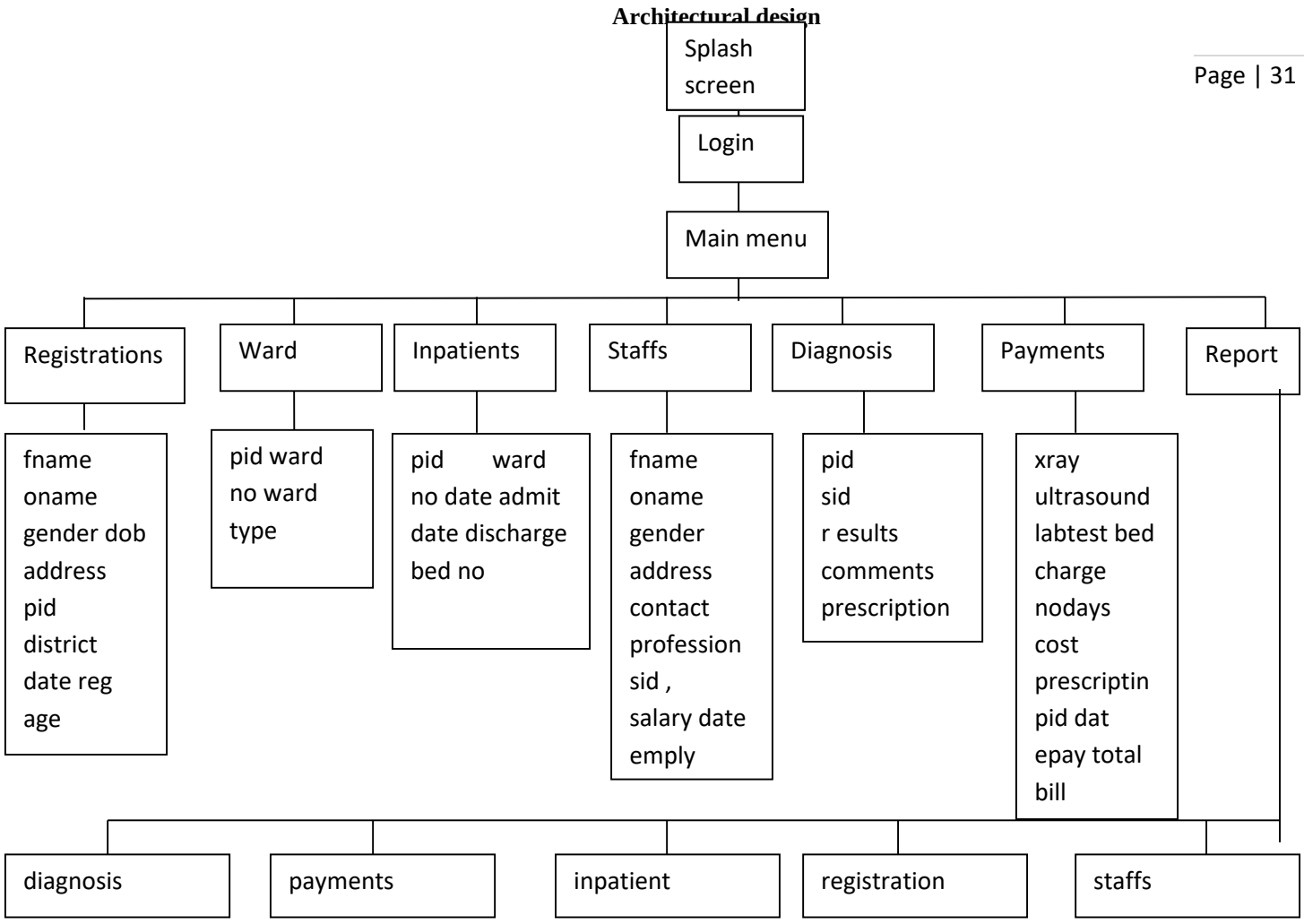
Figure 2: Authentication process flow chart



System design

Information gathered from the requirements analysis phase were divided into three groups; the software design had fundamental abstractions and their relationships were defined while the hardware design required the architecture of the proposed system. The output of this stage was an architectural model which described the hierarchical structure of the program components, the manner in which the components interact and the structure of data used by the components.

Figure 3: Architectural design



Physical design

Patient registration table

Field Name	Data Type	Description
Fname	Text(30)	First name
Oname	Text(30)	Other names
Gender	Text(1)	Male(M) or Female(F)
Dob	Date	Date of birth
Address	Text(30)	Location or residency area
Pid	Text(5)	Patient unique identification number
District	Text(30)	District
Datereg	Date	Date when registered
Age	Number(long integer)	Age of the patient registered
Regfee	Currency	Registration fee paid once

Table 3: Patient table

Staff table

Field Name	Data Type	Description
Fname	Text(30)	First name
Oname	Text(30)	Other names
Gender	Text(1)	Male(M) or Female(F)
Address	Text(30)	Location or residency
Contact	Text	Full-time contact
Sid	Text(5)	Staff unique identification number
Salary	Currency	Salary paid
Date emply	Date	Date when employed
Profession	Text(30)	Profession of the staff

Table 4: Staff table

Ward table

Field Name	Data Type	Description
Pid	Text(5) {FK}	Patient unique identification number given when registered, Foreign key
Ward no	Text(2) {PK}	Ward number, Primary key
Ward type	Text(20)	Ward type i.e maternity, accidents
Sid	Text(5) {FK}	Staff identification number

Table 5: Ward table

Inpatient table

Field Name	Data Type	Description
Pid	Text(5) {FK}	Patient unique identification number, foreign key
Wardno	Text(2) {FK}	Ward number, foreign key
Dateadmit	Date	Date on admission
Datedischarge	Date	Date on discharged
Bedno	Number(3)	Bed number

Table 6: Inpatient table
Diagnosis table

Field Name	Data Type	Description
Pid	Text(5) {FK}	Patient unique identification number, Foreign key
Sid	Text(5) {FK}	Staff unique identification number, Foreign key
Results	Text(30)	Examinations results, laboratory test results
Prescription	Text(30)	Prescription described or given to the patient
Comments	Text(30)	Doctor's comments i.e admit or discharge the patient

Table 7: Diagnosis table
Payments table

Field Name	Data Type	Description
Xray	Currency	X-ray's charges
Ultrasound	Currency	Ultrasound scanning charges
Labtest	Currency	Laboratory test charges
Bedcharge	Currency	Bed charges
Prescription	Currency	Prescription offered charges
Total	Currency	Total bill charges for services given
Nodays	Number	Number of days the patient spend at the hospital
Cost	Currency	Total cost for admission of the patient at the hospital
Pid	Text(5) {FK}	Patient unique identification number, foreign key
Datepay	Date	Date on payments

Table 8: Payments table

Relational schema

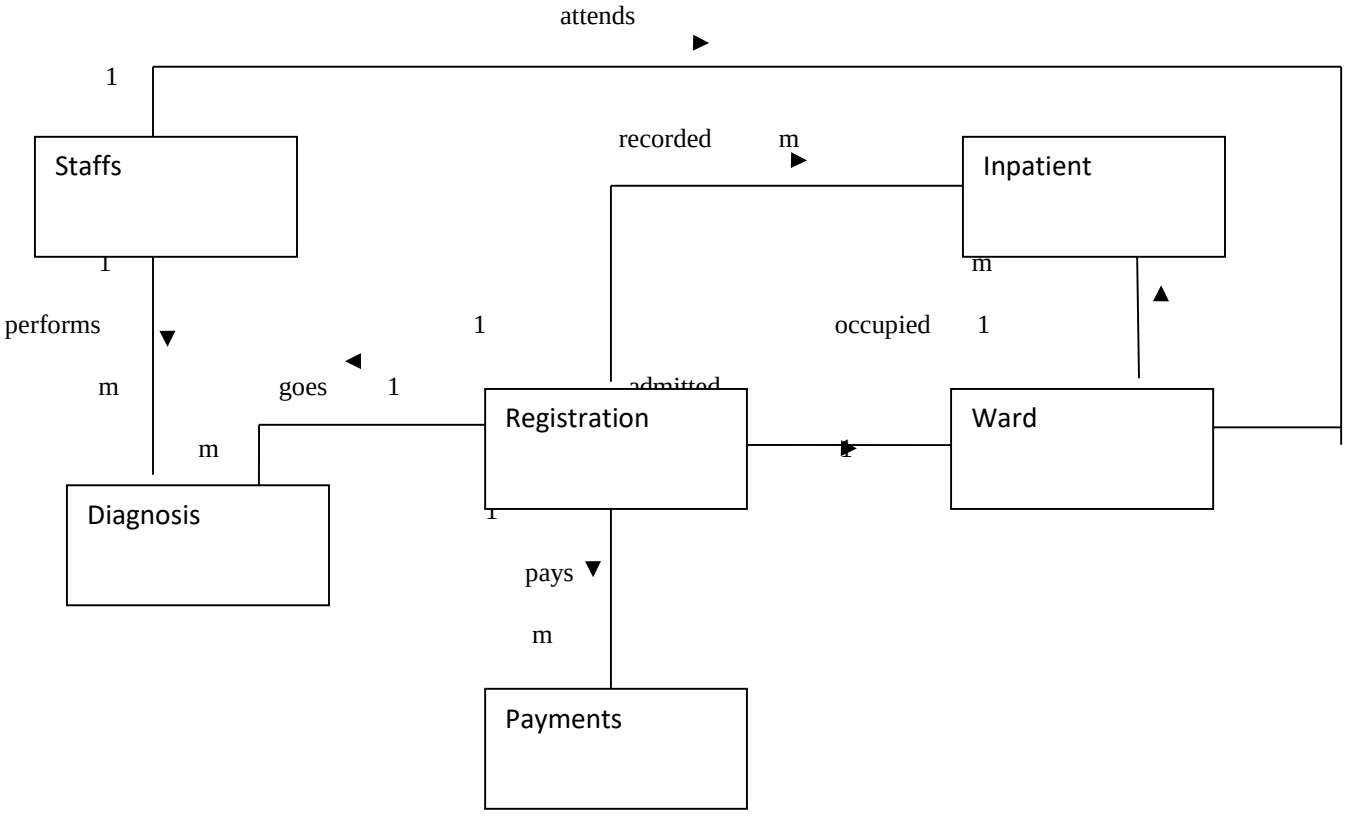
Primary keys are bolded and underlined, foreign keys are in bold only.
Registration (**pid**, fnme, oname, gender, dob, address, district, datereg, age, regfee)
Staffs (**sid**, fname, oname, gender, address, contact, profession, salary, dateemply)
Ward (**wardno**, **pid**, **sid**, wardtype)
Inpatient (**pid**, **wardno**, dateadmit, datedischarge, bedno)
Diagnosis (**pid**, **sid**, results, comments, prescription)
Payments (**pid**, xray, ultrasound, labtest, bedcharge, prescription, total, datepay, nodays, cost)

Logical design

The user data in the database was represented as relations as shown in the entity relationship diagram. The columns of the table contain fields and arrows of the table containing records for particular entities in the registration point. Microsoft Access was used to store the data.

Entity relationship diagram, E-R diagram

Figure 4: E-R Model



System presentations

The new system has the graphical user interface. Graphical user interface is a portion of program that the user interacted with [8]. Graphical user interface includes the following.

- A pointing device, typically a mouse.
- On screen pull-down menus that can appear or disappear under the control of the pointing device.
- Window that graphically display what the computer is doing.
- Icons, which are graphical images that represent certain items such as files and directories. Introduction to computer and information system.

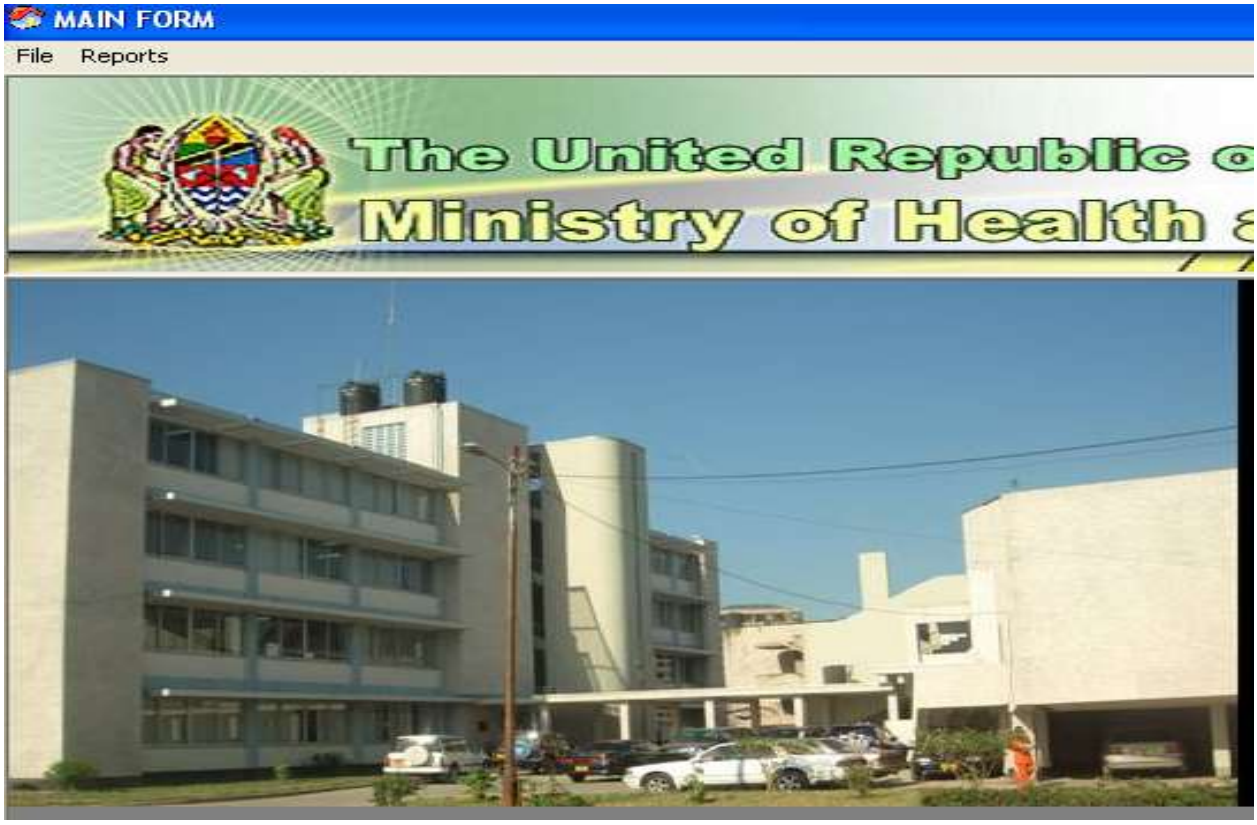
Figure 5: Splash screen

This is welcome screen which displays the title of the software product, version before loading the login screen and the system.

Figure 6: Login form

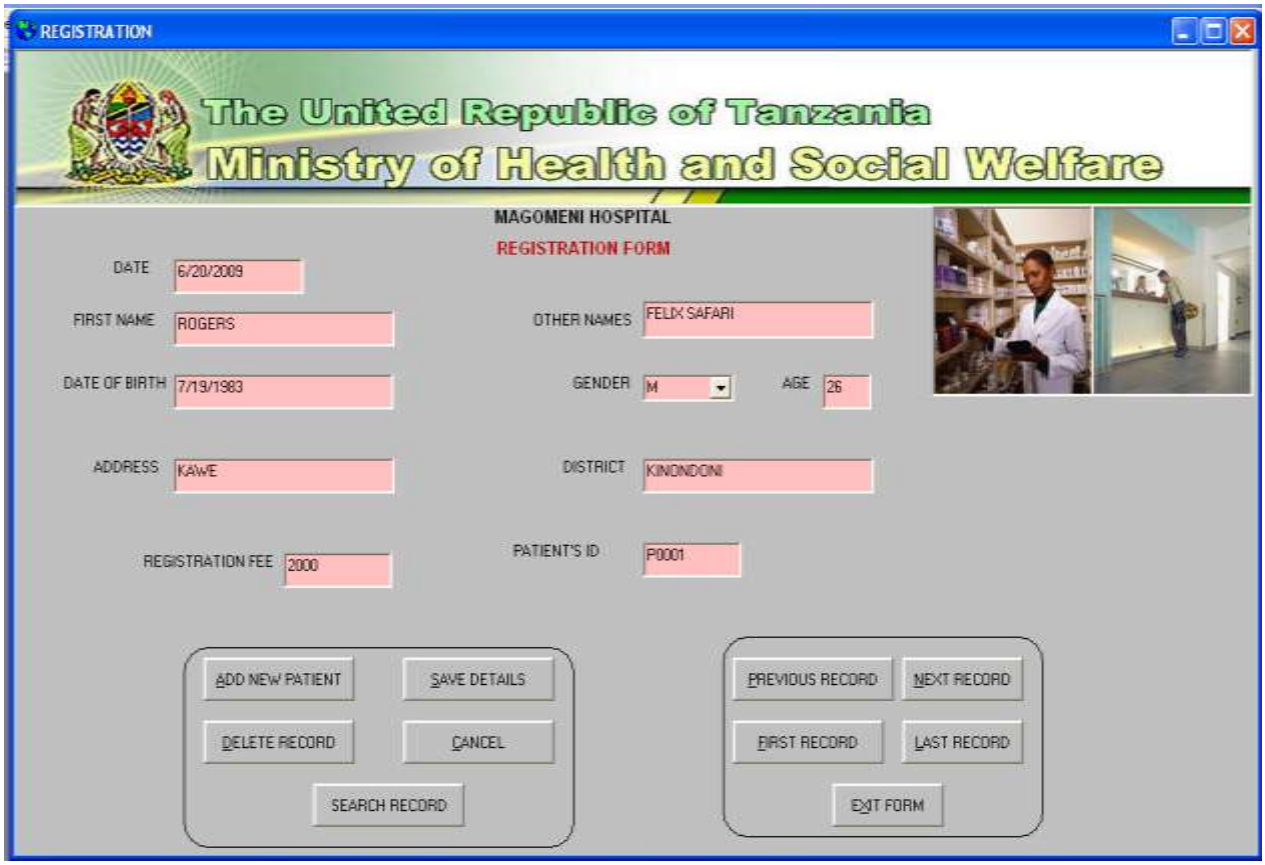
This is the security login screen to the system, only authorized registered users with username and password will be allowed to enter the system and access the records stored.

Figure 7: MDI form



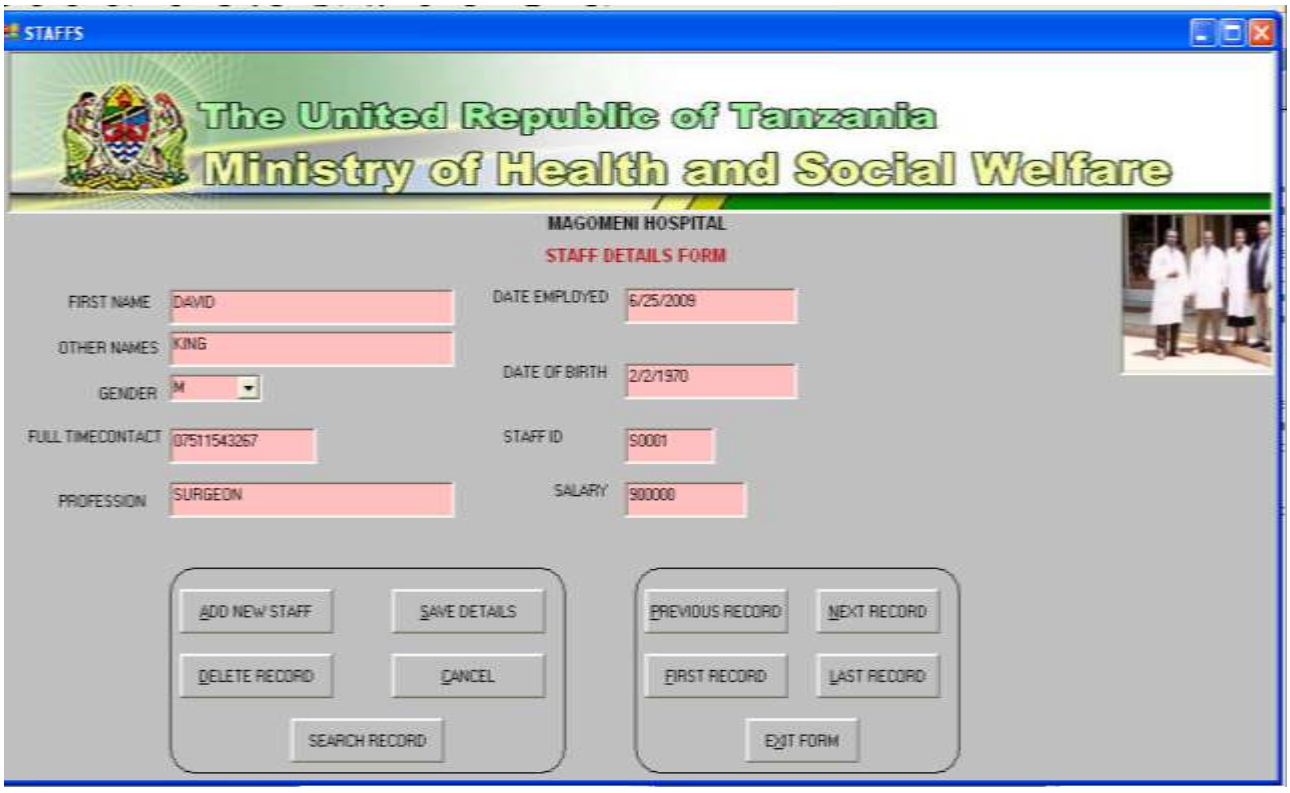
This main form which contains all the forms included in the system, main operations starts here

Figure 8: Outpatient registration form



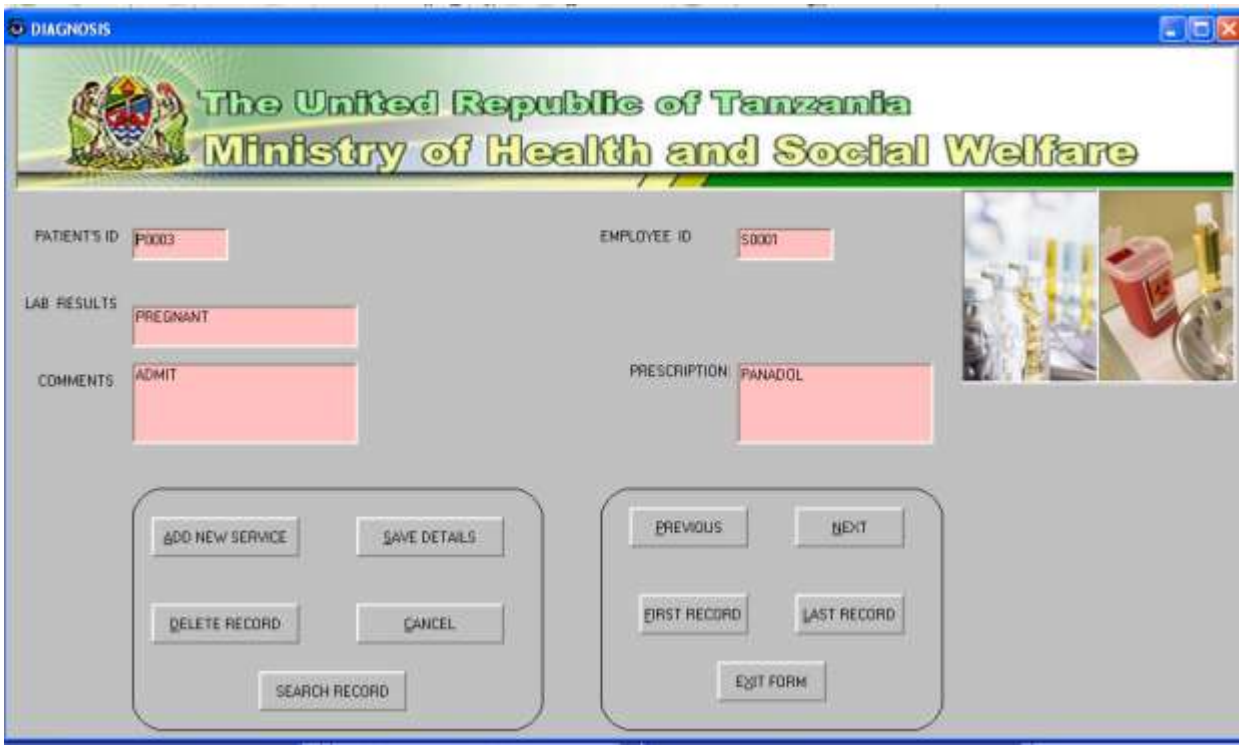
This is the registration form which captures the patients' details during the registration

Figure 9: Staff form



Staff details form, captures and displays the employees recorded details from the database

Figure 10: Diagnosis form

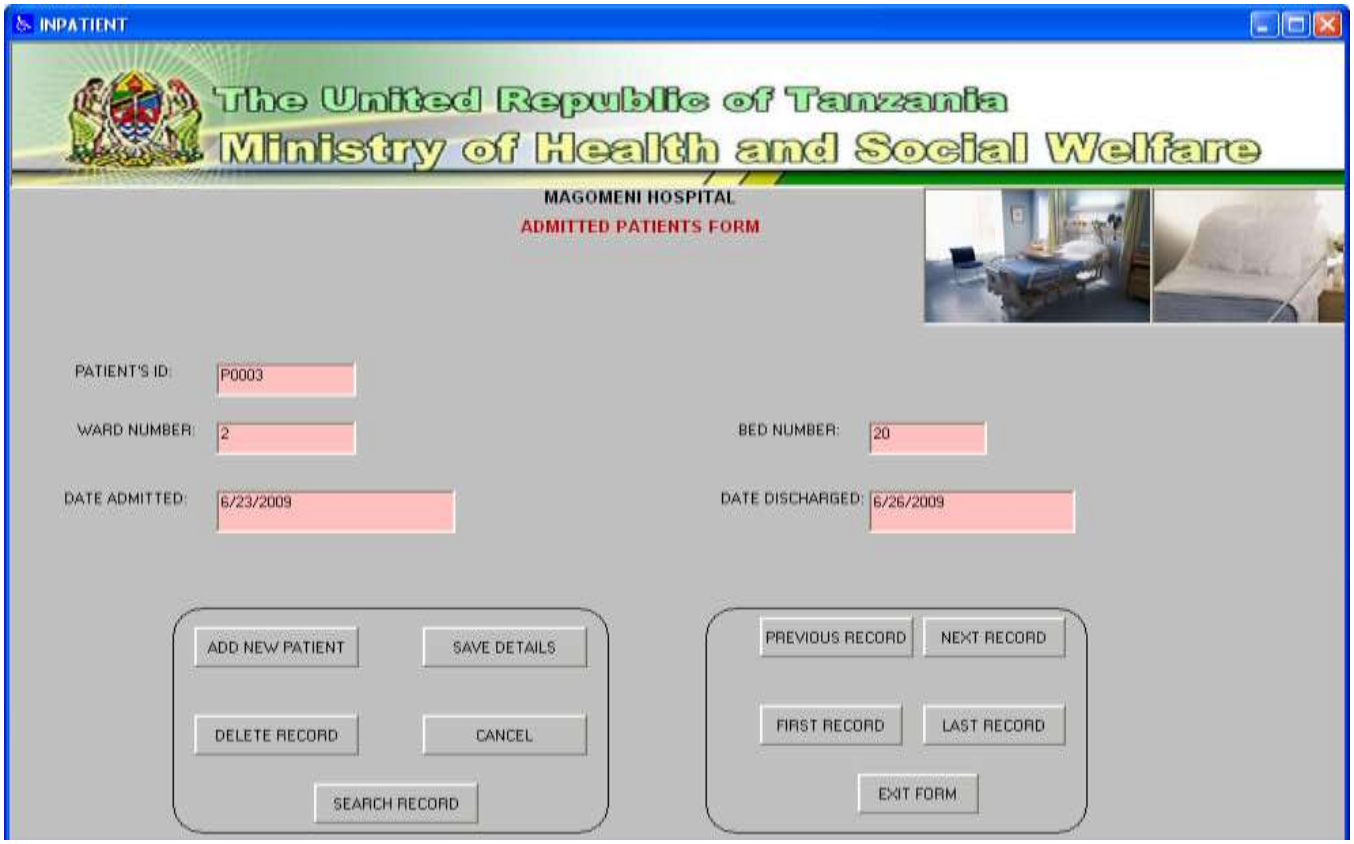


This is the form which is used to record results from the examinations done to the patient.

Figure 11: Ward form

This form displays ward details, shows the ward in which the patient is admitted.

Figure 12: Inpatient form

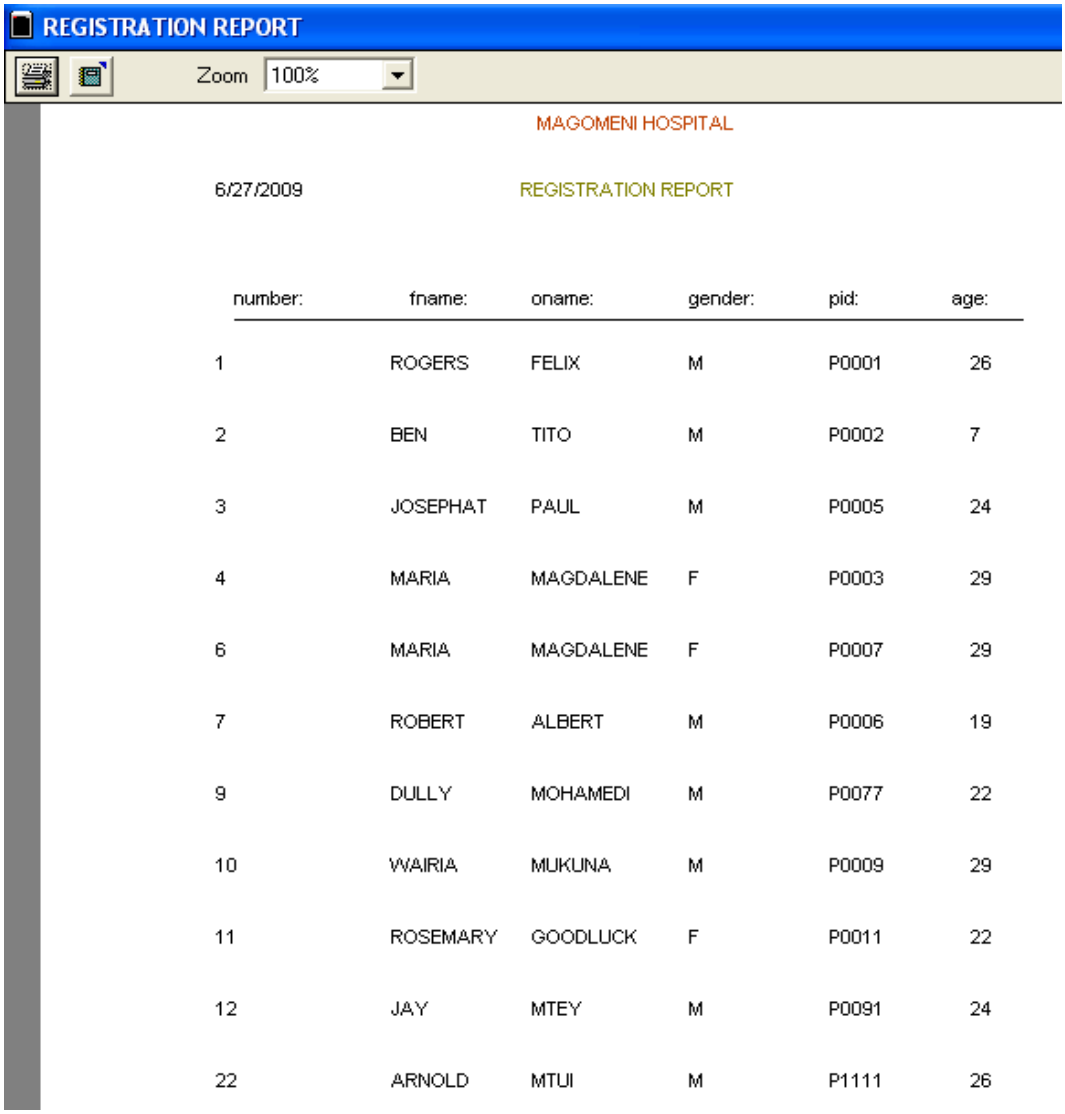


Form which displays admitted patients at the hospital.

Figure 13: Payments form

This is the payment form, captures, computes the transaction, stores and displays the bills.

Figure 14: Registration report



REGISTRATION REPORT

Zoom 100%

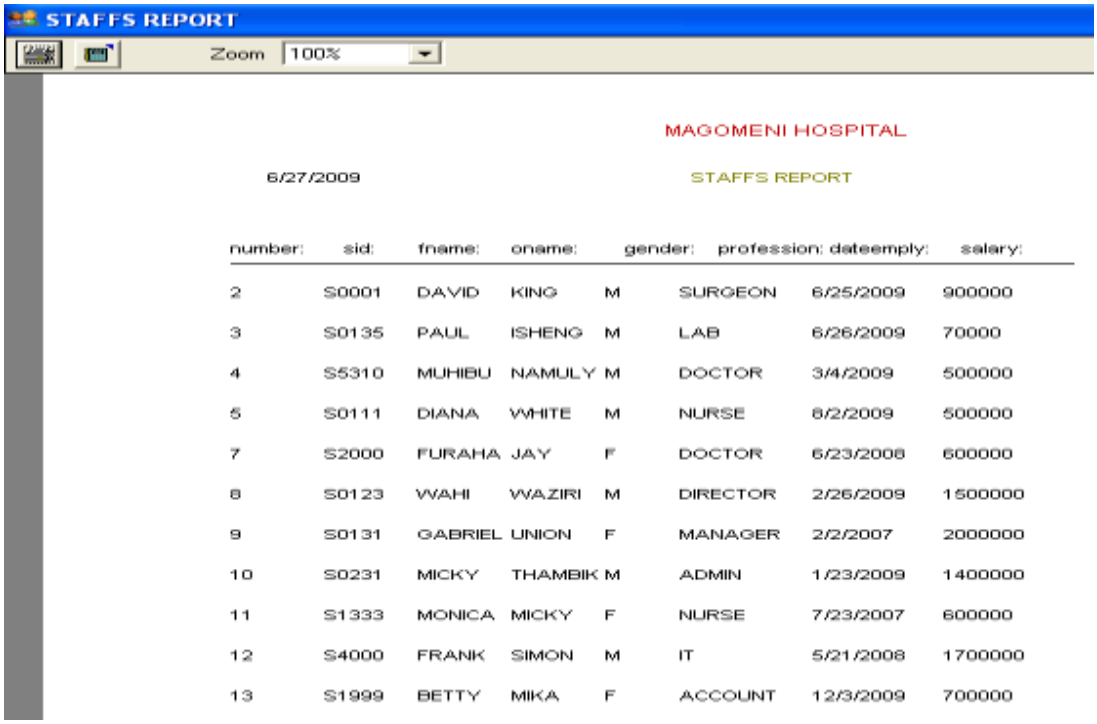
MAGOMENI HOSPITAL

6/27/2009 REGISTRATION REPORT

number:	fname:	oname:	gender:	pid:	age:
1	ROGERS	FELIX	M	P0001	26
2	BEN	TITO	M	P0002	7
3	JOSEPHAT	PAUL	M	P0005	24
4	MARIA	MAGDALENE	F	P0003	29
6	MARIA	MAGDALENE	F	P0007	29
7	ROBERT	ALBERT	M	P0006	19
9	DULLY	MOHAMEDI	M	P0077	22
10	WAIRIA	MUKUNA	M	P0009	29
11	ROSEMARY	GOODLUCK	F	P0011	22
12	JAY	MTEY	M	P0091	24
22	ARNOLD	MTUI	M	P1111	26

Report format for the registration form.

Figure 15: Staff report



STAFFS REPORT

Zoom 100%

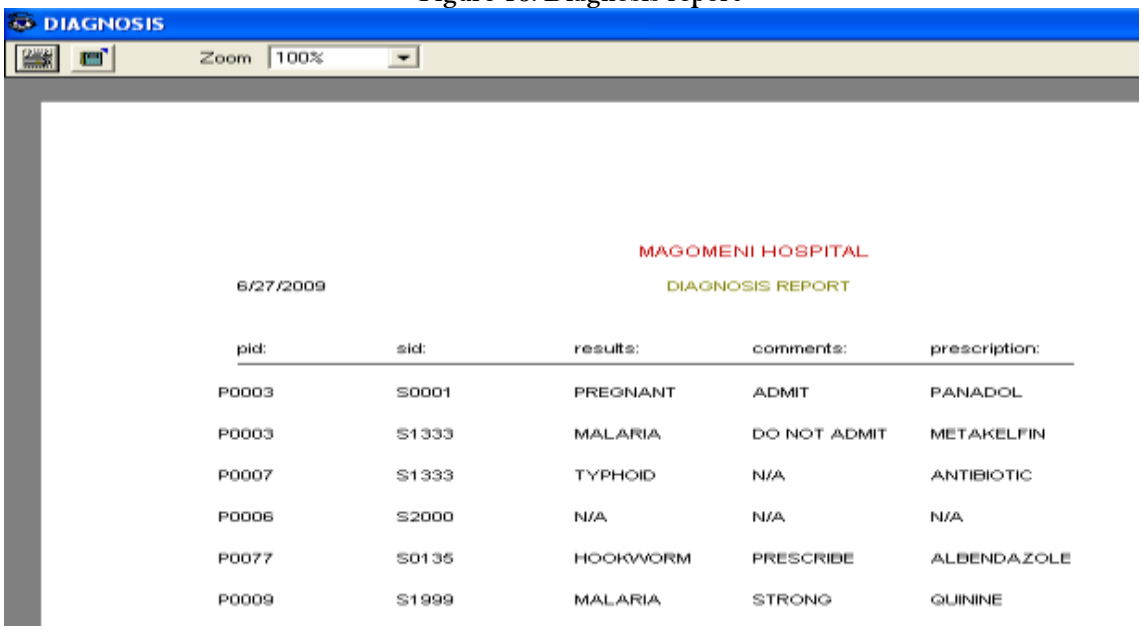
MAGOMENI HOSPITAL

6/27/2009 STAFFS REPORT

number:	sid:	fname:	oname:	gender:	profession:	dateemply:	salary:
2	S0001	DAVID	KING	M	SURGEON	6/25/2009	900000
3	S0135	PAUL	ISHENG	M	LAB	6/26/2009	70000
4	S5310	MUHIBU	NAMULY	M	DOCTOR	3/4/2009	500000
5	S0111	DIANA	WHITE	M	NURSE	6/2/2009	500000
7	S2000	FURAHA	JAY	F	DOCTOR	6/23/2008	600000
8	S0123	WAHI	WAZIRI	M	DIRECTOR	2/26/2009	1500000
9	S0131	GABRIEL	UNION	F	MANAGER	2/2/2007	2000000
10	S0231	MICKY	THAMBIK	M	ADMIN	1/23/2009	1400000
11	S1333	MONICA	MICKY	F	NURSE	7/23/2007	600000
12	S4000	FRANK	SIMON	M	IT	5/21/2008	1700000
13	S1999	BETTY	MIKA	F	ACCOUNT	12/3/2009	700000

Staffs report print out format

Figure 16: Diagnosis report



The print-out of the diagnosis records.

Coding

In this stage, the whole system was converted into computer understanding language. Coding the new system into computer programming language is an important stage where the defined procedures are transformed into control specifications by the help of a computer language. This is also called programming phase in which the programmer converts the program specifications into computer instructions, which we refer to as programs. The programs coordinate data movements and the entire process in a system. It is generally felt that the programs must be modular in nature. This helps in fast development, maintenance and future change, if required. This system has been developed using the visual basic 6.0 and Ms Access database management software. Ms Access allows accessibility of data and retrieval of data easily. It allows elimination of duplicated of data and also security of the database is possible.

Testing

Before actually implementing the new system into operations, a test run of the system is done removing all the bugs, if any. It is an important phase of a successful system. After the above codifying of the whole program of the system, a test plan developed and run on a given set of test data. The output of the test run should match the expected results. The following test procedures were carried out.

Unit testing

First stage of testing done by using written test planning and prepared test data. The path consist of a number of test runs such as valid paths through the codes. For each test run, there is a list of condition tested, the test data used and expected results. All the forms that are on the system were tested against the test plan and conditions.

Integration testing

This is the interfaces between programs in the same function area. Each program is linked to other programs with which it interacts. The whole process must be in a specific sequence and within specified response time. The integration between the program interfaces created in visual basic 6.0 and the database created in Ms Access was fully tested to ensure that they effectively linked.

System testing and implementation

This tests the whole system by linking together all the programs subsystems. Bugs are recorded and categorized in terms of priority are fixed and those with less priority can be addressed in the follow-ups

releases. The following are also carried out. Performance testing validates that all the response times or transaction periods specified in the functional specifications can be met by the system especially when it is fully loaded. Involves timing how long the system takes to respond to a user request, timing normal case path through and exception cases.

- Regression test, this ensures that the correction during the system test have not introduced new bugs, and test the key functions.

- Acceptance testing, this proves to the client, that the system, meets the business requirement agreed upon, in the functional specification. The tested data is replaced with live data provided by the client. The client records all errors and other aspects. They are discussed with the developer, whereby, the errors are corrected by the developer, and the changes are implemented at the expenses of the client.
- Data take-on and conversion, the data from the current system is transferred safely to the new system.

This is done by:

i) User enter data; one has to ensure that data entry errors are controlled.
ii) Data conversion by using a developed program that transfers data from the current format to the new format.

- User training, training should take place in learning environment with competent trainers and with well define training objectives. The training should cover all the function of the system until when the users are competent in the use of the system. The training is done by the system developers, more experienced staff.
- Installation and change over, this involves the following.

i) Installation on site, the hardware is brought, the software is installed that is operating system and management information system.
ii) Site commissioning, the system is installed on site, connected to any other third party component; commissioning test are running to identify discrepancies between interfaces, until the system work without any problem.
iii) System change over, direct method is used, it occurs when at given time one system end, and a replacement start immediately. The advantage is that it is the cheapest and there is a clear break between current system and new system.

System analysis, design and development were very interesting phases. Design included identifying entities, attributes and their relationships. This included liaising with the direct uses of the system. This was intended to reduce potential problems in future as possible. Once the design phase was complete, a further confirmation from direct and indirect users of the system was done until they were satisfied that all the intended purpose was achieved. This phase was complete by converting the design into a working application.

DISCUSSION

Recommendations

The package is highly recommended to be used at Magomeni hospital for effective process of registering, store and retrieval of patients' information. The report generated can be used to make statistics on how many patients are registered and treated at the health center, this will help senior managers to make decisions and future strategies for the institution to develop and improve its services offered daily to the people. Therefore, the researcher recommends that the organization to take full advantage of this new automated system for the operations to be more efficient.

Limitations to the study

- Limited experience
  Lack of experience in the particular field limited the speed and tact at which the project could have been carried out by fully skilled and experienced person. Therefore, I have to research and learn new techniques which also lessen the time available.
- Time constraints
  Other academic activities required attention; furthermore, time limits reduced the amount of time I could take to research and perfect the project.
- Financial constraints
  Financing a study of this magnitude in terms of research, software, hardware and other resources were costly, hence led to project stagnation.
- Lack of resources
  Resources to carry out such a project were not easily available, for example software.

CONCLUSION

Generally, the development of this software product was a great success because it was able to meet the needs of the hospital as intended. The report described the manual and computer methods of keeping information pointing out the drawbacks of current system in use giving the benefits of the new system. It also gave the background of the whole study, objectives, methods used to tackle the problem, risks encountered plus their solutions, requirements analysis, system design and implementation.

Areas for future research

The researcher has made the product flexible to accommodate future requirements by the organization resources such as medical store control, staff payments system was not covered and left for future enhancement. Also as the institution is growing and expanding there is a need to have the dynamic website catalog to expose the institution further, process of online doctors' reservation appointment, payments for those use credit cards and health insurances.

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