**A Research Proposal on the Design and Implementation of an Automated Healthcare Database Management System**

**(A case study of Olabisi Onabanjo University Health Centre)**

**By**

**Oluwatosin Samuel Olajumoke**

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**Abstract**

This project will focus on the development of an electronic health record management system to improve Olabisi Onabanjo University health record management service. This represents a transition from the traditional paper-based patient record keeping to a more sophisticated electronic/computer-based format. The software will be created with XAMPP platform, MySQL will be used to create the database and Hypertext Markup Language (HTML), Hypertext Preprocessor (PHP), CSS and Javascript will be used for the design of the interface, styling and sending of queries. The database will be connected with the Hypertext Preprocessor (PHP) so that data can be selected and inserted into the database using server-side execution. The username and password will be used to log in into various sections of the system. The developed system would see to the improvement in the Olabisi Onabanjo University’s health care record management when fully deployed, which would reduce problems associated with patients’ records keeping and also increase the rate at which data is accessed, thus improving healthcare service delivery and achieving greater turnaround time.

**Research Context**

Technology has aided the improvement of individual health, healthcare, biomedical research as well as public health through the science of bioinformatics (Shortliffe & Cimino, 2006). Therefore, healthcare institutions are seeking to develop integrated computer-based information-management environments to consolidate the inevitable application of big data to health care (Murdoch & Detsky, 2013). There exist various entry points into the clinical world where computational tools assist patient care matters; reporting results of tests, allowing direct entry of orders or patient information by clinicians, facilitating access to transcribed reports, and in some cases supporting telemedicine applications (Hartswood, Procter, Rouncefield, & Slack, 2003), because disorganized and incomplete patient records pose an obstacle to patient care.

The most common medium by which record of medical history are kept is paper (Mandl, 2001) making data management a serious impediment to productivity. However, the promise of a more efficient hospital service is obvious through the use of electronic health records management systems (Stroetmann et al., 2011).

Electronic health records may be alien to quite a number of health care facilities in Nigeria, but it has been in existence for nearly 50 years as various institutions have experimented since the 60s and 70s with various forms of electronic recordkeeping. Examples of early electronic systems include Health Evaluation through Logical Processing (HELP) (Demner-Fushman, Chapman, & McDonald, 2009), and Multiphase Health Testing System (MHTS), Computer-stored Ambulatory Record (COSTAR) (Barnett et al., 1979).

From the reconnaissance survey carried out in Olabisi Onabanjo University Health Centre, it is observed that medical records are being kept in physical folders and then placed on cabinets. It was also noted from the record section that patients (students and staff) records are stored in many formats and these results to disorganizations of the records, leading to a higher risk of medical errors, duplicate procedures, and time loss in searching and obtaining information.

Though paper-based records system provides accountability, it has its inherent challenges e.g., difficulty of access, time-consuming to update, it is not secured and it is impossible to swiftly share between different locations and maintain for a very long time without destruction (Amaechi, Agbasonu, & Nwawudu, 2018). An unfortunate disaster like a fire outbreak or damage by water could lead to the permanent loss of valuable patient data whose knock-on effect may be impossible to quantify. A fully electronic, nationalized, health records system could tackle and improve on some of these problems e.g., provide accountability, increase privacy levels since only authorized personnel can access a patient’s record as opposed to a paper file, increase efficiency; such that patient data could be retrieved within seconds instead of going through numerous files and provide access to generic patient data. (Mandl, 2001).

**Research Aim and Objectives.**

The aim of this research work is to develop an automated healthcare database management system for Olabisi Onabanjo University Health Service that will:

* Enable effective creation and management of patient’s data,
* Manage doctor’s schedule,
* Enable seamless transition of information from one department to the other,
* Handles the accounting business of the health center
* Accurately archive the patient’s information and diagnosis data.
* Allow high levels in giving full patient history
* Reduce lead time, shelf space, and errors due to damage, fatigue of staff
* Facilitate “just in time” deliveries
* Provides higher level security as the system would be passworded to prevent unauthorized access and,
* Help the management plan, monitor, optimize resources and ascertain their financial position at any time.

**Research Methods**

The methodology conforms to the following principles in order to design the automated Healthcare database management system. (Chudinov, Osipova, & Bobrova, 2017):

* The sequential approach in understanding expectative information needs and ability to modify the current descriptions
* Define information need as configurations linked to the typical data formats.
* Declaration of the relationships between data domains.

The database will be designed following the steps outlined below:

1. Analysis of the system target, which is the representation of the user's information needs as a set of initial entities in the domain area.

2. Definition of the relationship between the various data set

3. Development of the database in MySQL using tables and allowing “Id” as the primary key

**System target**

A proper understudy of the records and process of the Olabisi Onabanjo University Health Centre will be carried out through data gathering from various sources as shown in Table 1 in order to ensure appropriate enumeration of the various target of the system as it affects the various users. This enables the understanding of information needs and assignment of tasks to the various users in the different segments of the hospital (Sun & Jia, 2012).

**Table 1:** Methods of data collection

|  |  |
| --- | --- |
| **Method** | **Data collected** |
| Interview | Doctors and other personnel will be interviewed to understand the standard operating procedure of the health Centre |
| Hospital records | The kind of data required for every user will be collected towards building the database. |
| Observation | The service level agreement of the clinic will be deduced by careful observation |
| Literature | Books and Journals will be consulted to understand the various need in building management software for the hospital |

After the various observation and consultation, the following required information is determined to be needed for the system. This determination is fitting to the defined need of the clinic. The information required for the healthcare management system database are as follows:

* Patients’ main information
* Clinic staff main information and roles
* Medical condition
* The drugs dataset, laboratory test dataset and costing information for medical activities

**System Development requirement**

The system will be designed to keep patients' inventory, drug inventory, test and laboratory inventory, pricing and personnel database with the most useful output being to be able to schedule a patient for consultation, to update medical record and keep a log of activities in various departments of the hospital. Therefore, developing the system entails having some hardware and software as well as a robust procedure (Akomolafe, Timothy, & Ofere, 2014).

**Hardware**

The hardware requirement refers to the tangible (physical) gadgets used for the development of the system and these are; Personal computer (PC) 4G RAM /240G hard drive with a core i3 processor or higher.

**Software**

Windows 8 operating system software will be used. Cross-platform(X), Apache (A), MySQL (M), PHP (P), and Perl (P) (XAMPP) software will be used in the project to host the database and makes the system run on a local host. MySQL in the XAMPP software package will be used to create the database while the Apache makes the system run on a local host. A sophisticated text editor, Sublime text editor will be used for coding

**Research Design and Implementation**

**Users and Roles**

The designed healthcare management system handles the patients experience from start to finish. The system receives input, stores/updates data, and outputs the required information. The primary user targets hosted on the management system are record officer (front desk), patients, doctor, pharmacist, laboratory attendant and account personnel, all of whom have different role assignments, functional requirements and varying interaction levels as depicted in Figure 1.

**FIGURE 1. Use case function for the healthcare management system**

**Pharmacy**

**Administrator**

**Laboratory**

**Doctor Record Officer**

**Patient**

**The Administrator**

The administrator through the administrative section is the one who controls all of the systems. The administrator is the one that sets instructions to all the staff in the clinic; decides how the work will flow, handles new staff registration, set the functions of each section and their respective limitation, responsible for the drug/test management and the entire system maintenance.

**The Record officers**

The record officer mans the record section. This section is the first point of call when a patient visits the health Centre. It is the first place the patient will go to when he/she goes to the clinic either as new patients or returning patients. The record officer can create new patient record and/approve the record created by a patient. Thereafter the patient is added to the queue until a doctor picks up the patient from the waiting list. The queue list has three comments, which are: waiting - which means the patient is waiting for the pickup by the doctor; progress - which means the patient is still with the doctor and finished – which means the doctor is done with the patient.

**The patient**

The patients are the primary clients of the health Centre. The registration interface allows the patient to create new record if they are first time users. This section is used for registration where all the patients' data are collected and saved in the database. However, this would need approval from the record officer. Also, the record officer can create a record for patients who cannot use the self-service. The patient can also independently log in into the system to view reports.

**The Doctor’ section**

The section is the next section after the patient has made appointments from the record section. The doctor selects the patient from the queue, after which the patient’s id would be required to login to the patient’s account and consultation would resume. The doctor would not be able to resume consultation session if there is no patient on the queue, or if the patient's id is not available. The doctor can progress with consultation, make a request for tests or give drug prescription by clicking the relevant buttons e.g. laboratory request form or the medication button to prescribe a drug.

**Account section**

This section handles the charges from every unit in the Health Centre. Pharmacists and laboratory attendants post the relevant bills to be paid by a patient. The section is designed in such a way that patients cannot proceed for a test or collect medications without visiting the section and settling the bills as contained on their account.

**Laboratory section**

This section is designed specifically for the laboratory attendant to administer. The doctor's request for a test is posted to this section, where billing is done, and a report is made available after the patient has made the required payments and undergone requested tests

**Pharmacy section**

Pharmacy section is designed in such a way that the patient will have to visit the section after a prescription has been made by the doctor to collect the relevant medication. This section allows the pharmacist to post the cost of prescriptions to the patient's account, and medications would only be dispensed after payment. The pharmacy module display consists of the doctor's name the patient, medication date, payment and action. The payment row has two comments; ‘posted' and ‘paid'. The ‘posted' is when the price of the drug has been posted to the account section and when the patient pays for the prescriptions the comment will change to ‘paid'. For the action row, the ‘waiting for confirmation' means the drug has not been dispatched to the patient and if that is done the comment will change to ‘item collected'.

**Implementation**

This phase consists of the source code, together with documentation to make the code more readable. The various interfaces were built where the patients, record officer, the doctor, pharmacist, laboratory attendants, account personnel interact with one another. The flowchart is given in Figure 2

Patient log in

Record queue

Pick up?

no

yes

Consultation with Doctor

Paid and tested?

yes

Need test?

yes

Laboratory

no

Tested?

no no

Pharmacy

yes/NA

Paid?

no

Account

yes

Dispense drug

**Figure 2:** Flowchart for the designed Automated Healthcare management system

**Application Development**

Developing the application entails the creation of the database and the creation of a graphical user interface. The database for the university health clinic will be created with MySQL software.

**Designing the graphic user interface**

The graphic user interface section will be designed with HTML, JavaScript, CSS and PHP. These provided a friendly user interface for all users to input records or read information without coding. Being what the user sees on the screen, it will be designed to be as simple as possible for ease of use.

**Database creation**

The creation of the database aids the clinic to save and secure all the patients (staff and student) medical records. Tables will be created to house the rows and columns where the patient’s records were orderly saved. It will be arranged in a row and column format which represents a field and the collections of the fields makes the records, while the collection of records created tables, the collection of tables formed the database. The database is very important in this system since one of the aims of the project is to secure patients record for a very long time compared to the paper-based system. The database can only be accessed by the administrator.

Database will be created with SQL command mysql> "CREATE DATABASE databaseName";

The database name for the project is “oouhealthcare”

So, this will be created as mysql> "CREATE DATABASE oouhealthcare";

To create my ‘patient profile’ table:

mysql> CREATE TABLE patients’profile (

id INT,

Title VARCHAR,

First name VARCHAR,

Middle name VARCHAR,

Last name VARCHAR.

Sex VARCHAR,

Date of birth VARCHAR,

PRIMARY KEY (id)

);

The primary key used in the table was the “id” which will distinguished between the patients. Every table contained a primary key. The input design for patient data entry record is given in Table 2.

**Table 2:** Input design for patient data entry

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **FIELD** | **DATA TYPE** | **RELATIONSHIP** | **DESCRIPTION** |
| 1 | Patient\_id | Varchar(30) | Primary Keys | Access |
| 2 | Patient\_first name | Varchar(30) | Not Null | Patient First name |
| 3 | Patient\_last name | Varchar(30) | Not Null | Patient last name |
| 4 | Patient\_middle name | Varchar(30) | Not Null | Patient middle name |
| 5 | Gender | Varchar(10) | Not Null | Gender |
| 6 | Age | Int | Not Null | Student/Staff |
| 7 | Passport | Varchar(30) | Not Null | Patient passport |
| 8 | Phone\_no | Int | Not Null | Patients Phone number |
| 9 | Patient\_type | Varchar(10) | Not Null | Student/Staff |

Several tables will be created to make up the database namely: login, diagnosis, prescriptions, medical history, medication information, patients’ complaint, disease classes, symptoms etc.

**Creation of the home page**

The homepage will be designed as the first page displayed to the user which consists of the following links: about, contact, and login link.

**Login page**

The login link will be designed in order for the patient and healthcare staff to login via the user password and user name. All users including patients and the healthcare staff which includes; the doctors, pharmacists, laboratory attendances, accountants and the administrative staff can log in on this page. However, the only role a patient can play is to view reports. All other users can carry out duties according to the roles assigned to them.

**System Testing**

The system will be tested in the department of Mathematical Sciences and ensures that the system assures its aim and objectives by solving problems associated with the conventional way the patient’s records are stored and transferred as well as enabled fast data access within the university health Centre. Primarily, the system will be set up on five (5) different systems on the same network and concurrent usage of different modules will be carried out. Only the system set up as the server requires the XAMPP software while the other systems serving as the clients require only the web browsers. No untraceable bug will be observed during this phase. The modules will be worked on in parallel and periodic testing will be done to ensure the performance of the system is accurately monitored.

**Security**

The system will be well secured in such a way that the user can access their section with their user name and password, preventing access by unauthorized users. The patient records are also secured because unauthorized users cannot access the patient’s record without the consents of the patient. The administrative officer is the only person that has access to all the sections and can define roles for all other users.

**Significance of Research**

From the reconnaissance survey carried out in Olabisi Onabanjo University Health Centre, it is observed that medical records are being done manually and having seen the problem associated with the manual system, the research calls for a new system in patient related services. The new system is significance in many ways. The design of the new system will justify the research aim and objectives mentioned earlier by providing accurate up to date information on demand. It will minimize redundantly, loss of information will be prevented, the need for volume paper files and unnecessary spending of paper folders, file cabinet will be removed and adequate security will be provided to ensure database system.

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