

The Development of a Relational Database Management System For Uniongate Diagnostic Center Akure Ondo State Nigeria

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ABSTRACT

The business performance in many organizations is enhanced through the effectiveness and efficiency of their database management system. Management decision making is best achieved when the available data is at the right hand of decision makers to analyze a given scenario. Customer best service is rendered when data redundancy is eliminated. The entity overall bottom-line profit result is yielded when all the easily accessible data mixed together gives higher net profit above the total operational cost. However, the traditional way of managing data establish a major problem that affects their daily business operation. The technological advancement in every sector is driving change to all organizations; as there is need for them to catch up with the need of the moment by creating a DBMS that will help their day-to-day operations. The challenges of accurately recording data, storing, updating and tracking are the major problems faced by Uniongate Diagnostic Center because of the manual means of operations. They can overcome the problems of working manually with data by perusing the benefits of database management systems. The use of database will increase the efficiency of business operations and reduce overall costs. Database management system is used to stores, organizes and manages a large amount of information within a single software application. The data is entered into the system and it is accessed on a routine basis by assigned users. The users has an assigned password to gain access to the system. The project is developed for Uniongate Diagnostic center Akure Ondo State, Nigeria. The development of a relational database for the diagnostic center was implemented successfully using the Apache Server with MySQL running as the back end and PHP used as the server-side language. The results obtained show that the use of relational databases has reduced data storage costs, eliminate data redundancy, remove data inconsistencies and avoid duplicate processing. The overall business efficiency has improved significantly and work processes simplified with least time of data query.

Keyword: data, database, diagnosis, management, organization, test, query

1. INTRODUCTION

Database management systems (DBMS) are a common element of everyday work, dependent less of the area where they are applied [1]. The popularity of database is quite high as it is hard to imagine a business domain that does not make use of the benefits that come with database applications. This is evident in the fact that its proof acclaim and adoption can be found by browsing the basic and complex information systems which extend to our private lives especially in activities that require the management of data. The use of database systems allows for ubiquity of the system in our lives and surroundings [2].

1.1 Database Management System

DBMS is a software application package designed to define, manipulate, retrieve and manage data. It manipulates the data by itself, the data format, field

names, record structure and file structure [3]. It also defines rules to validate and manipulate the data. The organization of data is typically done into a model that represent an aspect of reality. These supports processes requiring information such as modelling the availability of rooms in hotels, in such a way that supports finding a hotel with vacancies. DBMS interacts with the user, other applications, and the database itself to capture and analyze data. A general-purpose DBMS is designed to allow definition, creation of querying, update, and administration of databases. A database is not generally portable across different DBMSs, but different DBMS can interoperate by using standards query language such as SQL, ODBC or JDBC that allows a single application to work with more than one DBMS. Database management systems are often classified according to the database model that it supports. The most popular database systems since the 1980s have all supported the relational model as represented by SQL language [4].

1.2 The problem Statement

Uniongate Diagnostic Center is faced with different challenges because the manual and the spreadsheet format process of keeping records are faced with many problems such as; data redundancy, time wasting, duplication, difficulty in update and retrieving of data. The fact that the organization uses computers to process all the results of their clients does not guarantee proper storage and efficiency of the records.

1.3 Significance of the system

The significance of this study includes the following:

- It will help to reduce cost in running applications.
- It will provide effective resource management.
- It will increase performance and support.
- It provides security and compliance.
- It enables easy access to information.

1.4 Objective of the study

The main objective of this project is to create a database for Uniongate Diagnostic Center. The specific objectives are:

- to develop a software that will be used to save customer information;
- to develop an application that can reduce difficulty in retrieving documents or information

2. LITERATURE REVIEW

Database is an application that involves the storing of a particular group of data with each database having one or more application programming interface for creating, accessing, managing, searching and replicating the data it holds. The relational database management system has been used successfully on different applications because of its ability to store and manage large volumes of data. In relational database all the data is stored into different tables and relations are established using primary keys or other keys known as foreign keys

The Design a Hospital Database Management System for Medical Doctors was implemented by [6]. The aim of the work is to design and implement a system that is able to alleviate the problem of handling patients' data in a hospital traditionally. The authors were motivated by the inherent problems of the manual system of hospitals file management system. The paper examines an existing information system of a hospital and designed an automated system that can help Medical Doctors and

those who handle hospitals' data do their work more effectively and efficiently. The implementation of the system was done using Window, Apache, MySQL and PHP (WAMP) software while the web application runs in a computer network. The design provides easy and fast access to stored data as needed by different users with security against unauthorized access. The result shows that it allows authorized users to add, delete and update data into the database on the user's assigned role. It was also reported that the interface is user-friendly.

A Library Database Management System was developed by [7]. The motivation comes from manual files being created for use by different departments/units within the organization. Database management system design involves three considerations which are, Library users needs for the application programs, Library database processing system and Library database itself that includes the login/password or IP filtering when the access is provided over the Internet. The result shows that the contents are accessible on the Intranet. It is also easier to host the borrowed external contents. However, access restrictions are to be put on the contents either with login/password and/or IP filtering when access is provided over the Internet.

A Student Database Management System for a University was developed by [8]. The system aims at eliminating the practice of time consumption and the vulnerable tradition of manual maintenance of student information in paper. Software development life cycle steps were followed. The steps involved are requirement analysis, designing, coding, deploying and maintenance. MySQL database was used to store and secure information. The result shows that the portal eliminates paperwork that could lead to the loss of data and redundancy. It also allows the possibility of queries to obtain information for various surveys.

[9] Developed a Column-Oriented Database. The work was motivated by the database system performance that is directly related to the efficiency of the system at storing data on primary storage (e.g., disk) and moving it into CPU registers for processing. The methodology employed are; SQL Server provides native support for columnar storage and column-oriented execution, adopting many of the critical design features that are common in column-stores, such as vectorized processing and heavily exploiting compression. The result shows that a column-store can access just the columns needed to answer such queries.

The design the design and implementation of a student registration and course management database application is presented by [10]. The system solves the problems of managing student and course registration in tertiary academic organizations. The methodology involves using Microsoft Access 2003. The work discusses the issue of selecting appropriate database model, interface design, system deployment and maintenance of the system. The record of growth in relation to the student population and the system requirement was carried out in the study while the applicability of the system in academic institutions was also discussed.

[11] Developed an Accounting Database Assistance System. The motivation comes from the quest for information, and critical time constraints. The accounting database utilizes a relational database, which supports creating reports based on ad-hoc queries. It can be accessed using any major browser that supports HTML 4.0 and JavaScript. It is implemented on Windows with Apache Server running. The MySQL database is used to store and manage data for the system. PHP (Hypertext Pre-processor) is used to query and access the MySQL database. HTML and JavaScript are applied for generating the web user interface. The system is implemented on Apache Web Server MySQL provides rich and useful functions for database creation, maintenance and management.

[12] Developed a Database System for student's registration. The aim is to track all the details of student from the first day in school to the end of his/her academic period, especially for reports purpose such as tracking of attendance, progress in the course, completed semester's years, coming semester year curriculum details, exam details, project or any other assignment details, etc. The results show that the design facilitates the exploration of all activities happening in the college. As noted, [12] organizing and managing student records into a cohesive and efficient system might seem like an impossible task.

3. METHODOLOGY

The development of a relational database for Uniongate Diagnostic Center is presented. The system deals mainly with hardware devices and installed software components on devices. The System performs many tasks, it consists of a web-based system used by the users and the administrators of Uniongate Diagnostic center. The system helps to record personal details of users and patients that visit the medical center for diagnosis. Therefore, the web-based part is expected to run on

various operating system platforms. The applications of the system will run on the web server connected to the database server.

3.1 System Operation

The operation of the system involves the software to be installed on the hardware components devices. The installed system will be used by the authorized staff and management of the Uniongate Diagnostic center which will be beneficial to the management and their clients. The application will run on the web server connected to the database server while the Internet is the interconnection of all the smart communication devices that have a valid IP. An installed browser software will be used to access the internet whenever the user wants to access the system. If the user wants to access the system through the intranet connection, they would have to install a relevant software because most of the intranet access modes refer to the website of the organization which can only be accessed by its employees who have a username and password.

3.2 The Software Design

The System Development model follows the software development life cycle (SDLC). The system development employed the proven cost-effective LAMP (Linux-Apache-MySQL-PHP) platform. MySQL, being free software, offers all the features required by the system for efficient low volume data storage and processing. Similarly, PHP is an open-source scripting language which offers a huge collection of built-in routines required to rapidly develop the system.

3.3 Program Design

It is designed as a web application that runs on web browsers, more especially Mozilla Firefox. The entire system development is a set of program modules with each performing a specific task.

MySQL - The database design is based on MySQL which is a multithreaded and multi-user SQL database management system. The program runs as a server and provides multi-user access to a number of databases. It is the most popular for web applications and also acts as the database component of the LAMP, MAMP, and WAMP platforms.

PHP - This is a major scripting language of the design with a reflective programming language originally designed for

producing dynamic web pages. This is chosen for the project work because it works well with the web development of part of the project.

Frontend -This section focuses on the presentational markup and client-side programming languages used in this system.

HTML - HTML, short for Hypertext Markup Language, is the predominant markup language for web pages and applications. It is a means to describe the structure of text-based information in a document by denoting certain text as headings, paragraphs or lists.

3.4 System architecture

In the client server architecture, the functionality of the system is organized into services, with each service delivered from a separate server. Clients are users of these services and access servers to make use of them.

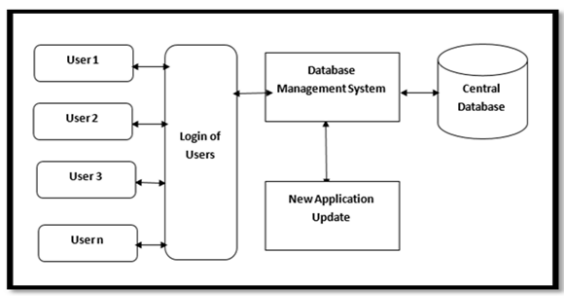


Figure 1: Architecture of the System

3.5 System architecture

In order to provide a clearer picture of the functionality provided. The system-level use case diagram gives a broad overview of the scope of the project, and the different sub-systems and actors involved. The actors identified are:

- User
- Registered Patient
- Administrator

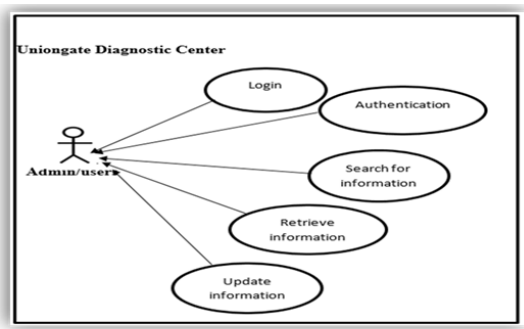


Figure 2: Use-case Analysis of the System

The Use Case analysis of the Uniongate Diagnostic Center is hereby presented. The login is from the users/admin when it is confirmed, the user can now search for information, retrieve, or update information.

3.6 The layers

The 3- Tier Client Server Architecture is used because data in a shared database is accessed from range of locations; servers can be replicated and also be used when the load on a system is a variable.

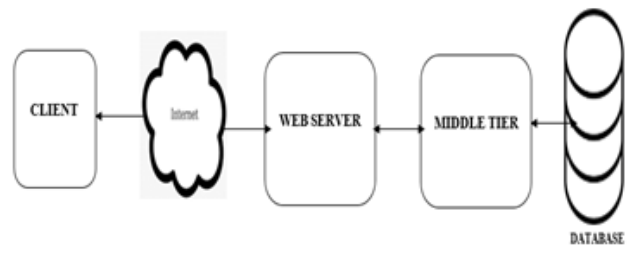


Figure 3: Database Layers

Data Tier - The data tier maintains the applications data such as Users’ data, patient’s data, appointment and the SQL queries. It stores the data in a Relational Database Management System (RDBMS) and all the connections with the RDBMS are managed in this tier.

Middle Tier - The middle tier (web/application server) implements the business, controller and presentation logic to control the interaction between the applications, clients and data. The business logic rules are done by the business logic which dictate how clients cannot access application data and how the applications can process data.

Client Tier - This is where the applications user interface connects data entry forms with client-side. It displays data to the user and they can interact directly with the application through user interface. The client tier interacts with the web/ application server to make requests and to retrieve data from the database. It then displays the data retrieved from the server to the user.

System view - Uniongate Diagnostic center system will allow the admin/users to view information. The users will first login to the system. Then click the “User” option, after clicking the login “Summary” option. Then the system will display the information. The login screen of the users’ is defined by the Client tier while the data for login and profile information with SQL queries are

maintained in the Data tier and controller logic for the login process. Loading the profile information from the database is defined in the Middle tier.

Communication - In this database system, there are a number of different processes, such as database server process, web server process, connections between the servers. HTTP protocol is used to communicate with web servers. The system deals mainly with hardware devices and installed software components on devices.

3.7 Database Design

The database model of the Uniongate Diagnostic Center is presented. The MySQL data model is adopted by the family RDBM.

A. Functional requirements:

- a. Admin Module
- b. Consultant Registrations Details
- c. Users Registration Module
- d. Patient Registrations
- e. Patient Card
- f. Test Registrations
- g. Test Type Module
- h. Gender
- i. Specimen Type
- j. Report Module
- k. Payment Module

B. Non-Functional Requirements:

- a. Security
- b. Performance
- c. User friendly
- d. Maintainability

C. Database Analysis:

Data are organized in table structure. It is composed of 11 relations. The sets of relations supported in the proposed applications are given as:

- a. ADMIN/USERS LOGIN: [admin_id; users_id; users_name: password: uploads: datetime: message]
- b. CONSULTANT_REGISTRATION_DETAILS [Consultant_id: name: age: sex: phone_number: specialities: year_of experience: email: profile_photo]
- c. USERS REGISTRATION MODULE [Id: name: Age: sex: phone_number: department: password: year_of_experience: email: profile_photo]
- d. PATIENT REGISTRATION [id: name: password: phone_number: email: next_of_kin: profile_photo]
- e. PATIENT_CARD [id: age: address: date_of_birth: state_of_origin: local_government_area: next_of_kin:

- gender: blood_group: height: weight: genotype: medical images]
- f. TEST_REGISTRATION [patient_id: patient_name: test_id: test_type: amount]
- g. TEST [test_id: test_name: test_type: test_date: recommendation]
- h. GENDER [patient_id: gender_id]
- i. SPECIMEN [patient_id: patient_name: specimen_type: consultant_in_charge: test_id]
- j. REPORT [patient_id: test_id: result: datetime]
- k. PAYMENT [patient_id: patient_name: consultant_id: diagnosis_id: amount: accountant_id: datetime]

3.8 System Requirements

Software Requirement: The software requirements are basically for both the server and clients. The server side requires Window Apache MySQL PHP (WAMP), whereas the clients require only the web browsers.

The Software Tools are:

- a. MySQL database.
- b. jQuery, JavaScript, CSS, HTML to develop the system.
- c. Apache Server.

Hardware Tools:

- a. Microprocessor: Intel(R) Core (TM) i5-6200U CPU @ 2.3 GHz.
- b. RAM: 8 GB of RAM
- c. Hard Disk: 1 terabyte (TB)
- d. Operating Systems: Windows 10 Pro 64 bits.

Results: The results obtained show that the use of relational database has reduced data storage costs, eliminate data redundancy, eliminate data inconsistencies, avoid duplicate processing, add, delete, and update data for maintenance tasks and it allows data independent of applications with centralize data management. In addition to benefit the project will maintain a more reliable, stable, and expansive technology. Overall, efficiency has improved and work processes simplified. Despite the fact that the objectives have been met, the system has room for improvement. It is robust and flexible enough for future upgrade using advanced technology and devices.

Recommendation: This research work is recommended to medical practitioners including doctors, nurses and medical laboratory scientist. Moreover, healthcare policy makers are encouraged to peruse the contributions of this project in the use of relational database system. The

organization needs to study the database benefits and limitations together with resources including human, technical, suitable planning which has a determinant factor in decreasing challenges. The Uniongate Diagnostic center has capacity to do the following: integrate existing data files, incorporate changes easily and quickly, simplify the use of data files, lower the cost of storing and retrieving data, improve accuracy and consistency and protect data security from unauthorized use.

Expected Contribution: A relational database system for Uniongate Diagnostic Center for easy update and retriever of information has been developed.

5. CONCLUSION

The project is designed for use at Uniongate Diagnostic center Akure Ondo State. The development of a relational database for the center was implemented successfully. The system has been developed with future development possibilities in consideration. The object-oriented approach of this system permits addition of new entities and methods to interact with existing ones and to extend the functionalities. In this project, the need to develop a relational database for Uniongate Diagnostic center has been identified. The database is very essential for the running of day-to-day activities of the laboratory center. The database has different advantages to the client and the organization for easy update and retrieval of information as at when needed.

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