Utilization of Health Information System to Enhance Health Care Delivery in Nigeria

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Abstract: Access to patient and population health data enables health care administrators, physicians, and nurses to make important care choices. Health information systems are crucial to getting health data into the right hands as quickly as feasible. Quick access to a patient's medical history, for example, might reveal prior therapies. These technologies also make it easier for health-care practitioners to gather information on macro-environmental factors such as community health trends. A Health Information System (HIS) gathers and organizes information about people's health and how a healthcare system works. When HIS does not work well, it makes national planning and other management decisions in the health system less effective. Data quality and coordination in Nigeria would be improved if this research can help the federal ministry of health build a master facility list that can be used for data collection and storage. Nigeria's Health Information and Human Resources (HIR) system has not been effectively integrated, resulting in poor data quality, incomplete, inconsistent, and erroneous data, as well as a large backlog of unprocessed data and many databases. The inability to communicate data due to the absence of integration of disparate systems is critical. The causes behind the poor implementation of HIS in Nigeria are discussed in this study, along with how it might be utilized to enhance the health-care system.

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1. Introduction

Information saves lives. This is unquestionably significant in the medical business. Access to patient and population health data enables health care administrators, physicians, and nurses to make important care choices that may make or break their patients' lives. Health information systems, which integrate health care with information technology in an efficient and effective manner, are crucial to getting health data into the right hands as quickly as feasible. A health information system may be used by health care organizations to collect, store, manage, analyze, and optimize patient treatment histories and other essential data (Asangansi, 2012). These technologies also make it easier for health-care practitioners to gather information on macro-environmental factors such as community health trends. Health information systems also provide information on particular physicians or health-care groups - for example, commonly used treatments or interventions that are linked with best outcomes. Doctors and nurses make data-driven judgments about many aspects of patient care using health information systems (Eboreime et al., 2017). Quick access to a patient's medical history, for example, might reveal prior therapies. Administrators may use health information systems to examine data about various departments or activities in order to effectively manage the organization's resources. Health care workers collect, store, manage, and analyze health data in each particular health care setting. They utilize this data to create comprehensive treatment plans, improve patient outcomes, and allocate resources wisely within the company (including staff) (Meribole et al., 2018).

Health Information Systems (HIS) are an important part of the health system in any country. When HIS doesn't work well, it makes national planning and other management decisions in the health system less effective and wastes more chances to use available resources to save more lives (Omole, 2015). Being one of the six core values of the World Health Organization's (WHO)

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Health Systems Strengthening framework, HIS has gotten more attention in several Low- and Middle-Income countries in the last ten years. HIS is the foundation for the production, analysis, dissemination, and use of quality data (Haux, 2006). A health information system (HIS) gathers and organizes information about people's health and how a healthcare system works. There are many parts that make up a health information system (Petersen, Wohlin, & Baca, 2009):

1. Getting and recording information
2. Data analysis
3. Sharing the results of the study and using them to improve care for patients.

A critical part of health information systems is the utilization of health and healthcare data to enhance care. Previously, the components of Nigeria's HIS were not organized in such a way that they could offer accurate health data for effective and efficient planning, monitoring, and evaluation of the country's health programs. According to the National Council on Health (NCH), National Health Management Information System (NHMIS) issues were recognized and NHMIS policy amendments were approved at its meeting (Federal & Prevention, 2007). HIS in Nigeria has been plagued by challenges like as leadership and governance for some time. It is largely due to technological advances and the surge in interest in the health sector that there has been so much activity and innovation in the creation of health information systems during the past decade. Data quality and coordination in Nigeria would be improved if this research can help the federal ministry of health build a master facility list that can be used for data collection and storage, as well as usage and flow, in order to help enhance data quality (Federal & Prevention, 2007).

2. Problem Statement

As a result, data is not effectively vetted and evaluated, resulting in poor data quality, incomplete, inconsistent, and erroneous data, as well as a large backlog of unprocessed data and

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many databases. There is a massive backlog of unprocessed data in several databases, and the data is partial, inconsistent, and erroneous. In addition, the inability to communicate data due to the absence of integration of disparate systems is critical. The causes behind the poor implementation of HIS in Nigeria are discussed in this study, as well as how HIS might be utilized to enhance the health-care system.

3. Related Works

A significant portion of the literature review concentrated on the Nigerian situation in terms of poor HIS performance, concentrating on such subjects as demographic variety and cultural effects on health care, a lack of infrastructure and support, corruption, and an availability of technological support services. In addition to technical elements such as data quality, system design, and the proper use of information technology, the effectiveness of an HIS is dependent on organizational factors. Other features include organizational and environmental factors that influence a nation's information culture. His organization, the roles and responsibilities of the various actors, and his available resources (Boned-Ombuena, 2007). HIS needs a broad Internet connection with high-speed data transport and retrieval capabilities in order to be successful in its use. Without a question, the lack of HIS implementation has harmed several key and critical areas of patient safety and care quality in Nigeria and Africa as a whole. When it comes to implementation, a lack of understanding and familiarity with electrical equipment is also a big factor. Poor data quality has long been a problem in health information systems. To keep the vanguard health care professionals in their decision-making, data systems are frequently unstructured. Data gathering is often required from "above" - a national Ministry of Health or a vertical health initiative (Consulting, 2009).

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According to the HIS report, Kenya has been implementing and expanding the use of a web-based system of District Health Information Software (DHIS2) to manage the country's regular health information. The purpose of the research was to determine the perceived possibilities and risks of the system in light of Kenya's decentralized style of administration. It also tried to propose recommendations for overcoming these challenges and expanding DHIS2 nationwide (Karuri, Waiganjo, & Orwa, 2014). According to Omole (2015), HMIS is an effort to collect, organize, and disseminate data on the operation of a health system or one of its component sections. Consequently, any health system may have a multitude of health applications. Utilization and knowledge of HIS in Nigerian hospitals are much behind where they should be. This study will investigate how one of the software tools deployed in health-care data analysis is used to make judgments.

4. Goals of Health Information Systems

Health information systems may be used by organizations to ensure improved patient outcomes. The following are a few examples.

4.1. Health Information Systems and Data Analytics

Health-care establishments routinely produce data. This contains data on the number of operations done, hospital stay lengths, patient health trends, insurance claims and billing, patient care costs and revenues, and more. One of the fundamental goals of health information systems is to make data collection, interpretation, and usage easier for businesses (Nutley & Reynolds, 2013).

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4.2. Health Information Systems Collaboration

Patients may need treatment from several health care specialists. A patient might get a preliminary diagnosis and treatment from a primary care physician before being sent to a specialist. Transportable patient records ensure that all clinicians have access to the same core information, facilitating cooperation in patient care (Suthar et al., 2019).

4.3. Information Systems for Population Health Management

A simple statistical analysis may reveal whether or not a given population is prone to diabetes in a particular manner. Information systems may be used by public health systems to identify trends in community health concerns. The coronavirus pandemic exemplifies how efficient use of health information systems benefits public health.

4.4. Health Information Systems and Cost Control

Access to health information systems is crucial for controlling expenses. To offer more specific treatment suggestions, physicians and nurses may use patient histories and similar case studies. In the meanwhile, managers may monitor the number of patients in different departments and allocate personnel and other resources prudently to the most in-demand regions.

5. Kinds of Health Information Systems in Existence

Multiple varied systems interacting within a wider IT environment are typical of all healthcare organizations. Understanding a portion of these many health information systems is advantageous.

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5.1.Provider-Facing Systems vs. Patient-Facing Systems

One distinction between systems is whether they are designed for patient input or for physician or administrator usage.

5.2.Health Information Systems for Patients

Many institutions of health care now provide "patient portals," which may be websites or mobile apps. By logging onto their personal accounts, patients may access protected information about their medical history, such as records of previous doctor visits. Frequently, physicians or nurses may document a care plan, which may include prescription drugs or follow-up visits, allowing the patient to participate more actively in his or her own treatment. In addition to seeing the results of lab work and other tests, patients may also utilize patient portals to check the status of their payments and insurance benefits (Haux, 2006).

5.3.Health Information Systems Examples

Several specific examples of health information systems fall under these broad categories. A few of the most common ones are given here.

5.3.1.   Software for Practice Management

Every health care institution must manage a tremendous number of administrative expenses, such as keeping track of appointments, sending out bills, and much more. The bulk of this job is often automated by the front office personnel of a medical practice using practice management software.

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5.3.2. Patient Index (Master)

Patients may also utilize patient portals to send secure and confidential communications to their physicians in order to inquire about follow-up care. Patient portals let patients to see information on their most recent appointments. The master patient index contains an entry for each patient enrolled. Health care administrators employ master patient indexes to eliminate duplicate patient files (Suthar et al., 2019).

6. Methodology

The research approach used for this study is the Waterfall Model. The waterfall model is a sequential, linear life cycle model that begins system development by identifying, defining, and comprehending system requirements and specifications. Figure 1 shows the different stages of the software development model.

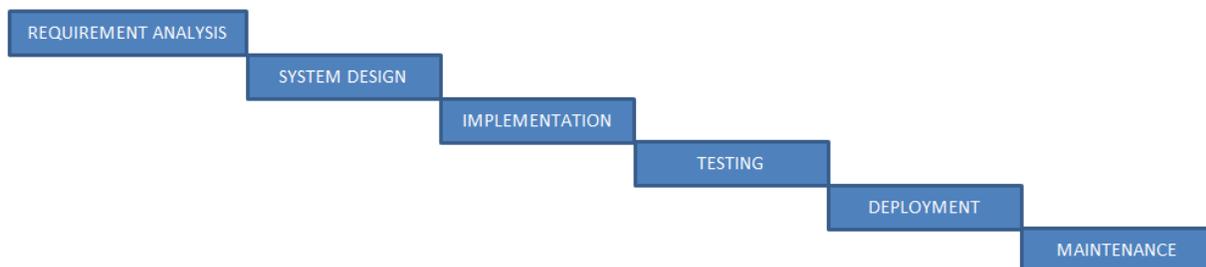**Waterfall Software Development Life Cycle Model**

REQUIREMENT ANALYSIS

SYSTEM DESIGN

IMPLEMENTATION

TESTING

DEPLOYMENT

MAINTENANCE

Figure 1: Waterfall Software Model.

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The Waterfall model consists of six major stages:

- **Requirement Gathering and analysis** – This is the first phase of the waterfall model. During this phase, system development requirements are specified, collected, and recorded. This acts as a guide for completing an effective system successfully.

- **System Design** – At this phase, a comprehensive study of the first phase (Requirement phase) is done and the intended system design is prepared. The system design phase defines the system requirements including both the hardware and software requirements. Also the system architecture is carefully deigned at this phase.

- **Implementation** – At this phase, a unit design of the system is done. The system is first developed in units which are then texted for effectiveness. This is often referred to as Unit Testing.

- **Integration and Testing** – The entire units designed at the implementation phase are brought together as whole. These units are integrated into a system after they have been well tested

- **Deployment of system** – Here the system is deployed to the client for use or make available for use by the general public.

- **Maintenance** – Certain issues might come up at the client's system after deployment that might require updates and release of new version. This is done at the maintenance phase.

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7. Proposed System Description

Microsoft Visual Studio Integrated Development Environment (MVS IDE) was the program used to design the proposed system. The reason for the choice of this application is due to the availability of functionalities that comes with the Microsoft Visual Studio which provides the ease of creating user friendly interfaces, which is one of the most important features of any application software.

The Health Information System comprises of two major sections, the first section is the interactive user interface which consists of login page, admin page and other pages. The second section is the data base where all the information resides. The system follows quite a simple process through the patient record capturing down to the information storage. For ease of usability and operability the proposed system is designed segmentally involving five major users (panels) with extended sub panels each. Figure 2 shows the architectural design and flow of activities of the proposed system which displays the five panels of the system.
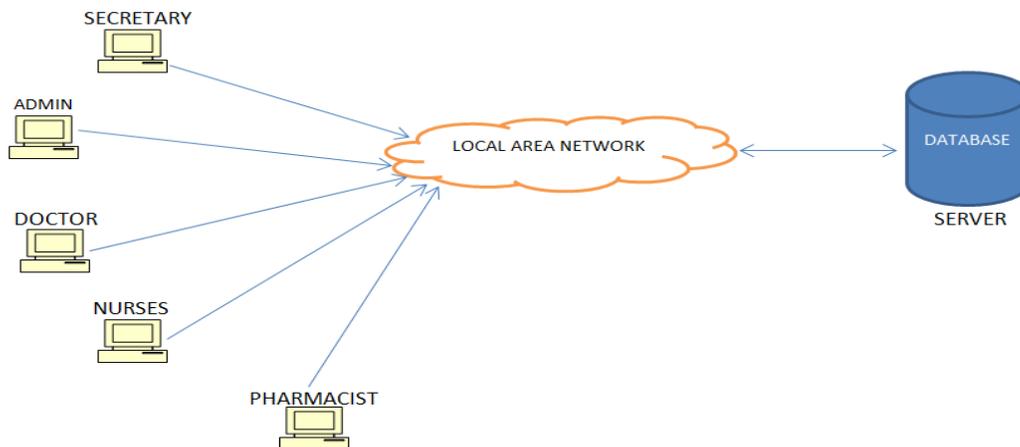
System Architectural Diagram

Figure 2: Proposed System Design and Activity Flow.

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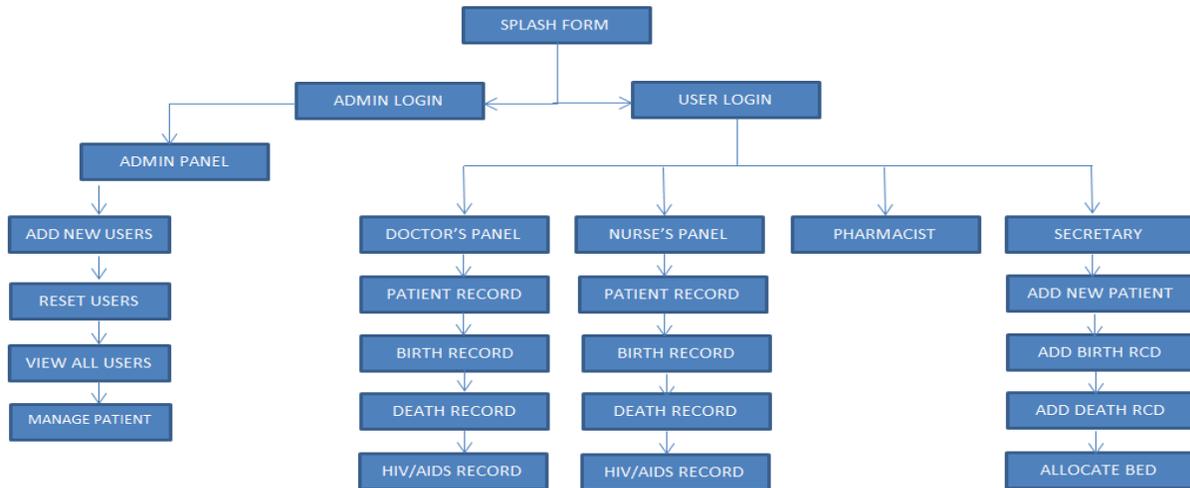**(An Open Accessible, Fully Refereed and Peer Reviewed Journal)**

Figure 3: Workflow Interconnections

7.1. Splash Form

The operation mode of the proposed system is highly interactive and user friendly. The system has an instruction page stating the functionalities of each of the buttons in each of the pages of the system. Below is a step by step processing algorithm of the system which is used to achieve the desired task on the system hence, each panel has different functionalities;

7.1.1. Splash Form and Welcome Page

When the application is launched, a splash screen is displayed to load up the software screen. Once the splash form is loaded successfully, a welcome screen is displayed which allows users to login accordingly. You either login as an admin or as normal user.

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7.1.2. Admin Login and User Login Windows (Pages)

The proposed system has two login windows, one for the super admin and the other is for the general users. The admin has a unique user name and password which serves as an access key into to the admin panel while the individual users have their unique access keys to login to their designated pages. Figure 4 shows an illustration of the login pages:
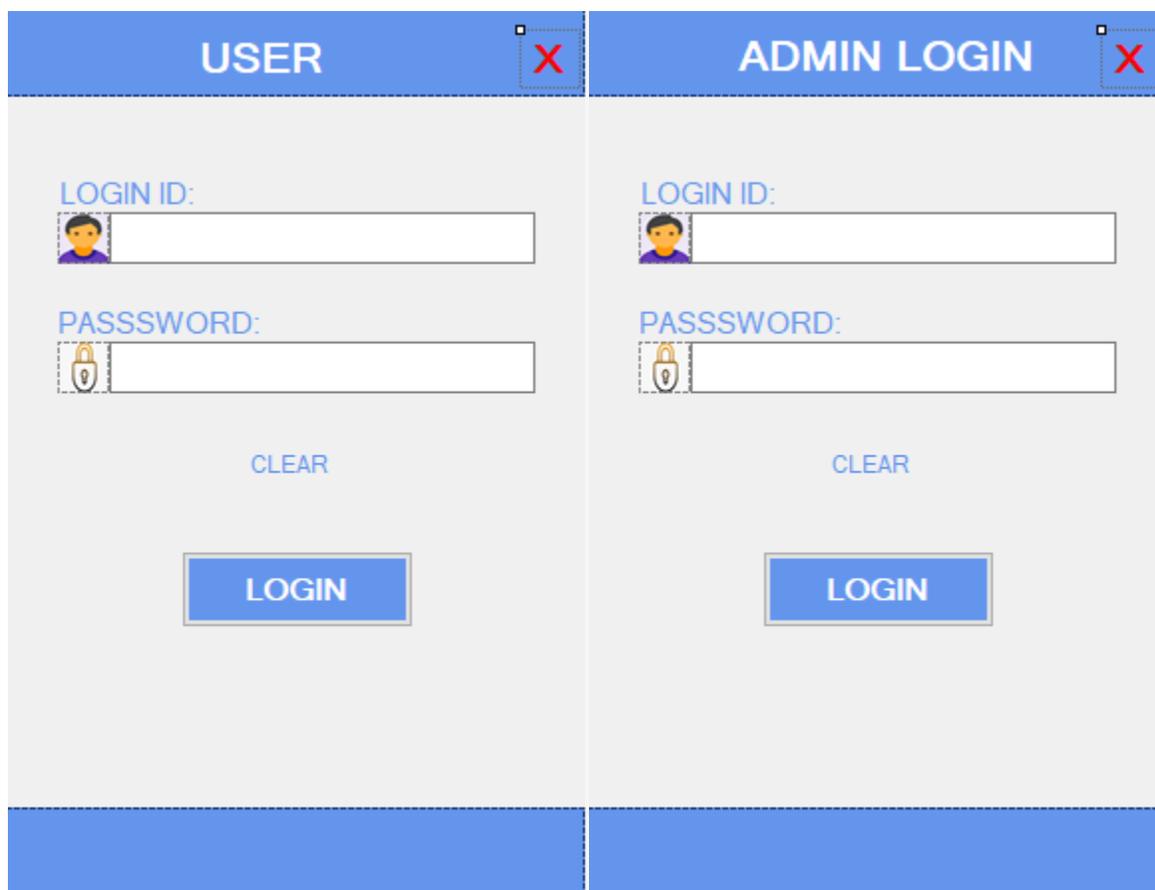

Figure 4: Login Interface of Admin and user

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7.1.3. Admin Page

The admin page allows the admin to manage all users. Admin has the privilege to do the following;

1. Add new user account
2. Edit user's account
3. Delete users
4. Manage patient record
5. Delete patient record
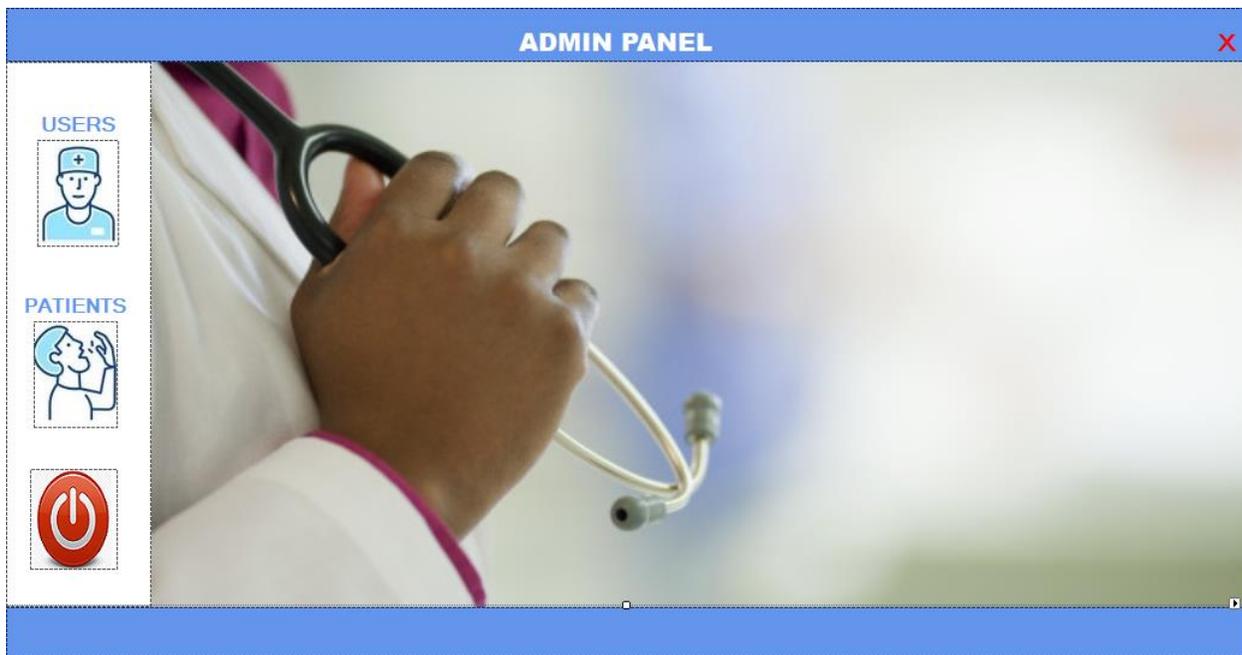6. User password reset

Figure 5: Admin Panel

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7.1.4. Users

Users either login as Doctor, Nurse, Pharmacist or Secretary.

a. Nurse's Module

The Nurse's module has a summary of all the activities in the hospital. The Nurse's dashboard presents a summary of the total number of Patient on admission, Total number of patient, Available bed space, Number of death and birth record and number of HIV/AIDS patient.

The Nurse's panel also has multiple buttons that allows the user to perform multiple tasks including;

1. Patient management

2. Keeping record of patient operation

3. Management of patients on admission

4. Management of both birth and death record.

5. Manage HIV/AIDS patient history or record

b. Doctors' Module

The doctor's module dashboard also presents a summary of the total number of Patient on admission, Total number of patients, Available bed space, Number of death and birth record and number of HIV/AIDS patient. The Doctor's module has more functionality on the system compared to the Nurse's Module. The Doctor's module allows the doctor to perform the following:

1. View patient health and treatment history or record

2. Create prescription for the patient

3. Management of both birth and death record.

4. Manage HIV/AIDS patient history or record

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c. Pharmacist Module

The pharmacist module caters for the maintenance of medicine, records of hospital's stock medicine status and availability. This module also allows the pharmacist to manage the medicine categories, watch prescription of patients and provide medication to prescriptions.

d. Secretary Module

The secretary module allows the user (secretary) to add new record into the system.

Other screen display of some other modules of the proposed system are shown in figure 6

Figure 6: Secretary Panel

8. Choice of Programming Language

The proposed system is designed and implemented using Microsoft C# programing language. The choice of the programming language used is due to the advantage of easy development and its flexibility. C# is a dot net programing language that supports interoperability. C# can access code written in any dot net compliant language and can also inherit the classes written in these languages. C# also has a portable executable file. All these features and more make c# suitable for the design and implementation of the proposed system.

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9.   Conclusion

The purpose of the study was to assess and determine the quality and quantity of reporting of health delivery services; and the benefits, challenges, failures, resolutions and conditions for implementing a HMIS in facilities in Nigeria. The report shows that the HIS is appropriate software for the Health Management Information Systems and it is just up to the agencies to make use of it effectively. This research study is informed by public health fields, health informatics and information system. In this research, it was enumerated that the ineffective use of HMIS in Nigeria as regards health data being reported is that information generated was not sufficient to support an informed decision-making and health planning because some of these reports are not precise and out of date. In conclusion, the requirement for effective linkages to those in authority with the responsibility for disease control imposes additional requirements on Health Information Systems. Therefore, the study shows that the HMIS is appropriate software for the Health Management Information Systems and it is just up to the agencies to make use of it effectively to be able to make the right judgments.

10. Recommendations

The following recommendations were made based on the findings of this study;

1. To improve the use of health information in developing countries, health professionals' feeling of data ownership must be strengthened, and the notion that their responsibility stops once they collect data and send it to the next level must be eradicated.

2. It is anticipated that the use of computerized data management tools such as the HMIS will enhance the ability of workers at all levels to analyze and interpret HMIS data, and

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when combined with training on data use for decision making, this will lead to a greater sense of ownership for data use, analysis, and interpretation at all levels.

3. Misinterpreting or underestimating non-technical integration challenges may account for a large share of HIS failures, according to the report. The integrated national HMIS included datasets for the study's vertical programs.

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