A Study on Automated Hospital Management System in Nigeria

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ABSTRACT

This thesis underscores the critical importance of effective data management in the operational and survival aspects of contemporary hospitals. Acknowledging the imperative for continuous enhancements in this domain, the study recommends a proactive approach to explore and advance the existing hospital data management project by transitioning it to an online platform. This strategic move includes the implementation of robust security measures, particularly a secure access code system, to fortify the protection of sensitive information. The proposed transition aims not only to modernize the hospital's data management capabilities but also to establish a secure online infrastructure, guarding against unauthorized access and ensuring the integrity and confidentiality of critical healthcare data.

The thesis concludes with a comprehensive overview of the development process for the computerized system. A detailed survey of the existing system laid the groundwork for the meticulous design of a database application focused on facilitating the search and retrieval of patient folders. The anticipated automated hospital management system is poised to significantly enhance the overall efficiency of healthcare services for both nurses and doctors, introducing notable improvements such as reduced time spent on locating patient folders, increased accuracy, and timely record preparation.

Throughout the implementation phase, substantial efforts were dedicated to eliminating data redundancy and inconsistency, with a specific emphasis on enhancing the integrity of the stored data. The chosen software model, the waterfall model, provided a systematic and sequential approach to software development. Additionally, a structured design methodology was employed during the design stage to ensure clarity and efficiency.

Recognizing the sensitivity of healthcare data, the thesis rigorously addresses security concerns by incorporating robust measures into the computerized system. These measures are designed to prevent unauthorized access, safeguarding the confidentiality and privacy of stored data. This multi-faceted approach to system development underscores the commitment to delivering a robust, efficient, and secure automated hospital management system aligned with the evolving needs of healthcare professionals, guaranteeing top-tier levels of data integrity and security.

Keywords: Healthcare Data Management, Online Platform Transition, Secure Access Code System, Automated Hospital Management System, Data Integrity and Security.

INTRODUCTION

A hospital management operation is an institution for medical care that provides patient treatment by technical staff and outfit. Generally, automated medical staff operations are funded by the public sector,

medical associations (for-profit or nonprofit), health insurance companies or charities, including finances by direct charitable donations. Historically, still, automated medical staff operations were frequently innovated. And funded by religious orders or charitable individualities and leaders. Ultramodern automated medical staff operation is largely staffed by professional medical staff, surgeons, and nurses Automated medical staff operation is distinguished by their power, compass of services, and whether they're tutoring automated medical staff operation with academic confederations. Automated medical staff operations may be operated as personal (for-profit) businesses, possessed either by pots or individualities similar to the medical staff or may be voluntary - possessed by non-profit pots, religious associations, or operated by central, state, or Megacity governments. Voluntary and non-profit automated medical staff operations are generally governed by a board of trustees, named from among community business and communal leaders, who serve without pay to oversee hospital management operation operations.

Community

Hospital management staff utmost community automated medical staff operation offer exigency services as well as a range of outpatient and inpatient medical and surgical services. Community hospital management staffs, where most people admit are, are generally small, with fifty to five hundred beds. This automated medical staff operation typically give quality care for routine medical and surgical problems. Some community automated medical staff operation is nonprofit pots, supported by original backing.

These include automated medical staff operations supported by religious, collaborative, or osteopathic associations. In the 1990s, figures of not-for-profit community automated medical staff operations have converted their power status, getting personal automated medical staff operations that are possessed and operated on a for-profit base by pots. These automated medical staff operations have joined investor-possessed spots because they need fresh fiscal coffers to maintain their actuality in a decreasingly competitive assiduity. Investor-possessed, acquire not-for-profit automated medical staff operation to make case grounded share, expand their provider networks, and access new medical care cases. Tutoring Hospital management staff operations are those community and tertiary automated medical staff operations combined with medical seminaries, nursing seminaries, or confederated- health professions training programs. Tutoring automated medical staff operation are the primary spot for training new medical staff where interns and resider work under the supervision of educated medical staff.

Furthermore, providing guidance to medical trainees while they attend to patients at their bedside. Cases in tutoring automated medical staff operation understand that they may be examined by medical scholars and resider in addition to their primary" attending" medical staff. One advantage of carrying care at a university-combined tutoring hospital management operation is the occasion to admit treatment from largely good medical staff with access to the most advanced technology and outfit. A disadvantage is the vexation and irruption of sequestration that may be affected from multiple examinations performed by residers and scholars. When compared with lower community hospital management staff, some tutoring automated medical staff operations have reports for being veritably impersonal; still, cases with complex, unusual, or careful assessments typically benefit from having acknowledged medical professionals and additional comprehensive resources available at these facilities.

Public Automated Hospital

Public robot doctors are controlled and run by big governments like the central, state, and those in mega cities. Many of them stick to the old habit of taking care of the less fortunate folks. They're generally located in the inner metropolises and are frequently in precarious fiscal situations because numerous of their cases are unfit to pay for services. The central government matches the countries' donations to give

a certain minimum position of available content, and the countries may offer fresh services at their expenditure.

General Automated Hospital Management

This is the stylish type of hospital management operation; it's set up to deal with numerous Kinds of conditions and injuries and typically has an exigency department to deal with immediate and critical pitfalls to health.

Quarter Hospital Management Operation.

This is the major medical care installation in with region, with large figures of beds for ferocious care and long-term care; and specialized installations for surgery, plastic surgery, parturition, and bioassay laboratories. Technical Hospital management operation. It is a special type of hospital management operation meant for a particular case like trauma centres, recuperation hospital management staff, children's hospital management staff, seniors'(senior) hospital management staff, and automated medical staff operation for dealing with specific medical requirements similar as psychiatric problems, certain complaint orders similar as cardiac, ferocious care unit, neurology, cancer centre, and obstetrics and gynaecology, oncology, or Orthopaedic problems. Conventions a medical installation lower than a hospital management operation is generally called a clinic and frequently is run by a government agency for health services or a private corporation of medical staff (in nations where private practice is allowed). Conventions generally give only inpatient services.

Problems of the Home-made System

1. Lack of immediate reclamation.
2. It's really tough to dig up this info, like finding the exact details is like searching for a needle in a haystack.
3. To find out about the case's history, the stoner has to go through colourful registers. This results in vexation and a waste of time.

Problem of the Manual System

1. Lack of immediate retrieval: -
2. It's really hard to get hold of the information and find specific details.
3. If you want to know about the patient's background, you got to shift through a bunch of different files. It's a pain and a total time-waster.
4. Lack of immediate information storage:
5. Storing the data from different transactions requires time and energy.
7. Error-prone manual calculation:
8. Manual calculations are error-prone and take a lot of time, this may result in incorrect information.

Automated Hospital Management at Glance

Kaelber and colleagues (2008) mentioned that lots of folks like patients, policymakers, doctors, insurance companies, bosses, and more are really into the idea of using personal health records (PHRs) to make healthcare cheaper, better, and faster. They said that tons of healthcare tech companies and doctors already have the stuff they need to give PHRs to their customers and patients. Like, around 50 million patients are being treated by doctors who use the EPIC EHR (Electronic Health Record) software system. The researchers concluded that to achieve this improvement, an upgrade of the hospital management was necessary. Previous examinations of research regarding electronic health record (EHR) data accuracy didn't pay much attention to measuring quality. According to Chan and colleagues (2010), they looked at a bunch of studies on EHR data quality, mainly focusing on the stuff that matters for measuring quality.

They found that out of the 35 studies they checked, most of them looked at different aspects of data quality. About 60% checked if the data was accurate, 57% checked if it was complete, and 23% looked at how comparable the data was.

Electronic Medical Record System

The search covered combinations of concepts for electronic medical records, office practice, physician and impact. Lau and his crew stuck to only looking at English articles from the past ten years because they figured those would be more on point than older ones (from 2000 to 2009). After getting rid of any copies from both MEDLINE® and CINAHL® searches, one person went through all the citations first. Then, two teams of two folks each (one scientist and one doc in each team) went through the whole articles. If they couldn't agree on something, the third doc (MP) made the call. They only picked articles for analysis if everyone agreed. They even reached out to the main authors of original articles to double-check some details. In the end, they noticed a bunch of key ideas. The work environment where the system gets used matters a lot. Having a good leader, someone who's really into the system, enough training, and support, and having the right resources are all super important for the EMR (electronic medical records) to work well. They also found that docs who use electronic health records think they make care better and they're pretty happy with them overall.

Healthcare Information Systems

Due to the growing use of electronic medical record systems, many hospitals now possess vast clinical data in various formats and structures (Cai et al., 2014). To streamline the integration process, the Linked Data Model has been expanded and applied to devise a method for searching and integrating personal electronic medical data.

These personal healthcare records are built on a network of linked information. The prototype indicates that the suggested approach is both effective and efficient. It's crucial for external researchers to be able to replicate published scientific findings, as this is essential for assessing and validating health research within the broader community (Hemingway et al., 2017). Given the increasing complexity, volume, and diversity of electronic health records available for research, it's imperative to ensure that findings derived from such data can be reproduced and verified by other researchers.

However, despite their effectiveness, acquiring, implementing, and maintaining these technologies can be both complex and costly. Electronic systems that gather, process, or exchange health information about patients and formal caregivers, as well as medication management information technology integrated with at least one HIT system, which processes patient-specific information and offers guidance to healthcare providers or patients, or facilitates communication between pharmacists and clinical prescribers, are examples of such technologies. Any article that talked about money stuff got a special check. They looked at full and partial money reviews for this study. A full money review is when they compare different options based on how much they cost and what happens because of them. They put them into three groups: (1) seeing if they're worth the money; (2) seeing if they're worth the value they bring; and (3) seeing if they're worth the benefits they give.

After the earthquake in Haiti in January 2010, the Israel Defence Force Medical Corps sent a team to set up a hospital. They used a fancy computer system in the hospital. It did hospital jobs and kept track of patient records. They also used a system to send and look at x-rays. In 10 days, they helped 1111 patients. The computer system and network hardly ever went down. They kept track of where patients moved in the hospital and had a screen to see everything. They used the computer system for patient care and to look at x-rays. It made things less chaotic and helped them use their medical stuff better.

Using computer records made sure patients got the right care and it was easy to keep track of it. This shows that using fancy tech in a field hospital can work during emergencies. People who deal with disasters should think about using tech too.

The computer system had two main goals. First, it helped with hospital stuff and let the bosses make good decisions based on what was really happening. Second, it helped keep track of each patient's care by making electronic records. They had to make sure they could send x-rays around the hospital because they had a new machine for that.

REVIEW OF LITERATURE

Kaisa Hänninen et al. (2023) conducted a systematic review on automated unit dose dispensing systems. Their research focused on the production of individually packaged and labelled drugs for inpatients within automated management systems. The study involved an assessment based on the use of automated management systems in various hospitals. The findings highlighted the efficiency and capabilities of these systems in delivering accurately packaged medications for inpatient care. This research contributes valuable insights into the utilization of automated technologies for enhancing drug dispensing processes in healthcare settings, emphasizing the importance of tailored medication packaging for individual patients.

John Roberts Padde et al. (2022) conducted a significant study, outlined in the journal "Bio-safety and Health," focusing on the assessment of bio-safety and bio-risk management practices among medical laboratory students. The research spanned two institutions globally, providing a comprehensive overview of practices in diverse settings. The findings underscored the importance of addressing bio-safety concerns in laboratory settings and highlighted the need for improved bio-waste management. The study emphasized the potential dangers associated with inadequate handling of bio-waste, emphasizing the urgency for enhanced protocols and awareness to mitigate risks. This research contributes valuable insights to the broader field of bio-safety and underscores the importance of robust practices to safeguard both the environment and individuals involved in laboratory work.

Ahmed Bature Ahmed (2022) In the dynamic realm of healthcare organizations in France, mirroring global trends, substantial metamorphoses are in progress, sparking a reassessment of resources and the streamlining of operational procedures. Amidst this evolution, automation stands out as a crucial catalyst, fostering value generation and elevating patient satisfaction. Noteworthy is the predominant focus of extant research on the technological facets of automation, neglecting essential organizational hurdles inherent in the implementation of this innovation, particularly concerning the management of hospital staff, including logistics personnel, amidst organizational shifts. This study endeavours to partially fill this void in the scholarly discourse. Drawing insights from an exploratory case study, it introduces an analytical framework aimed at addressing challenges and modifications in logistics flows (e.g., pharmaceuticals, waste, and laundry) impacting staff involved in overseeing these processes within a hospital context. The findings underscore the imperative for anticipatory measures in cultivating and deploying novel expertise and competencies to adeptly formulate and supervise automated logistics flows utilizing an Automated Guided Vehicle (AGV) system.

Malshani et al (2021) The linchpin of a nation's progress lies in its healthcare system, with a particular focus on the treatment of long-term diseases. Private hospitals in Sri Lanka play a vital role in this regard, organizing specialized clinics tailored to distinct disease categories. Given that individuals may contend with multiple ailments simultaneously, navigating the selection of doctors for each specific disease poses

a challenge within the private healthcare landscape. Unfortunately, the current private clinic management systems grapple with significant issues, particularly concerning the coordination lacuna among doctors, patients, and medical staff. A noteworthy hurdle for patients is the arduous task of maintaining comprehensive medical records across various clinics. In response, this research paper endeavours to present a comprehensive solution aimed at enhancing the operational efficacy of private hospital clinic management systems in Sri Lanka. The proposed system envisages a unified platform seamlessly connecting patients, doctors, pharmacy staff, and medical personnel, consolidating information encompassing patients, doctors, appointment details, and all medical records. Transforming from a traditional automated clinic management system to a modernized computerized framework, this innovation promises efficient creation and management of patient data, streamlined scheduling for doctors, unhindered information flow across departments, adept handling of the health centre's accounting, and accurate archiving of patient information and diagnosis data.

According to Zahra Yousefli at al. (2020), Navigating the intricate and unpredictable landscape of maintenance management in hospital facilities poses a considerable challenge for facility managers. The ever-present risk of building component failures, the daily influx of maintenance orders, and the fluidity of schedules contribute to this complexity. In such scenarios, the feasibility of centralized systems diminishes due to their inherently top-down approach, lacking a responsive feedback mechanism and disregarding new information. The need for constant reformulation renders centralized systems impractical, myopic, and problematic in the hospital setting, potentially leading to financial losses and patient dissatisfaction. Consequently, there arises a compelling need to institute a distributed maintenance management system to bolster the decision-making process of facility managers. The conceptualization of a Multi-agent Facility Management System (MAFMS) employed Unified Modelling Language (UML) diagrams, elucidating the specific agents and their interactions within the system. Initiating a multi-agent simulation using maintenance data from a hospital building, the results underscore the efficacy of the proposed system in reducing response times to maintenance requests compared to the prevailing centralized maintenance system.

JUSTIFICATION OF THE STUDY

This study emphasizes the critical importance of managing data effectively in today's hospitals, highlighting how it impacts their day-to-day operations and overall survival. It recognizes the need for ongoing improvements in this area and suggests taking a proactive stance by shifting the current hospital data management project to an online platform. This transition would involve implementing strong security measures, like a secure access code system, to better protect sensitive information. The goal is not only to modernize data management but also to establish a secure online infrastructure, guarding against unauthorized access and maintaining the confidentiality of important healthcare data. The study aims to justify the necessity of upgrading hospital data management systems and proposes transitioning to an online platform as a solution. By doing so, it seeks to improve efficiency and security in handling patient records, ultimately enhancing the quality of healthcare services provided.

OBJECTIVES OF THE STUDY

The following are the objectives of the study:

- To enhance hospital data management capabilities.
- To establish secure online infrastructure.

- To modernize data management.
- To safeguard sensitive healthcare information.
- To improve efficiency of healthcare services.

RESEARCH DESIGN

Research design is a blue print of the research. It describes how to proceed the research work. This study carried out on the basis of secondary data. the study conducts a detailed survey of the existing system to inform the development of a new computerized system. The focus is on creating a database application that simplifies the search and retrieval of patient folders. The chosen software development model, the waterfall model, provides a systematic approach, while a structured design methodology ensures clarity and efficiency in the process.

LIMITATIONS OF THE STUDYT
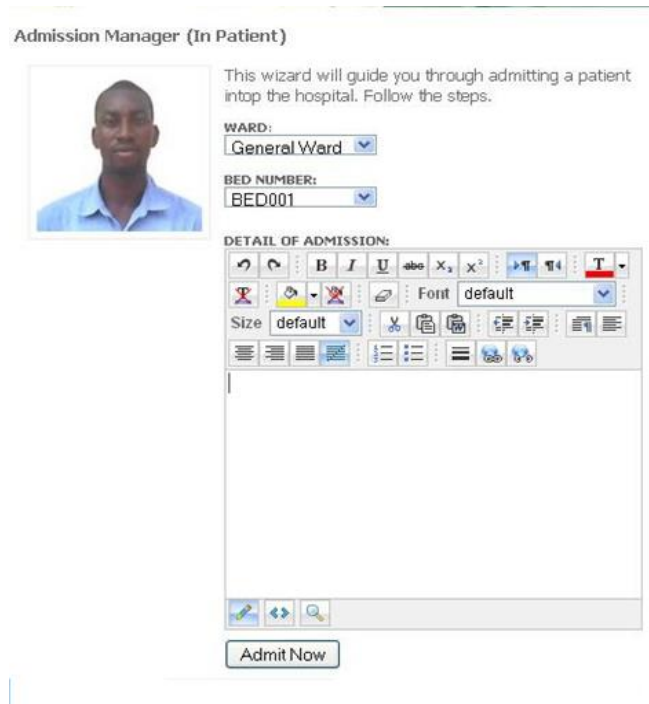
The study has the following limitations:

- Reliance on single software development model may not be suitable for all aspects.
- Challenges in ensuring full data accuracy and security during transition to online platform.
- Potential difficulties in addressing all security concerns, especially regarding healthcare data privacy.

REPORT AND ANALYSIS

ADMISSION: The in-patient admission feature presents detailed information regarding patient admissions and ward management, illustrated in Fig 4.11. This option reveals a submenu containing the following choices:
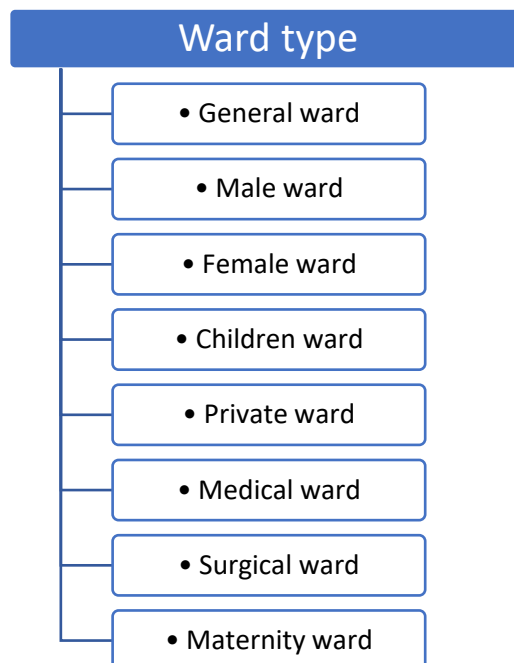
Ward type
- General ward
- Male ward
- Female ward
- Children ward
- Private ward
- Medical ward
- Surgical ward
- Maternity ward
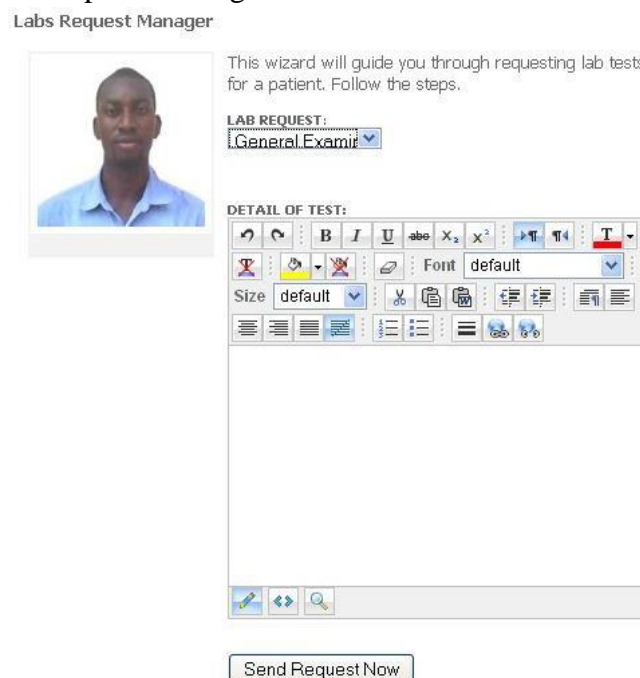
FIG 1: ADMISSION FORM

The admission process entails the following steps: click on the combo box for the general ward, select the ward type, and then click on the specific ward. Enter the bed number to complete the patient's admission. Provide additional details, such as the patient's ailment, to finalize the admission process for the respective patient. Click on "Admit Now."

LABORATORY

The laboratory request form is depicted in Fig 2
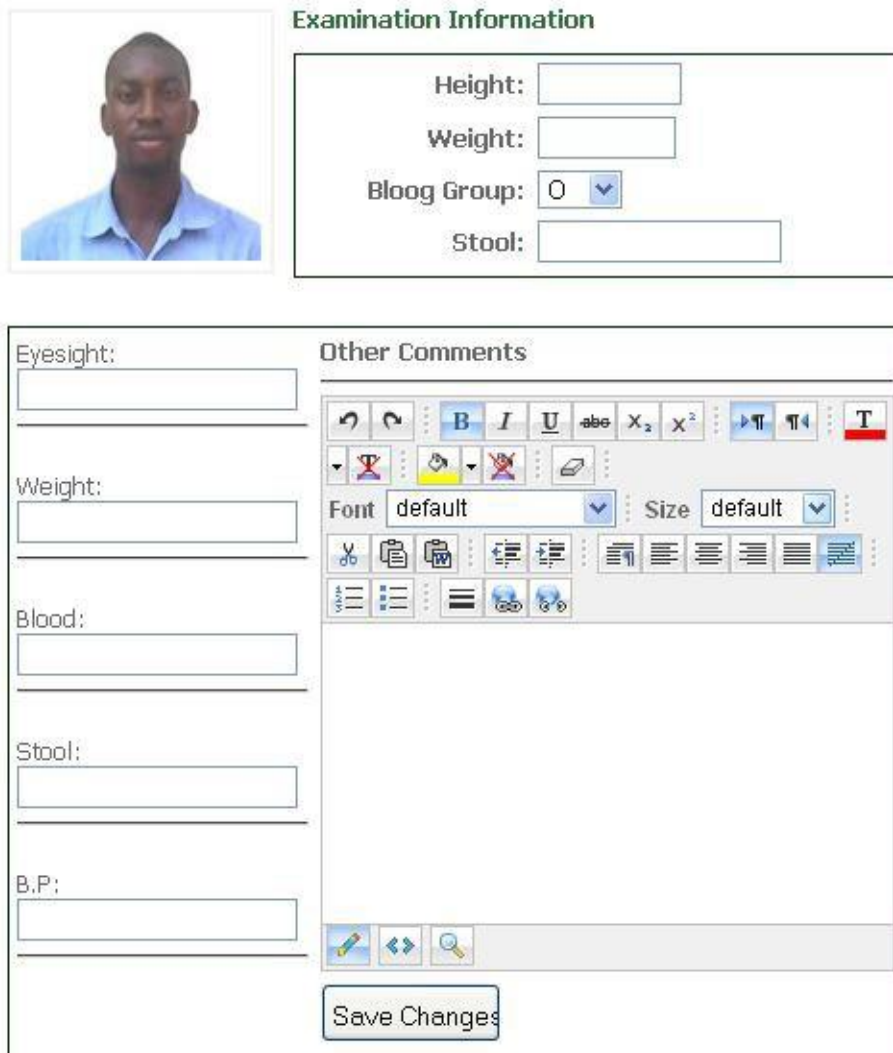
FIG 2 LABORATORY FORM

Select the combo box for general examination, choose the specific type of examination for the patient, and click on it. Enter the test details and click on the "Request Now" combo box.

EXAMINATION (NURSES WORKBENCH)

This form is utilized by nurses for pre-examination, enabling them to gather essential health information from the patient before the doctor's consultation, as illustrated in Fig 4.13.
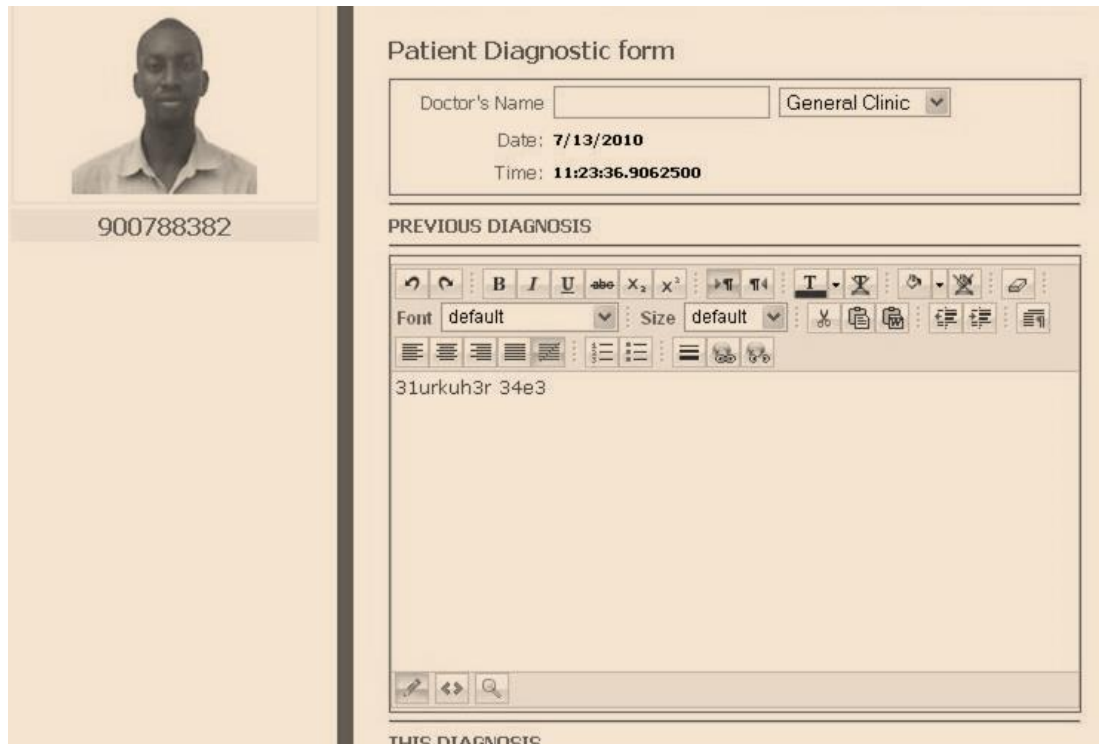

FIG 4.13 EXAMINATION FORM

The information gathered in this form comprises height, weight, blood pressure, and eyesight. Additional examination details may be included.
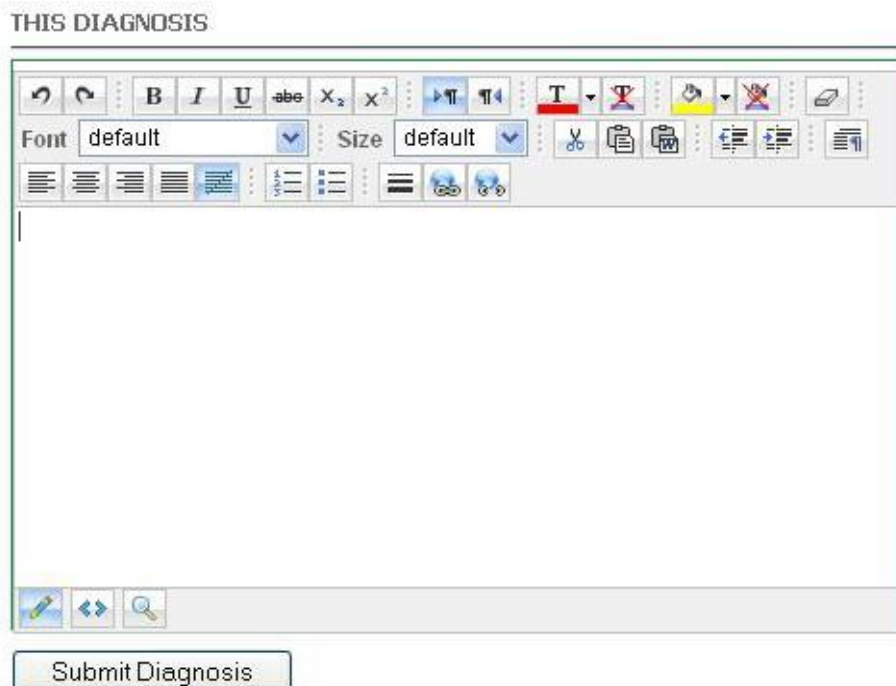
DIAGNOSIS (DOCTOR WORKBENCH)

The diagnosis form (Fig 4.14) serves as the central area in the doctor's workbench, managing diagnosis-related activities among doctors, and nurses, and follow-up interactions between healthcare professionals.

FIG 4.14 DIAGNOSTIC FORM

In this form, all diagnoses are systematically recorded in the database based on the date and time. The diagnosing doctor is required to furnish their name, clinic or department, review prior diagnoses, and input details of the new diagnosis.

DIAGNOSTIC FORM

The submenu option presents a combo box for the doctor's name, type of clinic, automatic update, and time. Input the diagnosis details and submit the diagnosis box to complete the process.

X-RAY

This form is employed by doctors to initiate an X-ray request for a specific patient at the individual patient level.

BILLING / ACCOUNTING SYSTEM

Although part of the accounting module, this section is dedicated to settling patients' bills or depositing funds into their accounts.

FIG 4.15 BILLING FORM

The information encompasses the following:
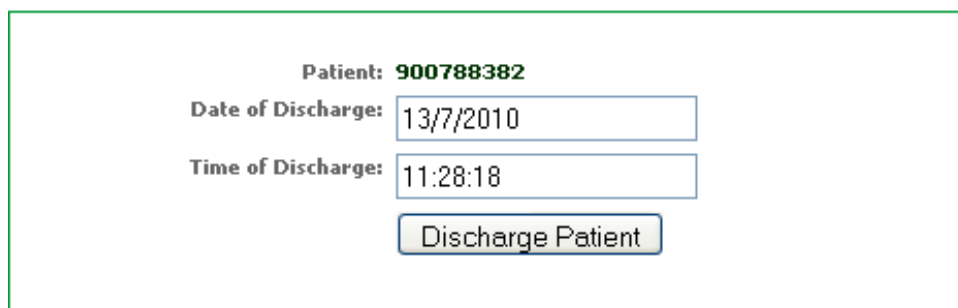
Total Bill

Total Initial Deposit

Total Balance

Amount to Pay

However, only the amount to be paid is required to be entered.

DISCHARGE (DOCTORS WORKBENCH)

This segment of the doctor's workbench is utilized for discharging patients once they have recuperated from their illness.
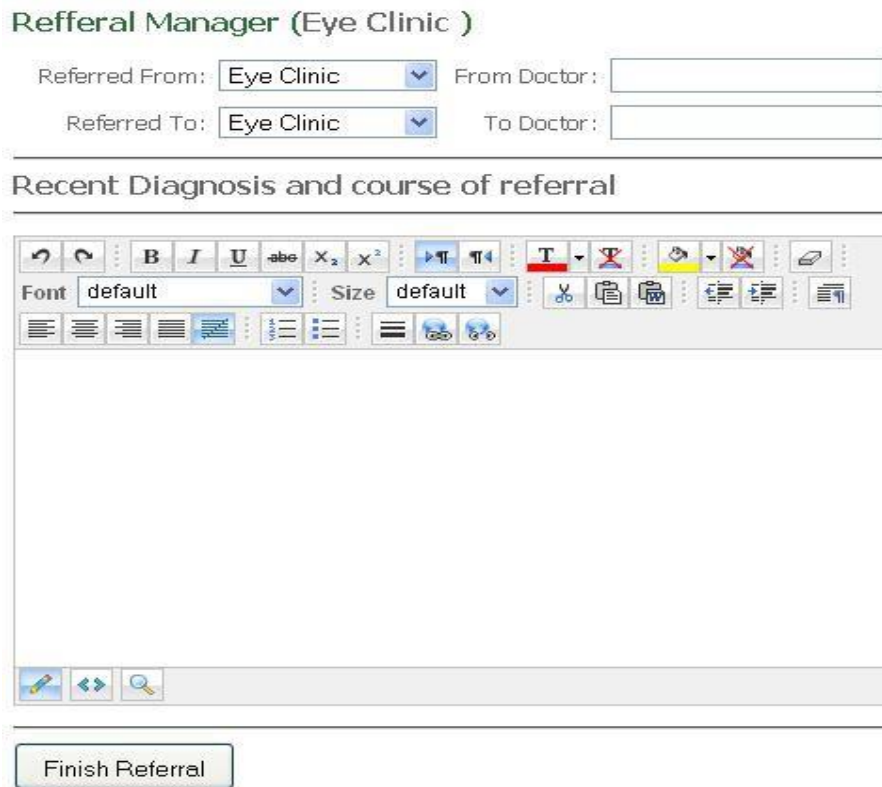

Fig 4.16 Discharge form

The date and time details are inputted. Upon clicking the discharge button, the patient is automatically marked as discharged.

REFERRAL SYSTEM: This form (Fig 4.17) is employed for transferring patients from one department/specialist to another. On the doctor's workbench, at the patient-specific level, doctors select the referral option to access and fill out the referral form.
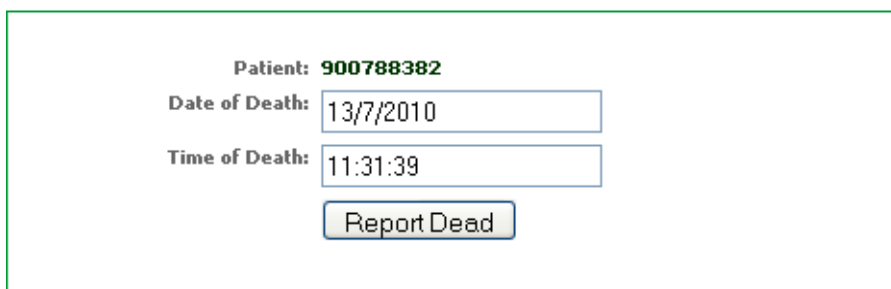
FIG 4.17 REFERRAL FORM

Within the form, the doctor inputs the essential information for the referral, clicks the "Refer" button to initiate the referral for the patient, and provides additional details. Clicking "Finish Referral" sends the completed form.

DEATH (NURSE/DOCTORS WORKBENCH): When a patient's demise is confirmed, the death option is selected. The date and time of the death report are automatically recorded.

Fig 4.18 Death report form.

FINDINGS

The implementation of an automated system brings about several improvements in patient care, including:

- Reducing staff time spent on form filling and searching for patient folders, allowing for more focus on critical tasks.
- Increasing productivity for nursing and medical staff.
- Enhancing the quality of care, procedures, and services provided to patients.
- Exerting control over costs incurred by diagnosis-related groups.
- Enabling each department to function differently while being managed integrally at the administrative level.
- Allowing AHIMS registered staff to log in from anywhere within the hospital network coverage.
- Facilitating unified management of resources and assets, transferable from one administrative end to another.
- Integrating an integral accounting system for each department, maintaining separate accounts and billing systems.
- Targeting over fifteen departments in the hospital, with each department running its own branched and independent part of the AHMS.
- Providing a 100% growth allowance if the hospital wishes to introduce more departments or functional tasks.
- Centrally storing hospital data and information in a secure database with secondary backup.
- Setting up Wi-Fi enabled intranet services in the hospital.
- Ensuring user-friendly and interactive functionality for the AHMS.

Advantages of Automated Hospital Management System:

1. **Efficiency and Time Savings:** o *Advantage:* Automation streamlines administrative tasks, such as patient registration, appointment scheduling, and billing processes, leading to significant time savings for hospital staff.
   Details: The system reduces manual paperwork and repetitive tasks, allowing healthcare professionals to focus more on patient care.
2. **Improved Accuracy and Data Integrity:** o *Advantage:* Automation minimizes the risk of human errors in tasks like record-keeping and prescription management.
   Details: The system ensures accurate and consistent data entry, reducing the chances of errors that could impact patient safety and treatment outcomes.
3. **Enhanced Patient Care:** o *Advantage:* Automated systems provide quick access to patient records, medical histories, and treatment plans.
   Details: This facilitates better-informed decision-making by healthcare providers, leading to improved patient care, timely interventions, and better health outcomes.
4. **Streamlined Communication:** o *Advantage:* Automated communication tools within the system enable efficient interaction among hospital staff, reducing communication gaps.
   Details: Doctors, nurses, and administrative staff can easily share information, coordinate tasks, and respond promptly to patient needs.
5. **Comprehensive Reporting and Analytics:** o *Advantage:* Automated reporting features provide valuable insights into hospital operations, resource utilization, and patient outcomes.

Details: Administrators can make data-driven decisions to optimize resource allocation, identify trends, and enhance overall hospital performance.

Disadvantages of Automated Hospital Management System:

1. **Initial Implementation Cost:** o *Disadvantage:* Implementing an automated system involves substantial upfront costs for software, hardware, and staff training.
   Details: Smaller healthcare facilities may find the initial investment challenging, potentially impacting budget constraints.

2. **Training and Learning Curve:** o *Disadvantage:* Staff members may face challenges adapting to new technologies, leading to a temporary decrease in productivity.
   Details: Training programs are necessary to familiarize employees with the system, and a learning curve may impact efficiency during the initial stages of implementation.

3. **Technical Issues and Downtime:** o *Disadvantage:* Technical glitches or system failures can lead to downtime, disrupting hospital operations.
   Details: It's crucial to have robust IT support and contingency plans in place to minimize disruptions and ensure quick recovery from technical issues.

4. **Data Security Concerns:** o *Disadvantage:* Automated systems store sensitive patient information, raising concerns about data security and potential breaches.
   Details: Hospitals must implement robust cybersecurity measures to safeguard patient confidentiality and comply with data protection regulations.

5. **Dependency on Technology:** o *Disadvantage:* Hospitals become heavily reliant on technology, and any breakdown can disrupt regular operations.
   Details: Backup systems and contingency plans must be in place to mitigate the impact of technology failures on patient care and administrative functions.

CONCLUSION

In the process of developing the computerized system, a comprehensive survey of the existing system was conducted. Subsequently, a thorough design of a database application aimed at facilitating the search and retrieval of patient folders was meticulously carried out. The automated hospital management system, once implemented, is poised to enhance the overall efficiency of healthcare services for both nurses and doctors. This includes notable improvements such as reduced time spent on locating patient folders, increased accuracy, and timely record preparation, among other benefits.

Throughout the implementation of this project, significant efforts have been invested in eliminating data redundancy and inconsistency. The focus has been on enhancing the integrity of the data stored within the system, ensuring that it remains accurate and reliable. The chosen software model for this project is the waterfall model, which provides a systematic and sequential approach to software development. Additionally, a structured design methodology has been employed during the design stage to ensure clarity and efficiency.

Recognizing the sensitivity of healthcare data, security measures have been rigorously incorporated into the computerized system. These measures are intended to prevent unauthorized access, thereby safeguarding the confidentiality and privacy of the stored data. This multi-faceted approach to system development underscores the commitment to delivering a robust, efficient, and secure automated hospital

management system that aligns with the evolving needs of healthcare professionals and ensures the highest standards of data integrity and security.

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