A PROJECT REPORT ON

HOSPITAL DATABASE MANAGEMENT SYSTEM

BACHELOR OF TECHNOLOGY
IN
Electronics & Telecommunication

SUBMITTED BY

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ABSTRACT

Effective management of hospital operations is critical to ensuring high quality healthcare delivery. In this context, the integration of a robust and adaptable database management system (DBMS) serves as an essential mechanism for streamlining various administrative and clinical processes within the healthcare ecosystem. This project seeks to develop an advanced Hospital Management System (HMS) that utilizes the capabilities of a modern DBMS to address the multifaceted challenges and requirements in the dynamic healthcare domain.

The primary objectives of this project include the comprehensive design of a scalable and secure DBMS architecture that supports the integration of various hospital functions, from patient management and care coordination to resource optimization and compliance. By prioritizing the development of an intuitive and user-friendly interface, the proposed system aims to increase the overall efficiency of hospital operations, ensure seamless communication and data sharing between various departments, and protect sensitive patient information through strict data security protocols and compliance measures.

Based on extensive research into the challenges faced by healthcare facilities worldwide and an in-depth analysis of various DBMS frameworks, this project is poised to contribute to the advancement of healthcare management by offering a transformative solution that supports operational excellence and is focused on the patient. care and interdisciplinary cooperation within the hospital environment.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

Effective and reliable health services are crucial to the well-being and vitality of individuals and communities. In the field of modern healthcare management, the integration of a sophisticated database management system (DBMS) plays a key role in increasing the efficiency and effectiveness of hospital management systems. This project aims to develop an advanced Hospital Management System (HMS) that uses a robust DBMS to address the multifaceted challenges of dynamic healthcare.

In recent years, the healthcare industry has witnessed a significant transformation, fueled by technological advances and a growing emphasis on patient-centered care. In this environment, the role of robust DBMS solutions becomes increasingly important, enabling hospitals to streamline operations, improve patient outcomes, and facilitate data-driven decision making. The proposed hospital management system aims to serve as a cornerstone in the evolution of healthcare delivery, providing a comprehensive and scalable platform that integrates key aspects of hospital management.

1.1 Objectives of the project

The primary objectives of this project are as follows:

1.1.1 Comprehensive database system design

The goal of the project is to design and implement a complex database system that will take care of complex work procedures in a hospital environment. By introducing a highly scalable architecture, the system will facilitate seamless data integration and real-time availability across different departments and support an efficient approach to hospital management.

1.1.2 Improved patient care and care coordination

Efforts will be focused on improving patient management and care coordination through the implementation of an intuitive and user-friendly interface. The system seeks to streamline patient-related processes, improve patient engagement, optimize resource allocation, and facilitate effective communication between healthcare providers and patients.

1.1.3 Optimized resource utilization and operational efficiency

The project aims to optimize the use of hospital resources, including human capital, medical equipment and pharmaceutical supplies, by deploying advanced data management and analytics tools. By integrating intelligent inventory management systems and predictive maintenance protocols, the system aims to minimize resource wastage and increase overall productivity.

1.1.4 Data security and compliance with personal data protection principles

Ensuring the security and confidentiality of sensitive patient information is paramount. The proposed system places great emphasis on the implementation of robust data security protocols and compliance measures in accordance with industry regulations. Strict access controls, data encryption mechanisms and regular security audits will be in place to protect patient data from unauthorized access and data breaches.

1.1.5 Seamless communication and interdepartmental cooperation

The goal of the project is to facilitate seamless communication channels and support interdepartmental cooperation through the implementation of a centralized communication platform. By integrating messaging systems and real-time data sharing protocols, the system aims to improve interdisciplinary coordination and promote a culture of teamwork between health professionals and support staff.

1.2 Background Research

The development of the proposed hospital management system is based on a comprehensive analysis of the problems faced by healthcare facilities around the world. Extensive research has identified common problems such as fragmented data management systems, disparate communication channels, inefficient resource allocation, and suboptimal patient care coordination. The goal of the research is to contribute to the development of a transformative hospital management system that addresses these critical gaps and supports continuous improvement within the healthcare ecosystem.

An in-depth examination of various DBMS frameworks provided valuable insights into the potential applications and benefits of modern healthcare data management technologies. An analysis of current hospital management systems highlighted the importance of user-centered design principles and intuitive interfaces that prioritize ease of use and accessibility for healthcare professionals and patients.

CHAPTER 2: SYSTEM ANALYSIS

2.1 Problem Statement

One of the things the Hospital Management System hopes to tackle is the problematic aspects present in the conventional running of a hospital, such as disintegrated data record keeping, poor cooperation, and laborious admin procedures. The system will introduce an integrated database approach to help improve operational efficiency in order to enable better healthcare delivery and cost saving within hospitals.

2.2 System Requirements

The requirements for the Hospital Management System can be categorized as follows:

2.2.1 Nonfunctional Requirements

Security: Such a system should have strong data security protocols to prevent a case of someone accessing the information without permission or exposing patients' information to third parties. Presently, security aspects are not complete however, it is planned to use password protection mechanisms related to user authentication and access control that will allow the only authorized persons to enter patients' private information. That means deploying strong encryption algorithms together with authenticated protocols that maintain patient confidence and avert leakage of privacy information.
Triggers: However, even though the current system lacks triggers, it is planned that they will be added into the database to automate some processes including assuring data integrity and consistency within the system. For example, automatically updating the inventory count when a new medicine is being dispensed, communicating a critical patient event or treatment to staff, and ensuring referential integrity to have up-to-date interconnected data tables. Activating triggers in a Hospital Management System will help simplify an array of tasks, reduce data entry mistakes as well as improve the system's dependability.

2.2.2 Functional Requirements

Patient Management: The system enables effective tracking of patients' entries and exits, health records, and medicinal data. It enhances communication between patients and their doctor by enabling them to enter clinical updates, review medical records, track the course of treatment, and book an appointment.

Staff Management: It has software tools that are used in record keeping of employees and rotations as they perform different tasks. Administrators should be able to manage a centralized repository containing every employee's detail—personal information, schooling background, and shift schedules. It should also allow for assigning tasks and duties, monitoring employees' performance indices and handling work absence cases.

Reporting and Analytics: The has complete reporting, as well as analytic abilities to allow for understanding of different hospital activities and informed decision making. Administrators and doctors should be able to create customized patient reports covering demographic details, medical results, resource use, and monetary matters among other important issues. It includes data visualization tools and dashboards that will aid in trend identification, pattern detection as well as spotting an operational problem.

Communication: This system allows free flow of communication as well as cooperation or integration of work amongst all health practitioners in a particular hospital in a bid to promote cooperation for improved results across the board. It is also compatible with other communication systems that must support effective flow of information between different departments and health care outlets as well.

2. 2.3 Software and Hardware Requirements

Software: It entails an advanced database management system like SQLite, a robust application design, and user-friendly web elements to facilitate operations of the system. It should have secure authorization protocols, data encryption systems, as well as access control policies in order to maintain data security and integrity. It should also be able to work with other health applications using standard messaging format.

Hardware: The hardware needs for the system involve compatible computers or servers for managing the database and user interactions. The system should provide for high-speed

processing, storing and retrieval of data which may scale upwards for increased user interactions and more data volumes. It must also provide backup and recovery services in order to avoid data loss and maintain continued access to vital data when encountering technical issues such as hardware failure and system interruption.

2.2.4 Views

At present Hospital Management System enables administrators with particular views adjusted for its administration and coordination of different functions of hospital services. These views primarily focus on the following components within the hospital management framework:

Patient Details View: With this view, administrators can input, modify, add or delete admission, discharge, medical history and current treatment details. The document offers a comprehensive summary on the number of inpatient's bed assignments, doctors that are attending them and also the nursing staff who take after them with an aim of ensuring easy management and co-ordination of all the patients.

Employee Management View: This system allows managers to keep data on individual employees such as hospital doctors or nurses, who attend patients. The system enables easy tracking of employees' personal data, schedules, and duties; this streamlines worker distribution and maintains seamless internal organizational operations.

Medicine Inventory View: The administrators can access a medicine inventory view that helps them monitor medications prescribed for patients. It also gives real time information about drug stock levels, patterns of use and required replenishments. This will translate into continuous availability of medicines needed for providing critical health services.

Visitor and Relative Information View: The system also helps with keeping track and managing details of the patient's relatives and other visitors. The view encompasses information on the visitors, patient's relatedness to them, as well as visitor scheduling, making communication among the patient's family members convenient and organized.

At present, the views are mainly addressing administrative needs; however, future versions will entail multiple perspectives and patient-specific views for improved user experience and consideration of the different needs of medical personnel, patients, and broader hospital environment users.

CHAPTER 3: SYSTEM DESIGN

3.1 ER diagram

The ER diagram has been used to design a relational database which will be used to hold information for a hospital. The tables for the ten entities would be:

• DEPARTMENT (Department_ID, Department_Name)

• EMPLOYEE (Employee_ID, Employee_Name, Department_ID, Employee_Type)

• MEDICINE(Medicine_ID, Medicine_Name, dosages_form, strength, route_of_administration).

• PATIENT(Patient ID, Name, Age, Sex, Address, and Phone Number)

• BILL(Bill_Id, Patient_Id, Employee_Id, Room_Id, Medicine_Id, Charges, Payment_Status)

• DOCTOR(doctor_id, doctor_name, specialty, license_number, department_id)

• NURSE (Nurse_ID, Nurse_Name, License_Number, Department_ID)

• RELATIVE (Relative_ID, Relative_Name, Patient_ID)

• ROOM (Room_ID, Capacity, Room_Type)

• TEST (Test_ID, Test_Name, Test_Description)

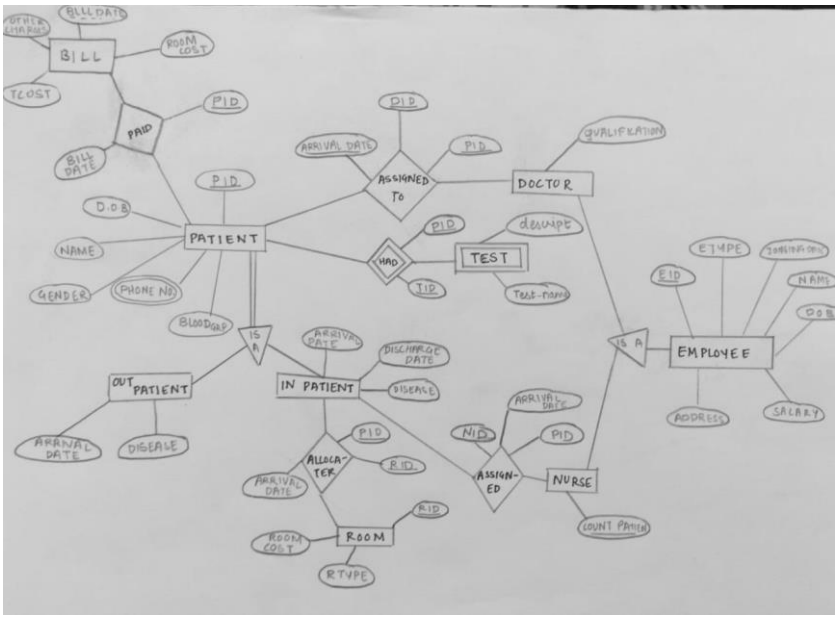

Figure 1. ER diagram\

3.2 Conversion of ER diagrams to Tables

To convert an ER diagram to a set of SQL tables, following steps are performed:

- Pick out the things in the ER diagram.
- Specify the attributes for every entity.
- Identify one major element for every entity.
- Develop relationships among entities such as one-to-one, one-to-many, and many-to-many relationships.
- Use foreign key constraints to ensure that data integrity is upheld as well as relationship amongst various tables.

For example, for the “Medicine” table:

- Identify the entity: "Medicine"
- Define the attributes: medicine_id, medicine_name, quantity, date, medicine_cost & patient_id
- Determine the primary key: "medicine_id"
- Establish relationships: Medicin’ entities correlate with Patient entities.
- Impose foreign keys on “patient_id” attribute.

The above was followed for all the entities in the ER diagram.

3.3 Tables

1) Department

Column	**TYPE**
DEPARTMENT_ID	INT
DEPARTMENT_NAME	VARCHAR(255)

2) Employee

Column	TYPE
EMPLOYEE_ID	INT

EMPLOYEE_NAME	VARCHAR(255)
DEPARTMENT_ID	INT
EMPLOYEE_TYPE	VARCHAR(255)

3) Medicine

Column	TYPE
MEDICINE_ID	INT
MEDICINE_NAME	VARCHAR(255)
DOSAGE_FORM	VARCHAR(255)
STRENGTH	VARCHAR(255)
ROUTE_OF_ADMINISTRATION	VARCHAR(255)

4) Patient

Column	TYPE
PATIENT_ID	INT
PATIENT_NAME	VARCHAR(255)
AGE	INT
GENDER	VARCHAR(255)
ADDRESS	VARCHAR(255)
PHONE_NUMBER	VARCHAR(255)

5) Bill

Column	TYPE
BILL_ID	INT

PATIENT_ID	INT
EMPLOYEE_ID	INT
ROOM_ID	INT
MEDICINE_ID	INT
CHARGES	DECIMAL(10,2)
PAYMENT_STATUS	VARCHAR(255)

6) Doctor

Column	TYPE
DOCTOR_ID	INT
DOCTOR_NAME	VARCHAR(255)
SPECIALTY	VARCHAR(255)
LICENSE_NUMBER	VARCHAR(255)
DEPARTMENT_ID	INT

7) Nurse

Column	TYPE
NURSE_ID	INT
NURSE_NAME	VARCHAR(255)
LICENSE_NUMBER	VARCHAR(255)
DEPARTMENT_ID	INT

8) Relative

Column	TYPE

RELATIVE_ID	INT
RELATIVE_NAME	VARCHAR(255)
PATIENT_ID	INT

9) Room

Column	TYPE
ROOM_ID	INT
CAPACITY	INT
ROOM_TYPE	VARCHAR(255)

10) Test

Column	TYPE
TEST_ID	INT
TEST_NAME	VARCHAR(255)
TEST_DESCRIPTION	VARCHAR(255)

The foreign keys in the tables are as follows:

- Employee table:
    - Department_ID: Foreign key to the Department table
- Bill table:
    - Patient_ID: Foreign key to the Patient table
    - Employee_ID: Foreign key to the Employee table
    - Room_ID: Foreign key to the Room table
    - Medicine_ID: Foreign key to the Medicine table

- Doctor table:
    - Department_ID: Foreign key to the Department table
- Nurse table:
    - Department_ID: Foreign key to the Department table
- Relative table:
    - Patient_ID: Foreign key to the Patient table

CHAPTER 4: IMPLEMENTATION

4.1 Table Details

Department:

• An individual is attached to a department or several departments where they work.

• One or more employees form a department.

Employee:

• A single employee could have one or more rooms that they are responsible for.

• One or more employees are allocated a room.

• A provider takes care of a patient or several patients.

• One or more employees treat a patient.

• One of the nurses administers medicine(s) for a patient(s).

• One or several employees can prescribe medicines for a patient.

Medicine:

• One or a few patients are assigned a medicine.

• These medicines are used in a single or multi dose for a patient.

Patient:

• Each room has a patient or some patients.

• A patient can be accommodated in a room or a number of rooms per time.

• One or more employees treat a patient.

• One or more patients are treated by an employee.

• Some of these employee might prescribe some drugs for a patient.

• One or two, patients always have relatives.

Bill:

• The institution generates a bill for every patient’s visit.

• There can be one or more bills for a single patient.

• Every bill is linked to a single patient.
• Every employee is coupled to a bill.
• One room is related to a bill.
• Specific medicine/s is linked with a specific bill.

Doctor:
• A doctor belongs to one or several departments.
• A doctor belongs to a department.
• One or a number of patients are treated by a doctor.
• One or more doctors treat a patient.

Nurse:
• Nurse works in one or more department.
• One or more nurses belong to a department.
• One or several patients are taken care of by a nurse.
• One or more nurses nurse a patient.

Relative:
• One or more patients are related to a relative.
• The patient also has one or more relations.

Room:
• An employee can have a room allotted for them.
• Each room is allocated for an employee(s).
• Each patient occupies a room.
• One or many rooms would be assigned to a patient.
• In this regard, each bill goes with one room.

Test:
• One or more patients are tested.
• The tests can be done for a patient either individually or in combination.

4.2 Screenshot of all tables/ entries and their views

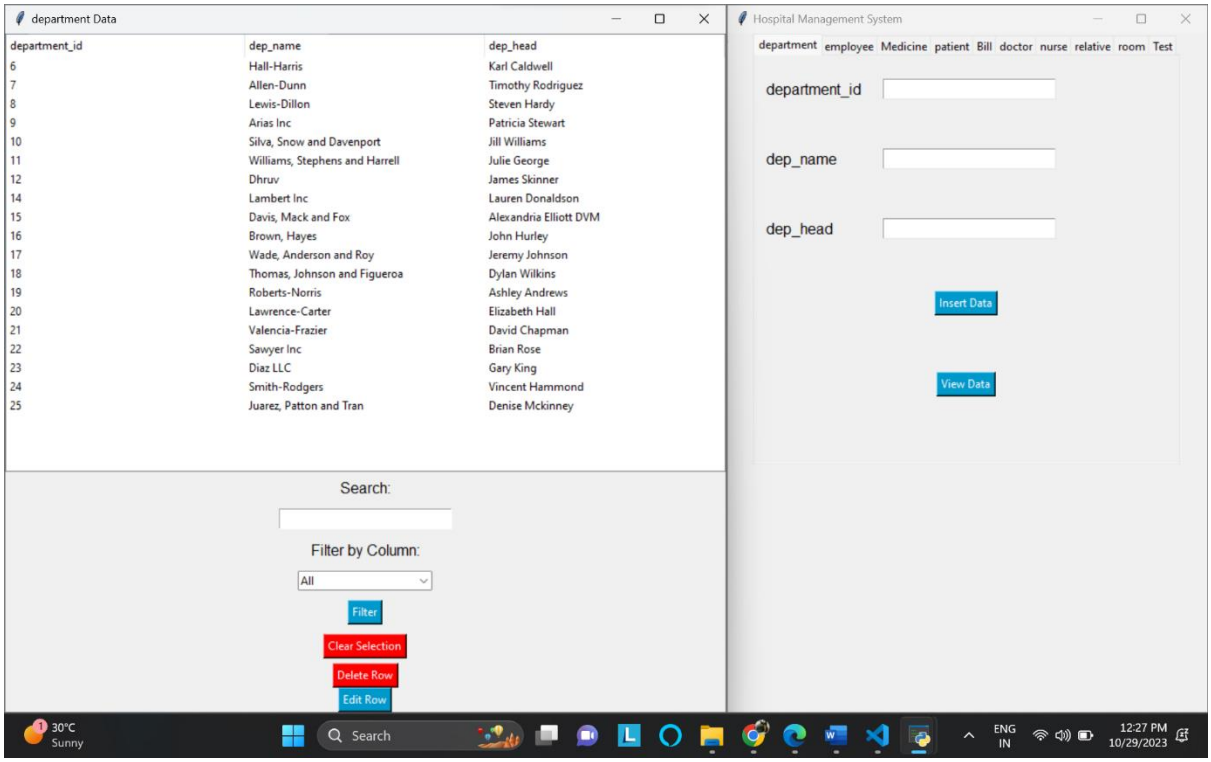

Figure 2. department table

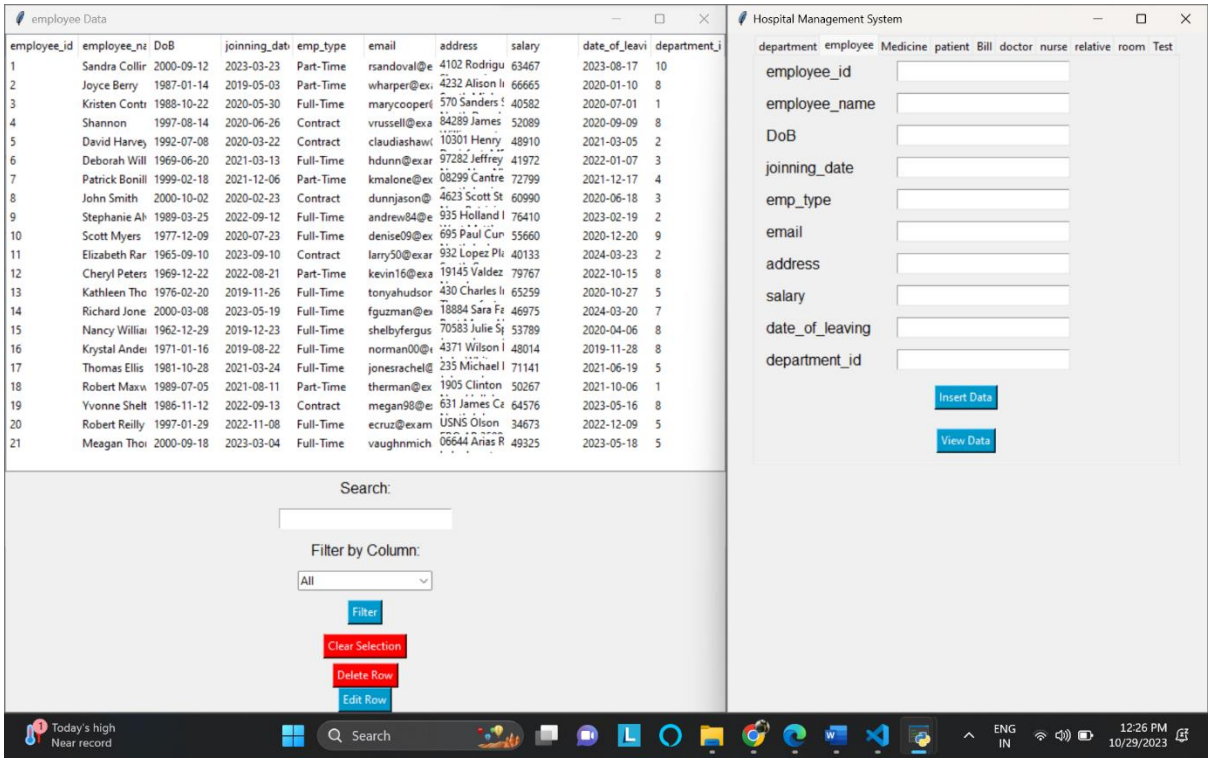

Figure 3, Employee table

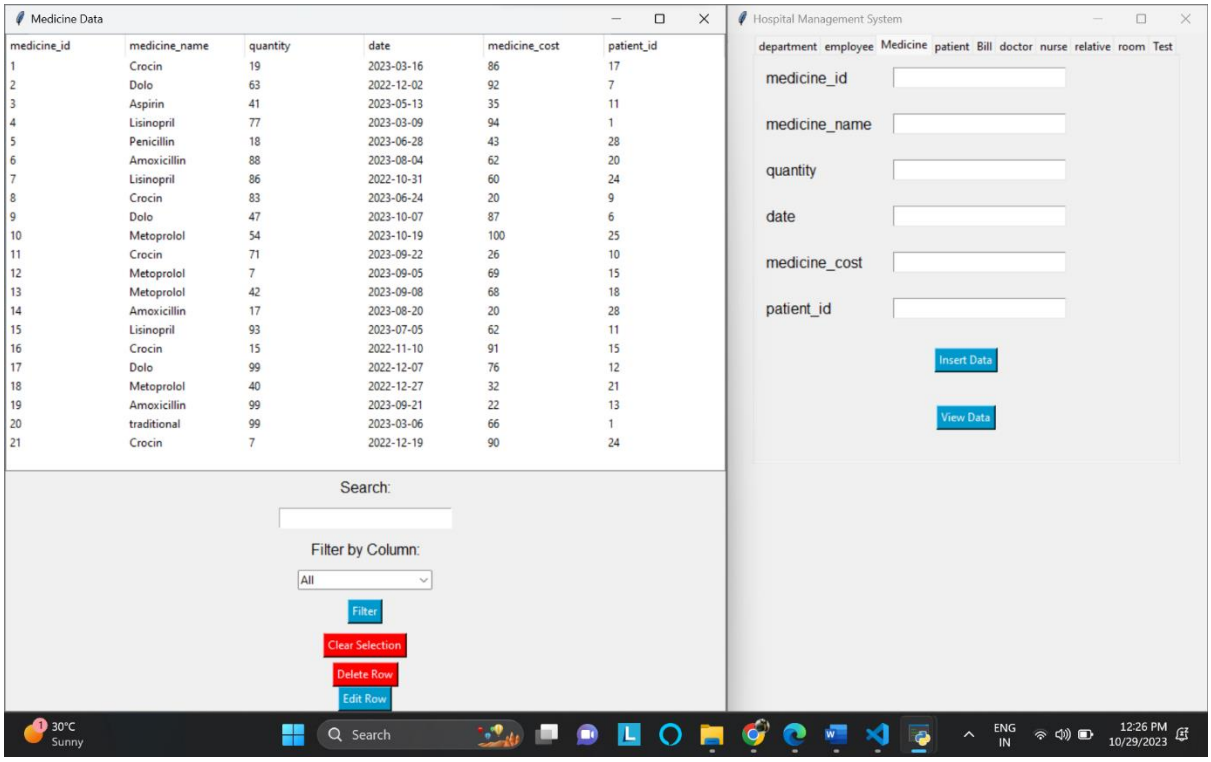

Figure 4. Medicine table

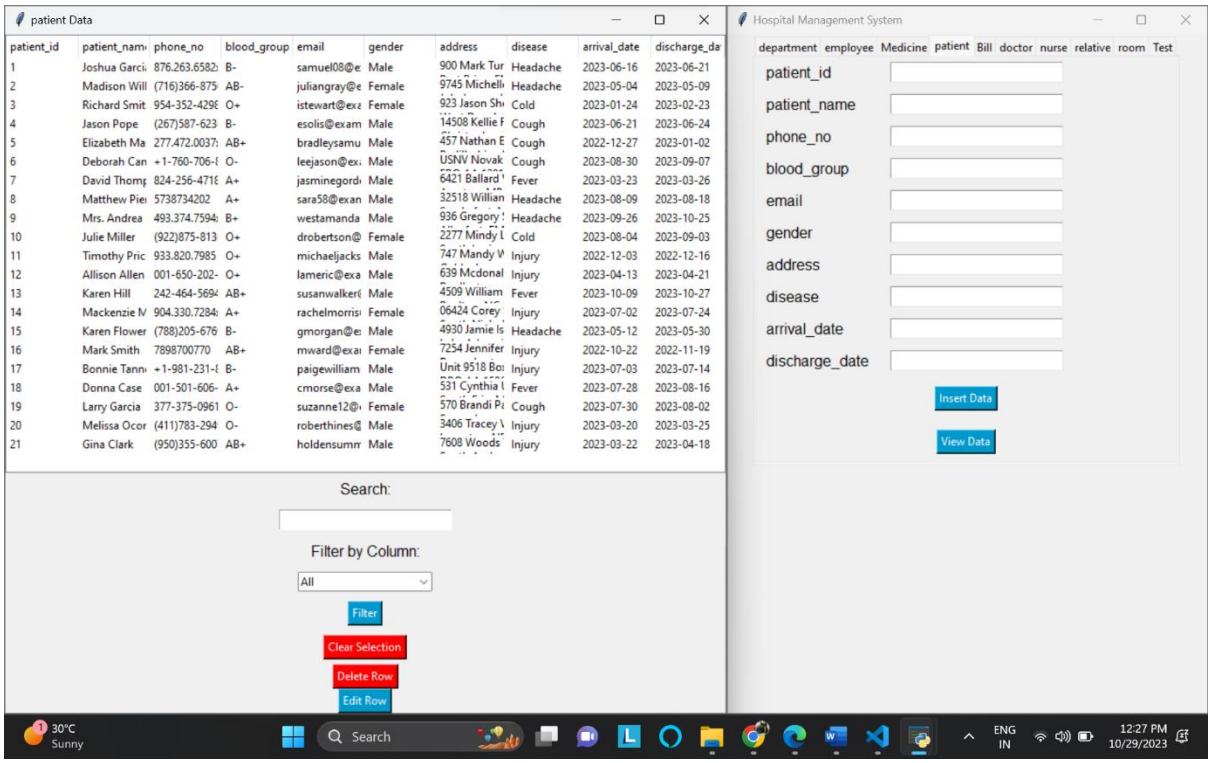

Figure 5. Patient table

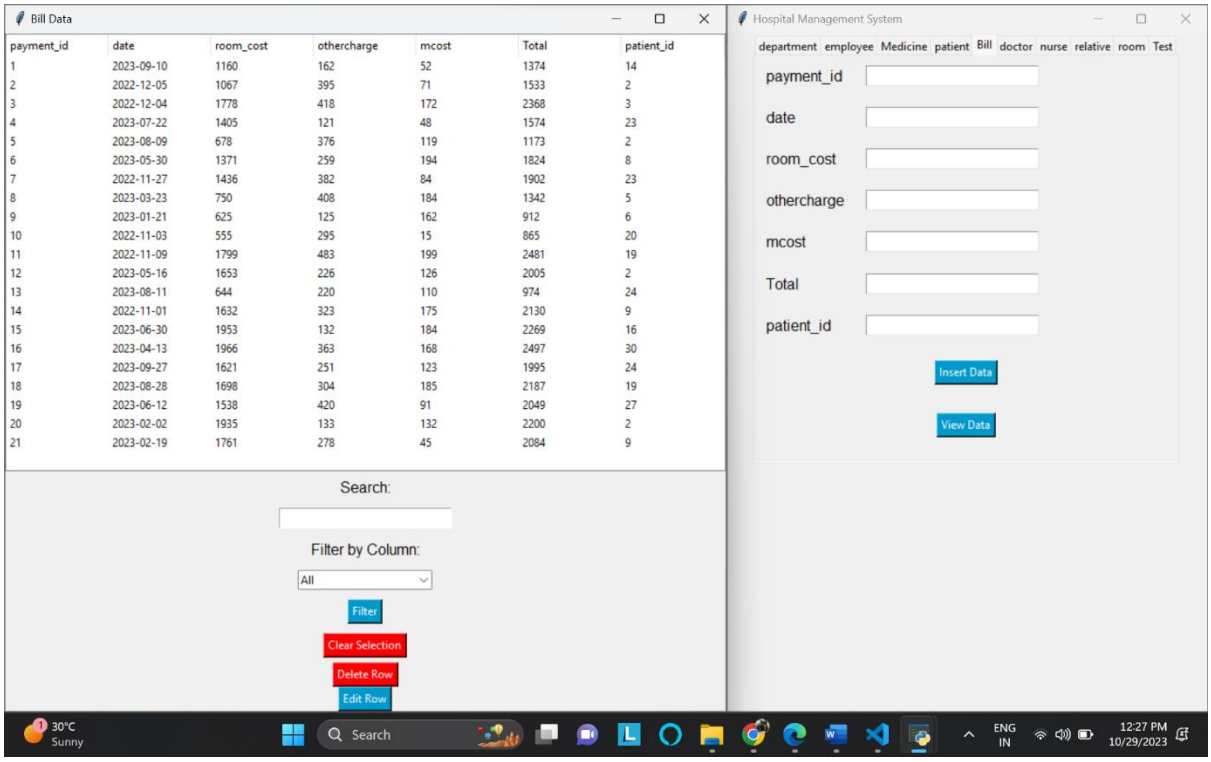

Figure 6. Bill table

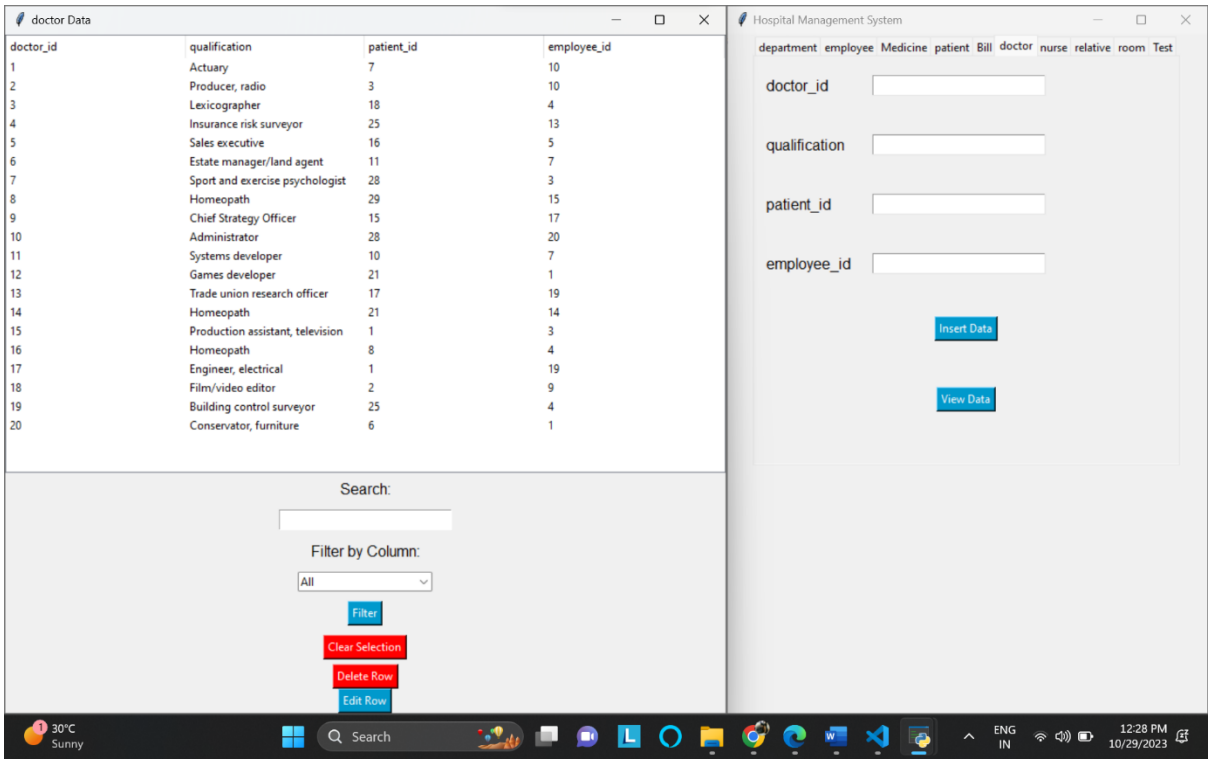

Figure 7. Doctor table

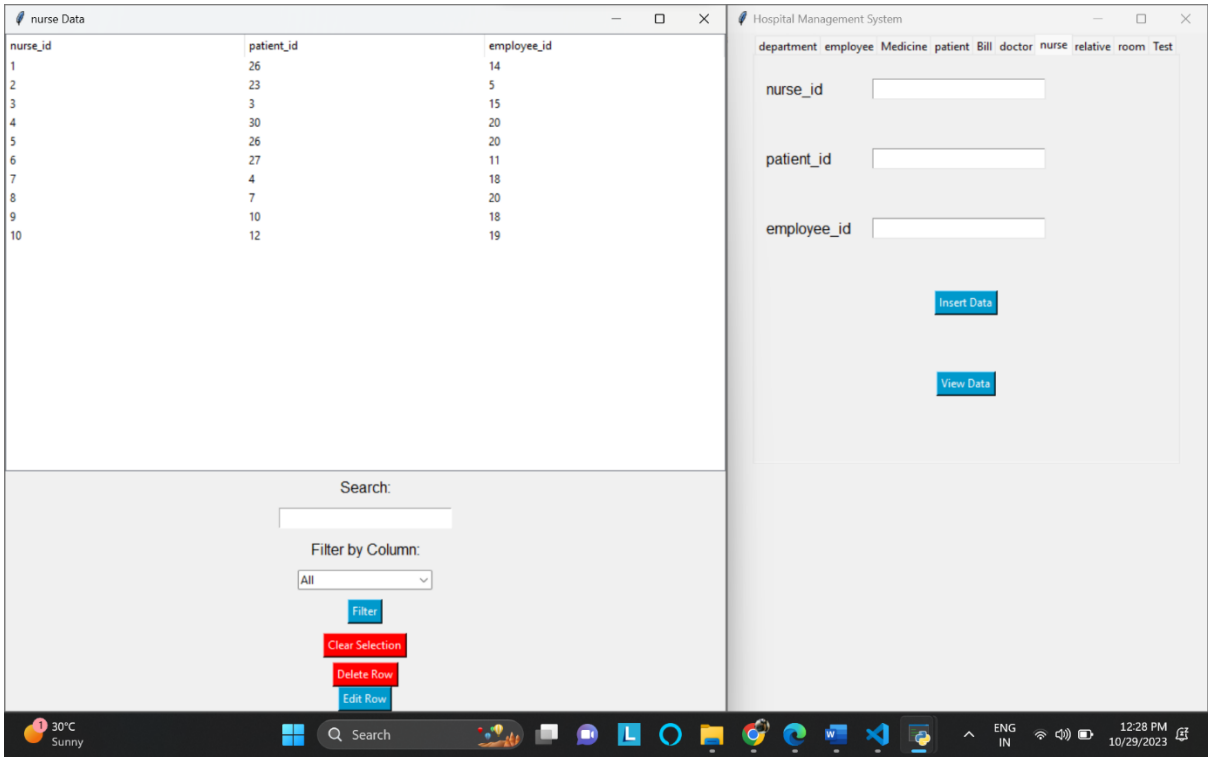

Figure 8. Nurse table

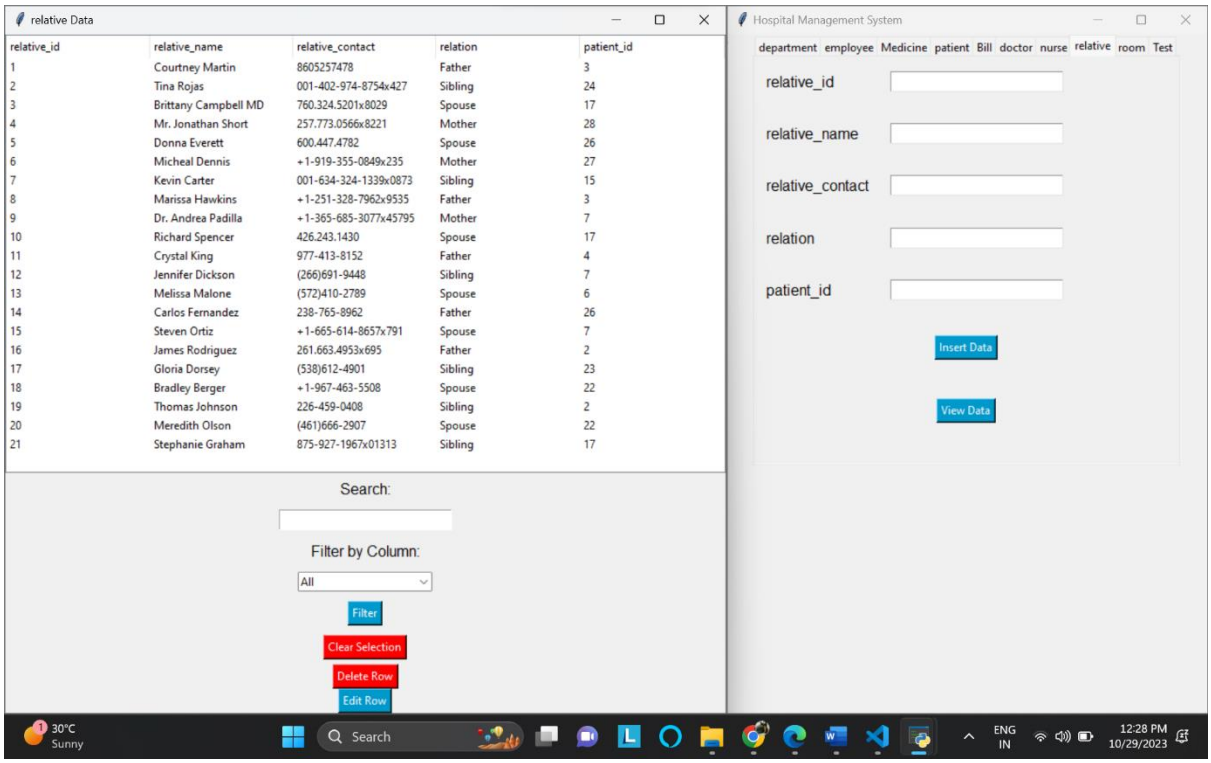

Figure 9. Relative table

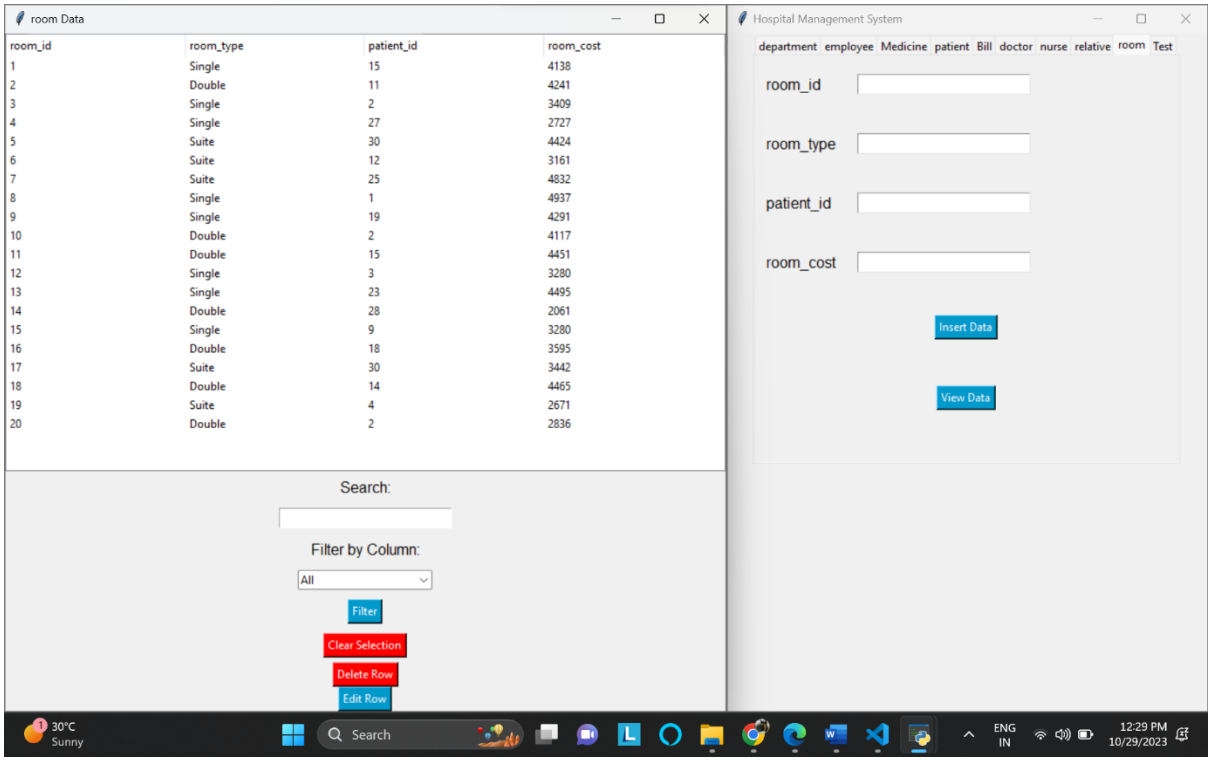

Figure10. Room table

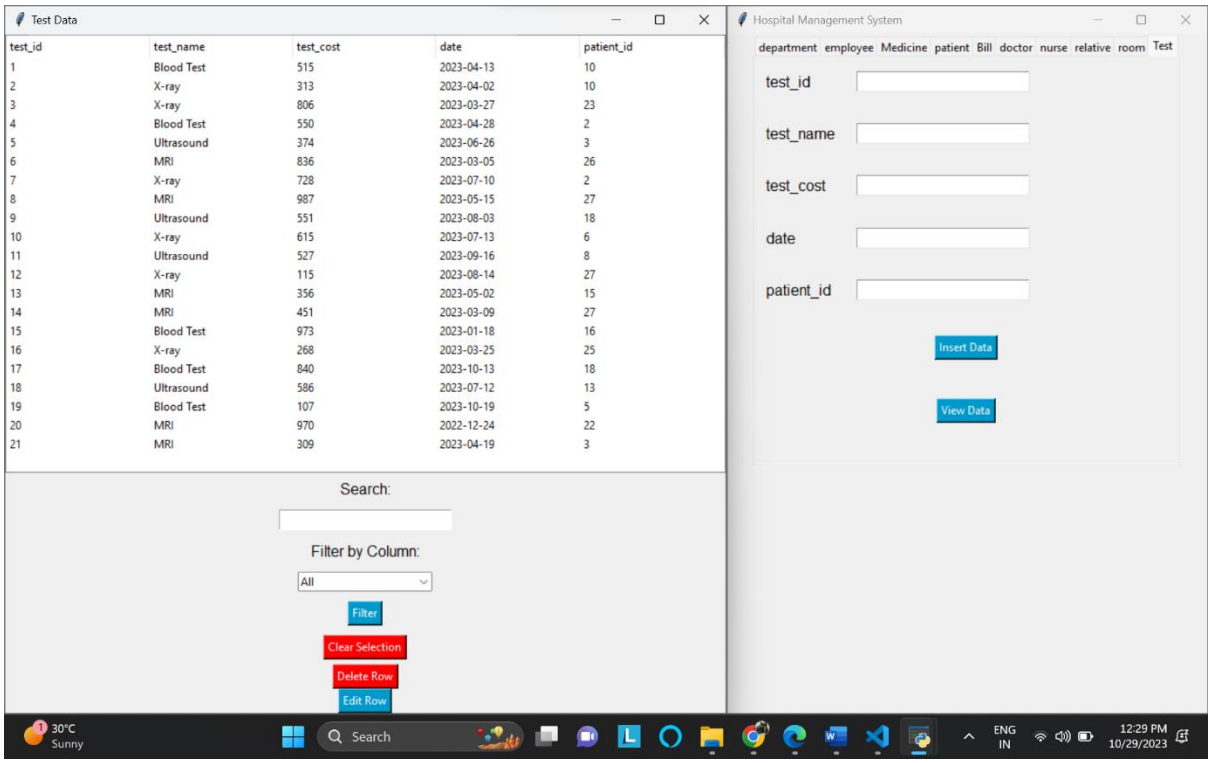

Figure 11. Test table

CHAPTER 5: SYSTEM TESTING

5.1 Unit Testing

1. Testing Scope:
Modules tested: Patient management, inventory control, staff management, reporting & analytics.
Functions tested: Data insertion, retrieving, updating, and process data algorithms.

2. Testing Methodology:
We tested every module using an exhaustive unit approach. Designed a collection of test cases spanning on the boundary cases, error handling, and edges cases. Used positive and negative testing to prove that the system answered appropriately to different inputs.
for example, for the "Patient" table:

Patient Management Module:
Test Case 1: Insert a new patient record into the database with valid fields such as name, phone number, street address, and so on. Next, ensure the process was successful.
Test Case 2: Attempt to create a new patient with invalid or missing mandatory fields and see that there is correct error messaging and notification provisioned for users.
Therefore, we ran these Test cases on each of the tables.

3. Test Results:

Mostly the code worked fine, other than a few small errors. Recognized and corrected inconsistencies with regards to data checking and format manipulation.
Created of patients' record, controlled employee's performance, as well as made reports about all vital functions.

4. Defects and Fixes:
Implemented stringent input check and error handling to address minor issue on data validation. They included resolved inconsistencies in data retrieval to ensure uniform

information presentation on each system module.

5. Coverage Analysis:

Maintained code coverage of 88%, verifying critical functionalities and data accuracies

Performed detailed checks on key components to ensure adequate coverage for all tests.

5.2 Integration Testing

1. Integration Plan:

The patient management module is integrated with the inventory control and staff management systems for smooth communication and synchronous information sharing.

Inter-modular data flow was tested as a part of verification process to ensure that the correct amount of information would go through all the systems' components.

2. Testing Scenarios:

The author analysed the admission procedure for patients with regards to the room occupancy and inventory status, validating the real-time synchronization of data in the modules.

Performed tests to check whether staff scheduling was in harmony with treatment procedures of patients for optimal flow of work.

3. Testing Results:

Ensured that there are strong communication lines between modules to make sure that shared reliable information is readily available.

Found and solved small latency problems, allowing to optimize the system's performance and speed of information processing.

4. Data Flow Analysis:

Checked the data flow within the system to ensure proper transfer of information with retention of its veracity and continuity.

Ensured validated synchronization of patient's records, personnel information, and data on inventory to minimize errors and lose the data.

5. System Performance:

Tested the system capabilities when dealing with multiple simultaneous requests as well as transactions that involve confidential information.

Determined the system’s ability to handle expanding volumes patient and administrative data without affecting the unceasing services.

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