Abstract

The main aim of the project is the management of the database of the pharmaceutical shop. This project is an insight into the design and implementation of a Pharmacy Management System. This is done by creating a database of the available medicines in the shop. In the current scenario where there has been a huge advancements and integration of technology into various fields leading to a better handling of data and maintaining data security and data automation, Pharmacy shops are still hanging back where there is still manual tabulation and maintenance of the drugs take place, Hence the primary aim of pharmacy management system is to improve accuracy and enhance safety and efficiency in the pharmaceutical store. The aim of this project is to develop software for the effective management of a pharmaceutical store. We have developed this software for ensuring effective policing by providing statistics of the drugs in stock.

The aim of the project is to create an effective software to help the pharmacist to maintain the records of the medicines, handle user details, generate invoice, check and renew validity and provide a scope of communication between users by using inbuilt messaging system. Pharmacy management system deals with the maintenance of drugs and consumables in the pharmacy unit. This pharmacy management system is user friendly. The Pharmacy Management System presented in this project overcomes the constraints of existing manual systems by incorporating an integrated software solution. The key goals are to obtain practical expertise in modeling software for real-world problems using a front-end (Java) and back-end (MySQL) . This system intends to provide an intuitive and user-friendly interface for pharmacy personnel, allowing for effective record-keeping of medicines, handling user information, producing invoices, checking and renewing validity, and simplifying communication via an inbuilt messaging system. The software also provides managers with options for securely managing employee records, such as assigning unique usernames and passwords.

Intialilly by using MySQL commands and its database this website Pharmacy management tends to store all the data received from the users including drugs sales details and the profit made by the owners are all in this database. This website allows the user to generate invoices for sales, check expiry and quantity remaining of the drugs. It also provides users with options to renew validity and add more drugs into the store along with updating companies and update the database accordingly. The integration of NoSQL with NLP, makes it easier to make proper distinction between drugs if more than one exists for the same treatment. The feedback provided by the user about the different types of drugs helps in better analysis of the user feedback and helps in analysis of sales of different drugs.

Table of Contents

List of Figures

List of Tables

GLOSSARY

ER	:	Entity Relationship Diagram
DFD	:	Detailed Design
SRS	:	Software Requirement Specification

Chapter 1

Introduction

This application can be used in any pharmaceutical shop having a database to maintain. The software used can generate reports, as per the user's requirements. The software can print invoices, bills, receipts etc of the purchases done by the owner from the companies. It can also maintain the record of the amount of supplies sent in by the supplier. Here, the admin who is also the owner of the pharmacy or any person handling the organization will be responsible to manage the record of the employee. Each employee will be given a separate userID and password.

The objectives of the project include:

- To develop an application that deals with the day-to-day requirement of any pharmacy.
- To develop the easy management of the medicines (drugs).
- To handle the inventory details like sales details, purchase details and stock expiry and quantity.
- To provide competitive advantage to the pharmacy.
- To provide detailed information about the stock on details necessary and help locate it in the shop easily.
- To make the stock manageable and simplify the use of inventory in the pharmacy

The scope of this project encompasses the development and implementation of a Pharmacy Management System designed to address the inefficiencies of manual record-keeping systems in pharmaceutical stores. The system aims to streamline inventory management by tracking medicines, managing stock levels, and monitoring expiry dates. It facilitates the sales process by generating invoices and maintaining accurate transaction records. User management functionalities ensure security and accountability within the organization, while an inbuilt messaging system enables seamless communication among pharmacy staff. The project focuses on designing a robust relational database structure, integrating Natural Language Processing (NLP) capabilities and a NoSQL database for handling unstructured data such as user reviews. Through front-end and back-end development using Java and MySQL, the system aims to provide a user-friendly interface and efficient data processing. Overall, the project aims to enhance operational efficiency, data accuracy, and decision-making capabilities within pharmaceutical stores, ultimately improving customer satisfaction and service quality.

Chapter 2

Software Requirement Specification

A software requirements specification (SRS) is a description of a software system to be developed. The software requirements specification lays out functional and non-functional requirements, and it may include a set of use cases that describe user interactions that the software must provide to the user for perfect interaction. Software requirements specification is a rigorous assessment of requirements before the more specific system design stages, and its goal is to reduce later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules.

2.1 Hardware Requirements

- Processor: 9th Gen Intel i5 / AMD Ryzen 3.
- RAM: 8.00 GB.
- Storage: 256 GB.

2.2 Software Requirements

- Operating System: Compatible with any OS.
- Windows/ MacOS/ Linux operating system.
- JRE and JDK.
- MySQL server, NoSQL server.

2.3 Functional Requirements

- User Authentication:
    - The system should allow users to login with valid credentials.
    - Different user roles (user, company) should have appropriate access levels.
- Drug/Medicines details and ordering:
    - Users should be able to search the required medicines and be able to order it.
    - The expiry dates of the drug should be mentioned along with the drug.
    - The system should display real-time drug availability.
- Display Company details:
    - Users should be able to see the drug manufacturing company details
    - Users can choose drugs based on the company.
- Sales History:
    - Provide the user an option to view the sales history of the drug.
    - Along with the manufacture and expiry dates of the drugs sold.

- Inventory Management:
    - Setting up alerts for low stocks to ensure timely restocking.
    - Implementing tracking for medicines with expiration dates.
- Review and Feedback Management:
    - Allow users to submit and feedback through the system.
    - Capture unstructured data such as comments, ratings and suggestions.
- Analysis of Reviews;
    - Implement algorithms for sentiment analysis on reviews to determine positive, negative or neutral comments.
    - Store and organize review data for future analysis and reporting.
    - Store and organize review data for future analysis and reporting.

Non-Functional Requirements

- Performance:
    - The system should handle simultaneous users without performance degradation.
- Security:
    - User data should be securely stored and encrypted.
    - Access to sensitive information should be restricted based on user roles.
- Usability:
    - Use clear and familiar terminology in the user interface.
    - Arrange menu items logically to facilitate user understanding.
    - Provide tooltips or help sections for complex functionalities

Chapter 3

Entity Relationship Diagram

An entity–relationship model describes interrelated things of interest in a specific domain of knowledge. It is composed of entity types and specifies relationships that can exist between instances of those entity types. The following ER- Diagram helps in better understanding of the existence of different entities in this project, and how the relations are established between them. Various listed entities are: Company, Drugs, Users, Login, Sales History and Message Inbox.

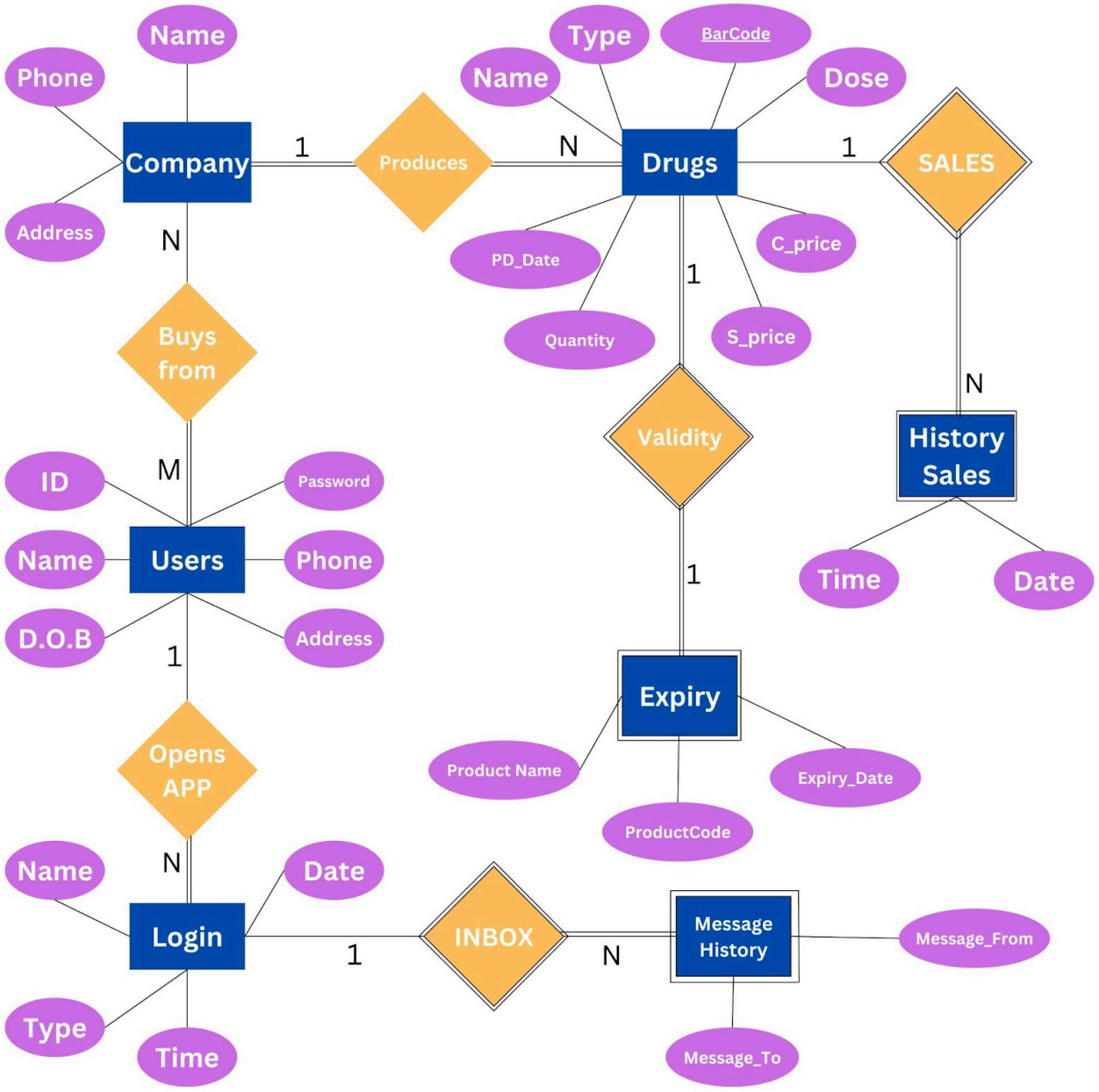


Fig 1 Entity Relationship Diagram

- Entities

    - **Users:** This entity stores information about the users of the system, such as their ID, name, password, date of birth, and address.
    - **Phones:** This entity stores information about the phones associated with users, possibly for contact purposes. However, the relationships in the diagram do not show how these are connected to other parts of the system.
    - **Drugs:** This entity stores information about the drugs sold by the pharmacy, such as their name, company that produces them, price, validity, and expiry date.
    - **Sales:** This entity stores information about the sales of drugs, such as the quantity sold, the sales price, and the date of sale.
    - **Messages:** This entity stores information about messages, such as the sender, recipient, time, date, and type of message. It’s not clear from this diagram what kind of messages this refers to.
    - **Expiry:** Tracks a drug's expiration details, likely with attributes like expiry date and batch number. It likely has a one-to-many relationship with Drugs, allowing one drug to have multiple expiry records for different batches.
    - **History_Sales:** Stores historical sales data, potentially including details like sold quantity, date, and total price. Its relationship with Sales could be one-to-one (more details) or one-to-many (each sale has a history record).

- Relationships

    - **Users can buy Drugs**: This relationship is represented by a line connecting the Users and Drugs entities. There is likely a foreign key in the Sales table that references the ID of the user who bought the drugs.
    - **Companies produce Drugs**: This relationship is represented by a line connecting the Companies and Drugs entities. There is likely a foreign key in the Drugs table that references the ID of the company that produced the drug.

Chapter 4

Detailed Design

Data Flow Diagrams (DFDs) are like maps for showing how information moves around in a system. They're useful because they make it easy to see how different parts of a system interact with each other. With simple pictures, DFDs help us understand how data flows between processes, storage areas, and outside sources. They're handy for planning and designing systems, as well as for explaining how they work to others. This preamble is here to explain why DFDs are important and how they help us understand and build systems better.

4.1 DFD Level 0

The highest level in a DFD, the Context Diagram, also known as Level 0, provides an overview of the entire system. It illustrates the interaction between the system being analyzed and its external entities, such as users, other systems, or data sources. In a Context Diagram, the system is represented as a single process, surrounded by external entities, with data flows connecting them. It serves as a high-level map of the system's boundaries and interactions with the outside world.

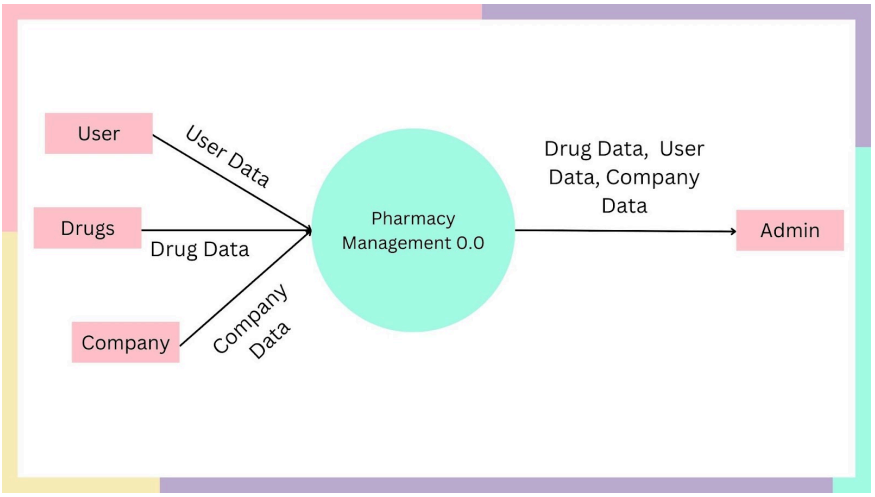


Fig 2 Data Flow Diagram Level-0

A level 0 DFD, also known as a context diagram, illustrates the Pharmacy management system as a single process interacting with external entities: Users who are the owners and workers in the pharmacy, Company who manufactures the drugs and details of drugs produced by different companies. The system receives data flows company data, drugs data and their orders and all the processes are controlled by the admin.

4.2 DFD Level 1

Level 1 DFDs decompose the processes identified in the Context Diagram into more detailed sub-processes. Each process in the Level 1 DFD represents a major function or activity within the level 0 system. Data flows between processes, external entities, and data stores are further

elaborated to show the specific data inputs, transformations, and outputs at this level. Level 1 DFDs provide a more detailed understanding of the system's internal workings while still maintaining a relatively high level of abstraction.

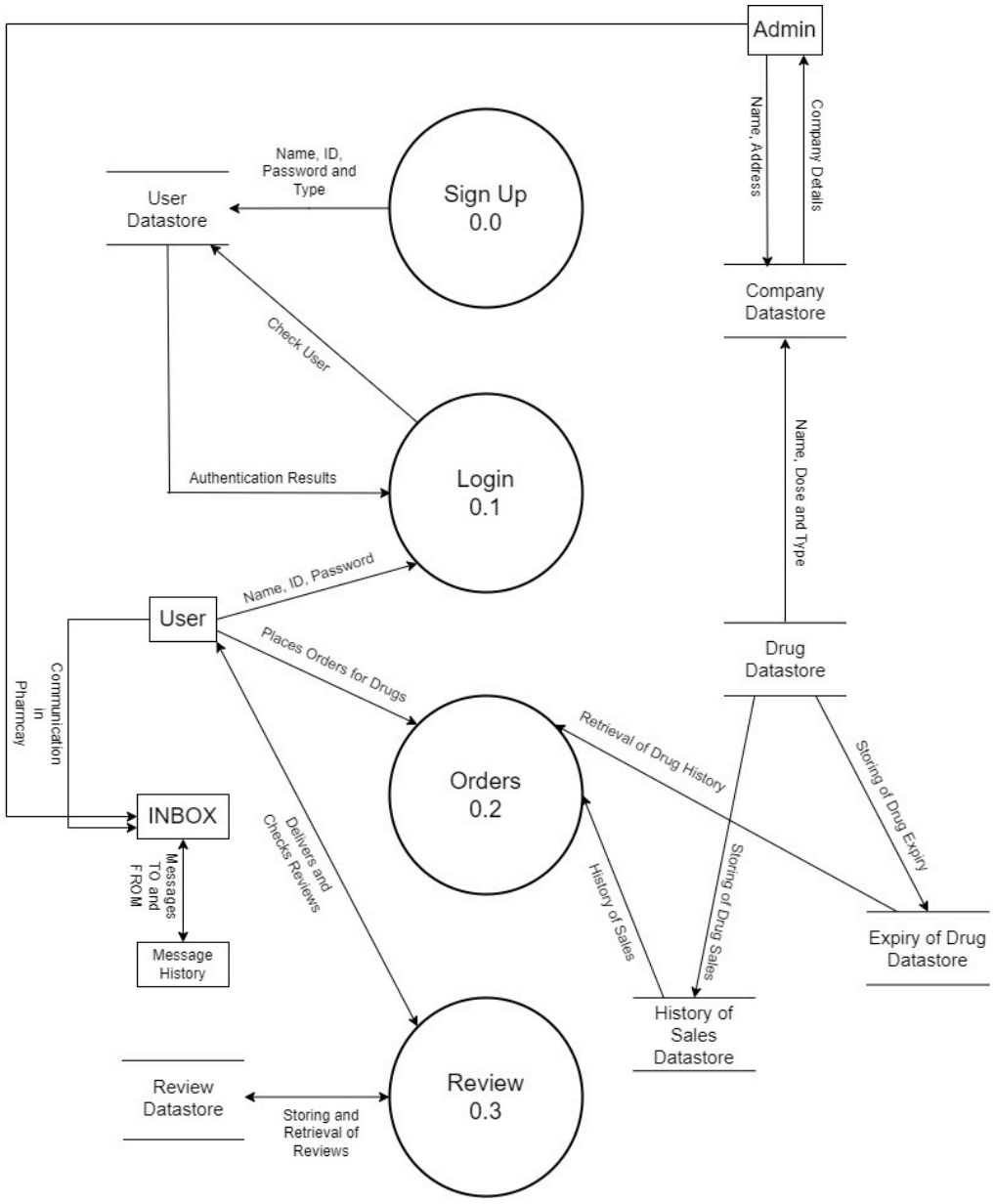


Fig 3 Data Flow Diagram Level-1

Processes:

- **Signup:** This process handles creation of the login credentials by giving user details.
- **Login:** This process includes login of the users with their used ID and password into the pharmacy management system.
- **Orders:** In this process the users can place orders for drugs manufactured by different companies and place them in the specific part of the pharmacy store so that there will be no confusion.
- **Review:** In this process the user reviews the drugs based on the sales and delivery, and also on the drug quality so that it'll help others to know about the drugs if they are interested.

Chapter 5

Relational schema and Normalization

Normalization and description

Database normalization is a process of organizing tables to minimize data redundancy, reducing errors and improving data integrity. There are different levels of normalization:

- 1NF (First Normal Form): Ensures each cell contains a single atomic value (no repeating groups).
- 2NF (Second Normal Form): Meets 1NF requirements and eliminates partial dependencies where a non-key attribute depends only on a part of the primary key.
- 3NF (Third Normal Form): Meets 2NF requirements and eliminates transitive dependencies where a non-key attribute depends on another non-key attribute, which in turn depends on the primary key.
- BCNF (Boyce-Codd Normal Form): For every functional dependency, the determinant must be a super key or candidate key of the table.

To formally prove that the tables are in Boyce-Codd Normal Form (BCNF), we need to check two key conditions:

- No Non-Trivial Functional Dependencies on Candidate Keys:
    - For each table, ensure that all functional dependencies involve only superkeys.
    - A superkey is a set of attributes that uniquely identifies a tuple in a table.
- No Redundant Data:
    - There should be no redundancy in the data, and each piece of information is stored in only one place.

Relational schema is a collection of meta-data. Database schema describes the structure and constraints of data representing a particular domain. The design and optimization of relational schemas through normalization play a pivotal role in ensuring the efficiency, integrity, and scalability of data systems. The relational schema serves as the foundational blueprint for organizing and structuring data within a database, defining the tables, attributes, relationships, and constraints that govern the representation of information. Concurrently, normalization is a systematic methodology employed to refine the design of a relational schema, aiming to minimize redundancy, dependency, and anomalies while enhancing data integrity and facilitating efficient querying and maintenance.

In the Pharmacy Management System, the relational data model forms the foundation for the structured data storage. Key entities that are included are Users, Company, Drugs and Message history along with weak entities like History of sales and Expiry dates each meticulously designed with attributes reflecting their specific information. Relationships such as one to one and many to one. Data normalization eliminates redundancy, and primary and foreign keys ensure uniqueness and relational integrity. For the best possible storage and integrity enforcement, appropriate data types and restrictions are allocated. Optimizing indexes on important columns improves query efficiency. Complex processes are made simpler by views and stored procedures, while database

transaction dependability is ensured by transaction management. This close attention to relational data model details guarantees that the database of our system is efficient, well-managed, and able to provide a flawless hotel reservation experience.

The provided Relational Schema contains tables indicating the Company, Drug, Sales History, Purchases and Sales, Users, Login Module and establishes a relation between the attributes present in these entities.

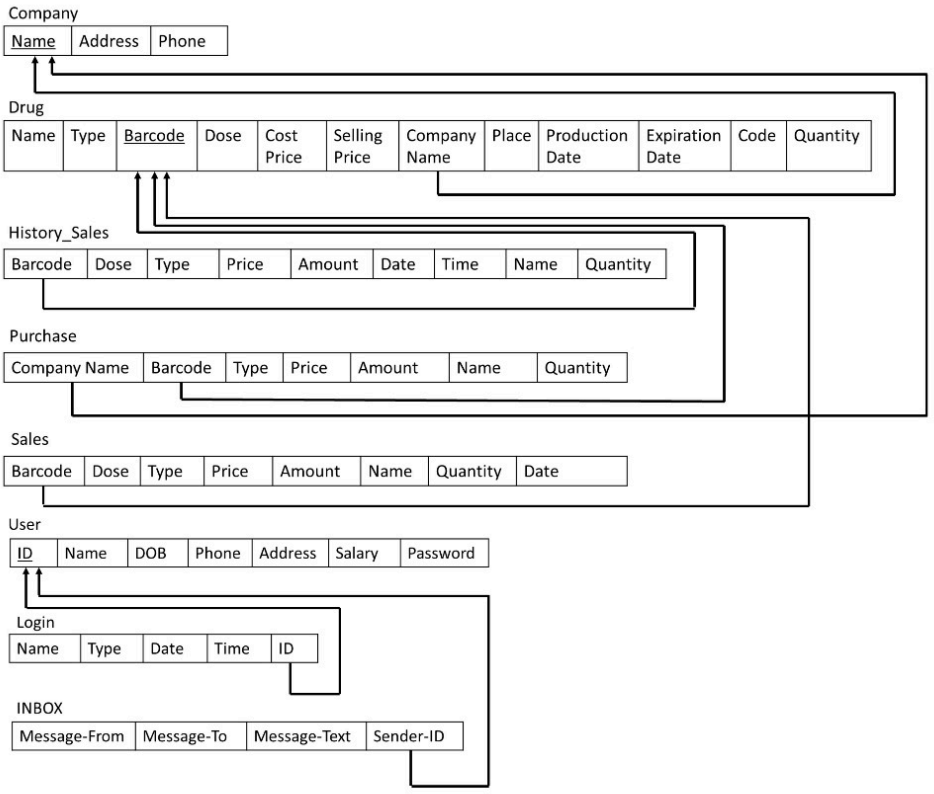


Fig 4 Relational Schema

Chapter 6

NOSQL

The project also deals with unstructured and dynamic data like reviews of the users about the drugs/medicines they've ordered. This unstructured data is handled by a NoSQL database. By drawing insightful conclusions from user reviews, the system is improved through the integration of Natural Language Processing (NLP) capabilities. Pharmacists can acquire a thorough grasp of client experiences by using natural language processing (NLP) techniques, which can assess sentiments, pinpoint important subjects, and classify comments. NoSQL and NLP work together to turn unprocessed feedback into actionable intelligence, giving the pharmacy the ability to quickly resolve issues and improve client happiness.

In the Pharmacy Management System described, NoSQL integration with SQL is utilized to handle unstructured and dynamic data effectively, such as user reviews about the drugs or medicines they've ordered. Here's how NoSQL is integrated with SQL:

- **Data Separation**: SQL databases are great for structured data with defined schemas, while NoSQL databases excel at handling unstructured or semi-structured data. In this system, SQL databases (like MySQL) handle structured data such as user information, drug details, sales history, etc., while NoSQL databases are used to manage unstructured data like user reviews.
- **Use of NoSQL for Unstructured Data**: NoSQL databases, with their flexible schemas, are well-suited for managing dynamic data like user reviews, which might have varying attributes or structures. NoSQL databases allow for easy storage and retrieval of such data without requiring a predefined schema.
- **Natural Language Processing (NLP) Integration**: NoSQL databases can be integrated with NLP tools and libraries to analyze unstructured text data effectively. In this system, NLP techniques are applied to user reviews stored in the NoSQL database to extract insights, such as sentiments, key topics, or classifications of comments. This integration allows pharmacists to understand customer experiences better and make informed decisions based on the feedback.
- **Actionable Insights from Unstructured Data**: By combining NoSQL with NLP, the system can transform raw feedback into actionable intelligence. This means that the pharmacy can extract valuable information from user reviews, identify patterns or trends, and use this knowledge to improve their services or products. For instance, identifying recurring complaints about certain drugs could prompt the pharmacy to investigate quality issues or consider alternative suppliers.
- **Integration for Comprehensive Solution**: The integration of NoSQL with SQL in this system provides a comprehensive solution for managing both structured and unstructured data effectively. While SQL databases handle traditional data management tasks, NoSQL databases complement them by offering flexibility and scalability for handling dynamic and unstructured data, thereby enhancing the overall functionality and usability of the Pharmacy Management System.

Chapter 7

Results and Analysis

The Pharmacy Management System aims to address the inefficiencies of manual record-keeping systems in pharmaceutical stores by providing a comprehensive software solution. Here's an analysis of the results based on the project objectives and scope:

- Management of Database: The project successfully implements a database system to manage medicines, handle user details, generate invoices, and track stock levels. By automating these processes, the system improves accuracy, efficiency, and safety in the pharmaceutical store.
- User-Friendly Interface: The system offers an intuitive and user-friendly interface for pharmacy personnel, facilitating easy navigation and efficient record-keeping. Features such as generating invoices, checking validity, and communicating via an inbuilt messaging system enhance usability.
- Integration of NoSQL with NLP: The integration of NoSQL with Natural Language Processing (NLP) enables effective analysis of unstructured data, such as user feedback on drugs. This analysis provides valuable insights into customer preferences, allowing the pharmacy to make informed decisions and improve service quality.
- Inventory Management: The system effectively handles inventory management by tracking medicines, managing stock levels, and monitoring expiry dates. This streamlines the sales process, ensures accurate transaction records, and helps prevent stockouts or expired products.
- Security and User Management: User authentication and role-based access control ensure security and accountability within the organization. The system allows the admin to manage employee records securely, assigning unique usernames and passwords for each employee.
- Competitive Advantage: By leveraging technology to automate processes, streamline inventory management, and analyze customer feedback, the Pharmacy Management System provides a competitive advantage to the pharmacy. It enhances operational efficiency, data accuracy, and decision-making capabilities, ultimately improving customer satisfaction and service quality.
- Scalability and Flexibility: The use of Java for front-end and MySQL for back-end development ensures scalability and flexibility. The system can be easily adapted to accommodate changes in business requirements or scale up to meet growing demands.

Overall, the Pharmacy Management System successfully achieves its objectives of improving pharmacy operations, enhancing inventory management, and providing a user-friendly interface for effective record-keeping. The integration of technology, including database management, NLP, and user authentication, contributes to the system's efficiency and effectiveness in addressing the challenges faced by pharmaceutical stores.

Chapter 8

Conclusion & Future Enhancement

The implementation of a Pharmacy Management System brings significant social impact by enhancing community safety, well-being, and confidence in the pharmaceutical sector. By optimizing procedures and minimizing the possibility of errors in pharmaceutical administration, the system ensures precise documentation, preventing the sale of outdated medications and ensuring appropriate stock levels. Moreover, the system promotes transparency in pharmaceutical operations, reducing the likelihood of errors and unauthorized access to private data. This fosters trust among consumers, ensuring access to safe and effective medications while improving overall efficiency in prescription drug manufacturing, distribution, and treatment management processes.

Future Enhancements:

- **Integration of BARCODE Facility**: Incorporating barcode functionality using a barcode reader can enhance the system's efficiency by automatically detecting expiration dates and other relevant information about medicines, thereby streamlining inventory management and ensuring the quality and safety of pharmaceutical products.
- **Financial Planning and Analysis**: Enhancing the system to provide comprehensive financial planning and analysis capabilities enables companies to make informed decisions and stay abreast of their financial position in the market, facilitating smoother business operations and strategic decision-making.
- **Implementation of Biometric Verification**: Including biometric verification adds an extra layer of security and authentication, safeguarding sensitive data and ensuring only authorized personnel have access to critical information, thereby enhancing overall data security and confidentiality.
- **Adoption of Newer Technologies like Cloud**: Expanding the system to leverage emerging technologies such as cloud computing enhances scalability, flexibility, and accessibility, enabling seamless data management and collaboration across different locations, while also ensuring data integrity and disaster recovery capabilities.

References

1. V. G. Carmel, K. A. N, and V. S. Kumar, "Role of Modern Pharmacy Management System in the Health Sector," Department of Computer Applications, Krupanidhi Degree College, Bengaluru, Karnataka, India. 28 December 2022

2. Goundrey-Smith S. “Information Technology in Pharmacy: An Integrated Approach.” Springer Science & Business Media; 2012 Oct 5.

3. L. Bao, Y Wang, T Shang, X Ren, R Ma. “A Novel Clinical Pharmacy Management System in Improving the Rational Drug Use in the Department of General Surgery.” Indian Journal of Pharmaceutical Sciences. 2013 Jan; 75(1): 11.

4. Ren X, Wang Y, Ma R. “A Novel Clinical Pharmacy Management System in Improving the Rational Drug Use.” Clinical Medicine Research. 2016 Feb 4; 4(6): 229.

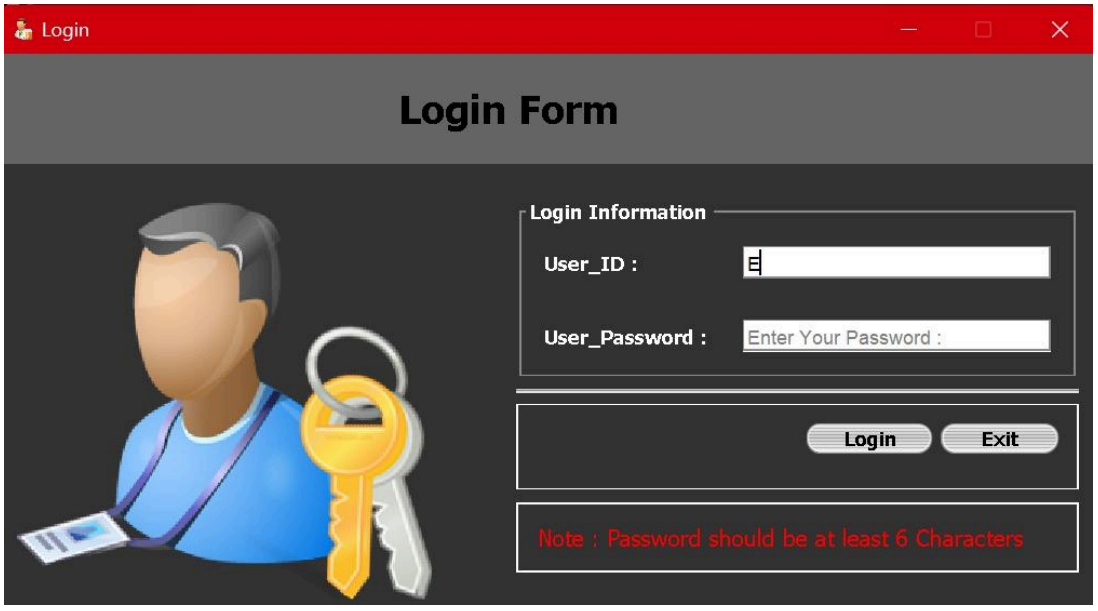
5. Nasution MK, Noah SA, Harahap U. “Overview of the Pharmacy Management System in a Hospital.” Systematic Reviews in Pharmacy. 2020; 11(11): 650-5.

6. Rachna Priya, Swarna Kumari, Arjun Kumar, “Research on Pharmacy Management.” Conference Paper. May 2022

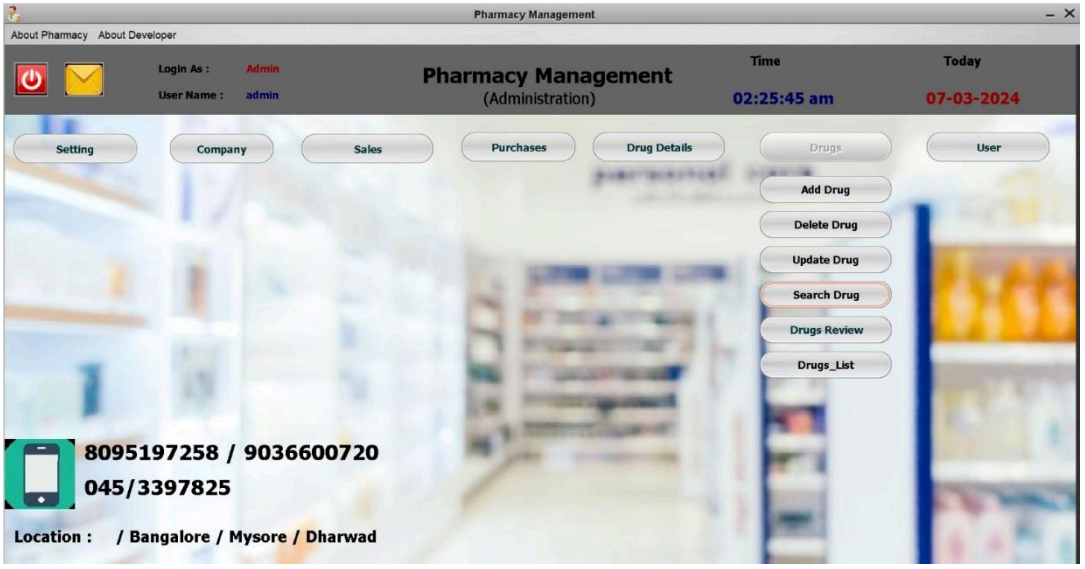
7. Ahmad, O. K. The Future of Pharmacy: How AI Is Revolutionizing the Industry. Intelligent Pharmacy. 2023, 1, 32-40.

Appendix

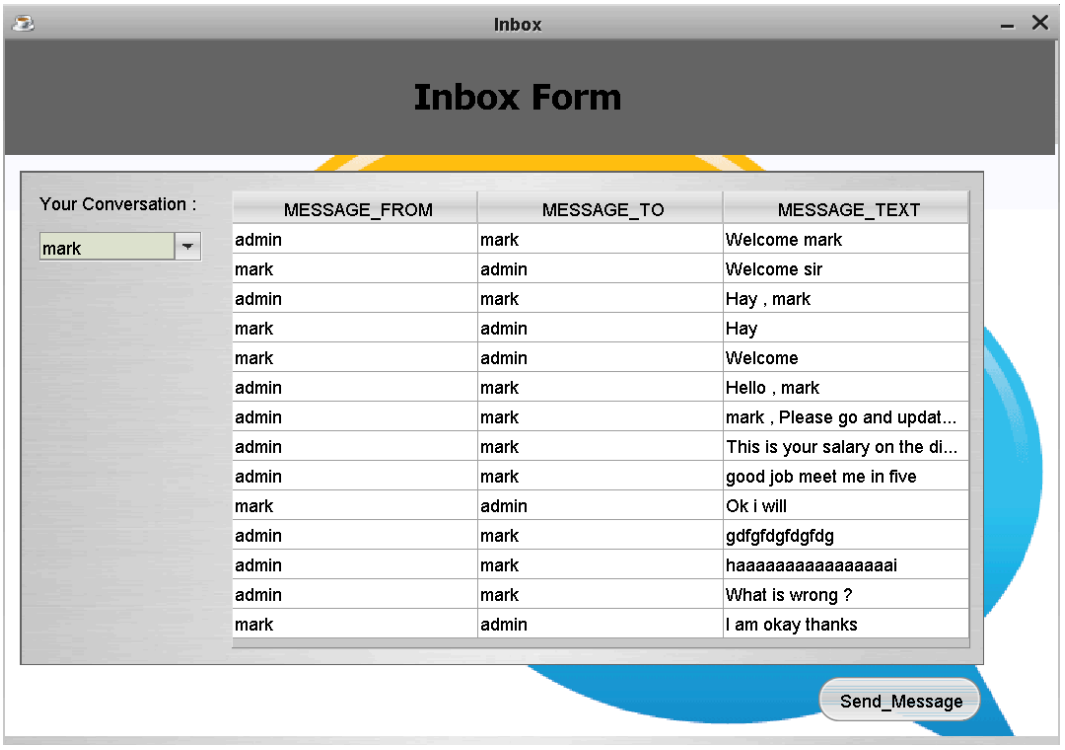
- The below image is the login page of the Pharmacy Management System.



- The image describes the home page along with the dashboard of the Pharmacy Management System.



- Message inbox window from where user can send and receive messages to co-users.



- User form where the administrator can register/ delete/ update the user.