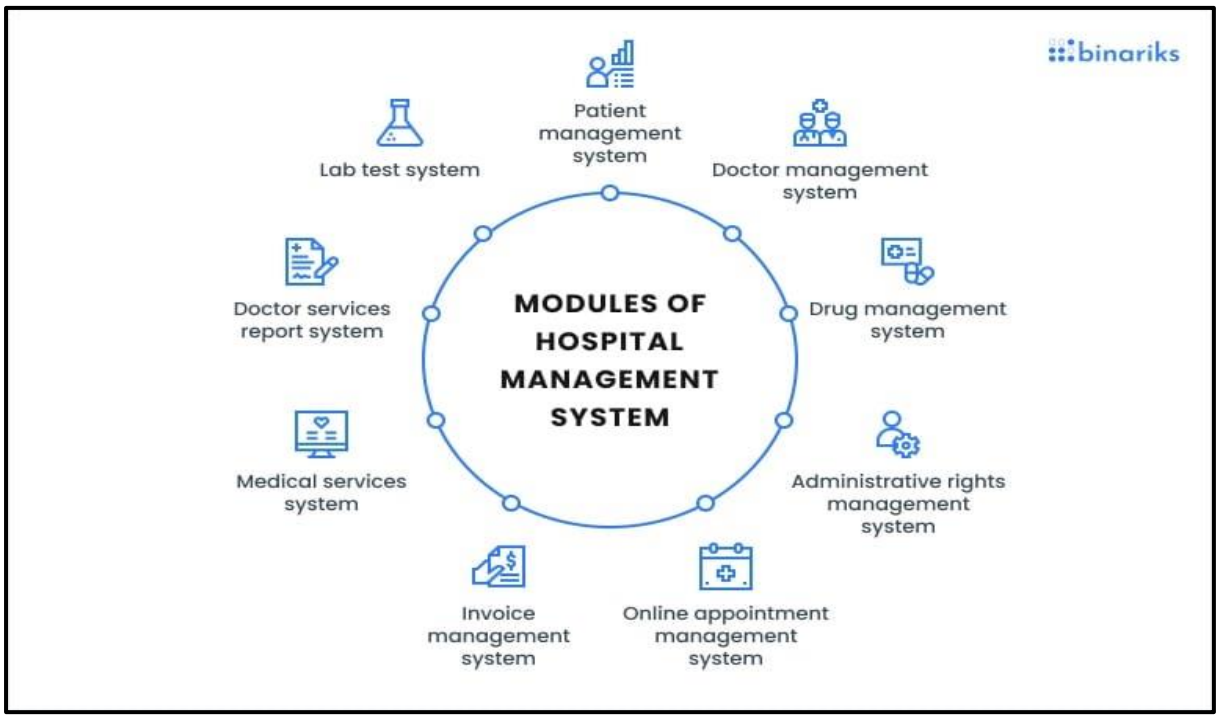
INTRODUCTION

Purpose

Efficient management of the clinical, financial, and administrative aspects of a healthcare facility is the aim of a hospital management system (HMS). HMS seeks to improve patient care, simplify procedures, and maximise resource use. It functions as a centralised platform for the management of appointments, patient data, inventory, billing, and provider-to-provider communication. Through the automation of repetitive operations and provision of decision support tools, HMS enhances workflow effectiveness, minimises errors, and guarantees regulatory compliance. It also encourages patient participation, backs data-driven decision-making, and makes it easier for healthcare delivery to continuously improve quality.

Product Scope

A Hospital Management System (HMS) project's scope includes, but is not limited to, developing software modules for electronic health records (EHR), patient management, appointment scheduling, billing and invoicing, inventory management, and reporting. It also involves integrating these modules into an organised structure that satisfies the particular demands and specifications of the medical facility. In addition, user training, data migration from current systems, customisation to fit certain workflows, and continuous technical support and maintenance are all included in the project scope. In addition, the scope might include putting in place security measures to protect patient data, making sure that laws and regulations like HIPAA (Health Insurance Portability and Accountability Act) are followed, and making sure that the system is scalable to allow for future expansion and technological improvements.



Product Functions

The Hospital Management System's product functions are explained in further detail below:

Admin Functions:

Patient Registration:

- *Admins can oversee and manage the registration process for new patients*
- *They have the authority to create and manage unique patient identifiers.*

Appointment Scheduling:

- *Admins can have control over the overall appointment scheduling system.*
- *They manage the appointment calendar for doctors and other staff members.*

Electronic Health Record Management:

- *Admins have access to and manage the storage of electronic health records (EHRs) for patients.*

Inventory Tracking:

- *Admins handle inventory tracking for medical supplies, medications, and equipment*
- *They facilitate efficient stock management and automatic reordering.*

Billing and Invoicing:

- *Admins generate bills and invoices for services rendered.*
- *They oversee the integration with insurance systems for claims processing and manage billing and payment transactions*

Staff Management:

- *Admins manage employee profiles, roles, and schedules.*
- *They handle shift assignments, leave management, and performance evaluation for staff.*

Doctor Functions:

- ***Appointment Scheduling:***
- *Doctors can view and manage their appointment schedules.*

Electronic Health Record Management:

- *Doctors have access to patient EHRs, including medical history, diagnoses, medications, lab results, and treatment plans.*
- *Doctors can place test orders, track samples, and access and interpret laboratory test results..*

1. ***User Functions:***

Patient Registration:

- *Users (patients) can register and provide essential demographic information.*

Appointment Scheduling:

- *Users can schedule appointments with healthcare providers.*

Electronic Health Record Access:

- *Users have access to their own electronic health records.*

Billing and Invoicing:

- *Users may interact with the system for billing inquiries and payments.*

Pharmacy Management:

- *Users can view their prescription orders and medication histories.*

Classes User and Characteristics

In a medical store management system, different **classes** (or **roles**) are assigned to users based on their responsibilities and functions within the system. Each class comes with its own set of

characteristics that define the access, permissions, and tasks each user can perform. Below are common classes, users, and their characteristics in a medical store management system:

Pharmacy Manager

Characteristics:

- ***Permissions:*** Full access to all system features, including inventory management, supplier orders, sales reports, and financial data.
- ***Tasks:***
    - Oversee all store operations.
    - Approve stock orders, returns, and payments.
    - Generate and review compliance reports.
    - Manage and assign roles to other users.
    - Monitor system performance and security.
- ***Responsibilities:*** Ensuring that the store complies with regulations, managing finances, and maintaining stock levels.

Pharmacist

Characteristics:

- ***Permissions:*** Limited access to inventory, prescriptions, and controlled substances.
- ***Tasks*:**
    - Verify and process prescriptions.
    - Dispense medications to customers.
    - Manage medication safety, including checking expiry dates and controlled substance handling.
- ***Responsibilities:*** Handling sensitive customer prescriptions and ensuring proper handling of medications in line with health regulations.

Sales Staff

Characteristics:

- ***Permissions*:** Basic access to sales transactions and customer data.
- ***Tasks:***
- Assist customers with over-the-counter product sales.

- Process cash and card payments.
- Record sales transactions and issue receipts.
- Perform basic inventory checks (e.g., checking stock levels).
- ***Responsibilities:*** Customer-facing duties and daily sales operations, ensuring smooth transaction processing.

Inventory Manager

Characteristics:

- ***Permissions*:** Access to inventory records, supplier information, and stock movement.
- ***Tasks:***
    - Track product stock levels and update inventory.
    - Perform regular stock audits and reconcile inventory discrepancies.
    - Place restocking orders with suppliers.
    - Monitor the expiry dates of medications and remove expired stock.
- ***Responsibilities*:** Ensuring that stock levels are maintained, inventory is up-to-date, and expired products are flagged and removed from the store.

Store Administrator

Characteristics:

- ***Permissions:*** Full system access, including user management, reporting, and configuring system settings.
- ***Tasks:***
    - Configure system settings (e.g., pricing, product categories).
    - Create and manage user roles and permissions.
    - Ensure system security and data backup.
- ***Responsibilities:*** Administering the entire system's setup and maintaining overall store management, security, and system maintenance.

Customer

***Characteristics: Permissions*:** Limited access to their personal purchase history and prescriptions (if applicable).

- ***Tasks:***
    - Browse products available for sale.

- Request prescription refills (if applicable).
- Make purchases and pay for products.

- ***Responsibilities*:** Purchasing products and receiving prescriptions, ensuring they are aware of product details and usage.

Functional requirements

Functional requirements for a Hospital Management System (HMS) typically include a wide range of features and capabilities to ensure efficient operations and effective patient care. Here are some common functional requirements for an HMS:

Functional Requirement 1

1. ***Patient Management*:**
    - *Registration: Ability to register new patients, including capturing personal and medical information.*
    - *Appointment Scheduling: Allow patients to schedule appointments with doctors or departments.*
    - *Admission/Discharge: Manage the admission and discharge process for patients.*
2. ***Staff Management:***
    - *User Authentication: Secure login for staff members with different access levels (admin, doctors, nurses, etc.).*
    - *Staff Roster: Manage staff schedules, including doctors, nurses, and administrative personnel.*
4. ***Billing and Insurance:***
    - *Billing: Generate bills for services rendered, including consultation fees, procedures, medications, and room charges.*
    - *Insurance Claims: Manage insurance information and submit claims to insurance providers.*
5. ***Pharmacy Management:***
    - *Medicine Inventory: Track medication stock levels and manage inventory.*
    - *Prescription Management: Record prescriptions, dispense medications, and manage refill requests.*

3. ***Medical Records Management:***

   - *Electronic Health Records (EHR): Store and manage patient medical history, diagnoses, treatments, and test results.*
   - *Medical Imaging: Integration with systems for storing and viewing medical images such as X-rays, MRIs, and CT scans.*

6. ***Laboratory Management:***

   - *Test Orders: Accept requests for laboratory tests from doctors.*
   - *Test Results: Record and provide access to test results for medical staff.*

UseCASE

Descriptive use case Use cases

UseCase Name	Actors	Description	Preconditions	Postconditions
Manage Users	**Admin**	**Admin adds, edits, or removes users from the system.**	**Admin must be logged in.**	**User list is updated.**
Manage Inventory	**Admin, Pharmacist**	**Adds, updates, or removes medicine from stock**	**Valid login credentials.**	**Inventory is updated.**
Purchase Medicine	**Customer**	**Customers buy medicine online or in-store.**	**Medicine must be in stock.**	**Order is placed successfully.**
Process Orders	**Pharmacist**	**Pharmacist processes and verifies medicine orders.**	**Order request exists.**	**Order is completed.**
Generate Reports	**Admin**	**Generates sales, stock, and supplier reports.**	**Admin must be logged in.**	**Report is generated.**
Manage Suppliers	**Admin, Pharmacist**	**Updates supplier details and orders stock.**	**Valid supplier information required.**	**Supplier database is updated.**

Other Nonfunctional Requirements

Performance Requirements

- The system shall accommodate high number of booking and users without any fault.
- Responses to view information shall take no longer than 5 seconds to appear on the screen.

Safety Requirements

- Ensure medications are stored in controlled environments with proper temperature, humidity, and light conditions to maintain their efficacy and prevent degradation.
- Limit access to authorized personnel only, especially for controlled substances. Secure storage areas with locks and surveillance to prevent theft and misuse
- *Provide employees with necessary PPE like gloves and masks to protect against potential hazards when handling medical products and chemicals.*
- Ensure all staff are trained in safety protocols and regulatory requirements. Regularly update training to align with evolving safety standards and legal regul
- *Follow proper procedures for disposing of expired, hazardous, or unused medical items. Keep the storage area clean and well-maintained to avoid contamination of products.*

Security Requirements

- System should use secured Database.

- Normal users can just read information but they cannot edit or modify anything except their personal and some other information.
- System will have different types of users and every user has access constraints.
- Proper user authentication should be provided.
- No one should be able to hack users password .
- There should be separate accounts for admin and members such that no member can access the database and only admin has the rights to update the database.

Software Quality Attributes

In the **hospital management system**, software quality attributes are

1. ***Reliability***: The system must operate without frequent crashes or errors, ensuring continuous availability for tasks such as inventory management, order processing, and compliance reporting. It should handle unexpected failures gracefully and provide error logging for troubleshooting.
2. ***Security***: Given the sensitive nature of medical data and controlled substances, security is essential. The software must protect user data (e.g., patient information, inventory data) through encryption, user authentication, and access controls. It should also safeguard against unauthorized access to controlled medications.
3. ***Usability:*** The software should have an intuitive and user-friendly interface, making it easy for store personnel to input data, track inventory, and manage transactions. Clear navigation and efficient workflows help minimize user errors and increase productivity.
4. ***Scalability:*** As the store grows or the range of products expands, the software should scale to accommodate larger inventories, more users, and more complex workflows. This ensures the system can handle increased transactions and data volume without compromising performance.
5. ***Compliance and Accuracy***: The software must support compliance with local and international regulatory requirements for medical stores, such as proper labeling, tracking of expiry dates, and secure disposal of expired products.

Business Rules

1.Role-Based Access Control (RBAC):

- *Only authorized personnel (e.g., pharmacists, store managers) can access sensitive information, such as inventory levels, controlled substances.*
- *Sales staff may only access basic product information and sales functionality but cannot modify inventory or access sensitive data.*

2.Inventory Management:

- *Only store managers and supervisors can approve stock orders and make updates to inventory quantities.*
- *All stock entries and exits must be logged with the user ID, time, and date to ensure accountability.*
- *Inventory records must be updated immediately after a transaction (sale, return, or restocking) to maintain real-time accuracy.*

3.Expiration Date Management:

- *The system should automatically flag products that are close to their expiration date (e.g., 3 months before) for review and potential removal from sale.*
- *Only authorized personnel, such as pharmacists or store managers, can approve the disposal or return of expired products.*

4.Controlled Substance Handling:

- *Only authorized personnel (e.g., pharmacists) can dispense, store, or record transactions involving controlled substances.*
- *Transactions involving controlled substances must be recorded with additional verification steps, such as a second person's approval (e.g., two-person verification for narcotics).*

5.Reporting and Compliance:

- *The system must generate regular reports on sales, stock levels, expiry dates, and controlled substances usage for regulatory compliance and audits.*
- *Only managers or supervisors can approve and generate compliance-related reports.*

6.Transaction Limits:

- *Sales staff may only process transactions within certain value limits. Transactions above a specific threshold must be approved by a manager or* senior staff member.

7.Refund/Return Policies:

- *Returns of medical products (especially medicines) are allowed only if they are unopened, within the return window, and meet specific store policies.*

- *Return transactions must be tracked with the reason for return and the person authorizing it.*

8.User Audit and Monitoring:

- *The software should track and store an audit trail of all actions taken by users, especially regarding inventory changes, sales transactions, and sensitive data access.*
- *Audit logs should only be accessible to store managers and administrators.*

Other Requirements

. 1. *Performance Requirements*

- The system should handle simultaneous logins of at least 500 users without performance degradation.
- Response time for retrieving patient records should be ≤ 2 seconds.
- Appointment scheduling and billing transactions should be processed in ≤ 5 seconds.

2. *Security Requirements*

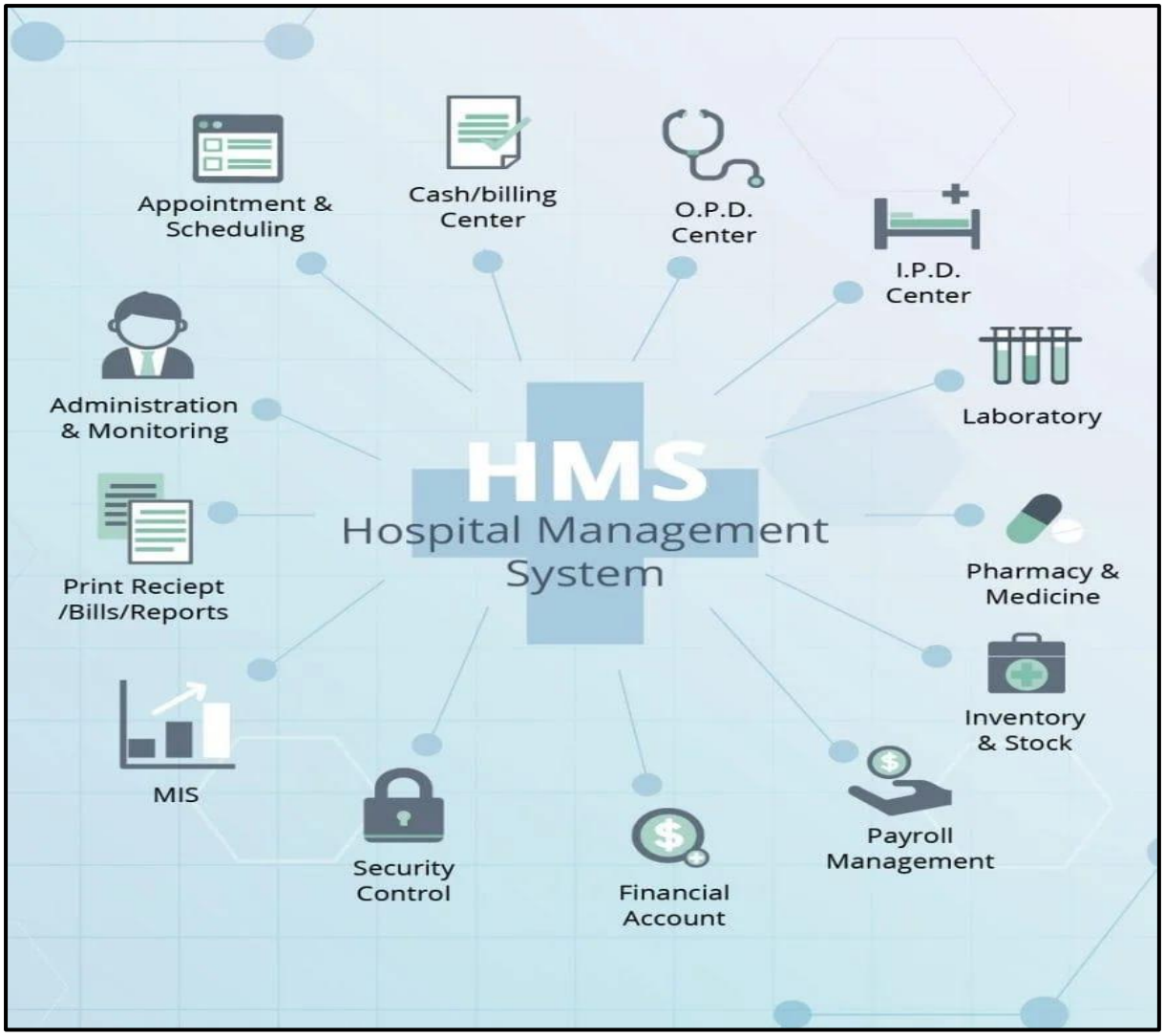
- Role-based access control (RBAC): Only authorized personnel can access sensitive data.
- All patient data must be encrypted using AES-256 encryption.
- Must comply with HIPAA, GDPR, and other healthcare regulations for data privacy.
- Multi-factor authentication (MFA) should be implemented for administrative access.
- Regular automatic backups to prevent data loss.

3. Usability Requirements

- The system should have an intuitive UI/UX with minimal learning curve.
- Must be accessible on desktop, tablet, and mobile devices.
- Should support multiple languages for better accessibility.
- System should provide real-time notifications for appointments, billing, and alerts.

4. Availability & Reliability Requirements

- The system should have 99.9% uptime (downtime ≤ 8.76 hours per year).
- Automatic failover mechanisms should be in place to handle server failures.
- Regular data backups should occur at least once every 12 hours.
- System should automatically recover from crashes within 5 minutes.



Appendix A: Glossary

- This appendix provides definitions of key terms used in the *Hospital Management System (HMS)* to ensure clarity and understanding for all stakeholders.
- ADT (Admission, Discharge, and Transfer):* A module that manages patient admissions, discharges, and transfers within the hospital.
- API (Application Programming Interface):* A set of protocols enabling communication between the HMS and other healthcare software.
- Billing Module:* A system that automates patient invoicing, insurance claims, and payment processing.
- Backup & Recovery:* A data protection mechanism ensuring stored information can be restored in case of failure.
- Clinical Decision Support System (CDSS):* A tool that aids physicians by providing evidence-based recommendations.
- Compliance:* Ensuring the system adheres to healthcare laws like HIPAA and GDPR.

- Dashboard:* A real-time graphical interface displaying key hospital metrics and analytics.
- Data Interoperability:* The ability to exchange and use data seamlessly across different healthcare systems.
- Disaster Recovery Plan (DRP):* A predefined strategy for restoring HMS functionality during system failures.
- EHR (Electronic Health Records):* Digital records containing patient medical histories, treatments, and test results.
- Encryption:* A cybersecurity technique used to protect sensitive patient data from unauthorized access.
- FHIR (Fast Healthcare Interoperability Resources):* A modern standard for the electronic exchange of healthcare information.
- Front Desk Management:* A system module handling patient registration, appointment scheduling, and inquiries.
- GDPR (General Data Protection Regulation):* A European law governing data privacy and protection in healthcare.
- HIPAA (Health Insurance Portability and Accountability Act):* A U.S. law ensuring patient data privacy and security.
- HL7 (Health Level Seven):* A set of international standards facilitating electronic health information exchange.
- Integration:* The process of connecting the HMS with external systems like laboratory, pharmacy, and insurance databases.
- Inventory Management:* A system that tracks hospital supplies, including medications and medical equipment.
- Laboratory Information System (LIS):* A system that manages diagnostic tests, lab workflows, and report generation.
- Medical Coding:* The process of translating patient diagnoses and procedures into standardized billing codes.
- Multi-Factor Authentication (MFA):* A security measure requiring multiple verification steps for system access.
- NABH (National Accreditation Board for Hospitals & Healthcare Providers):* A certification ensuring quality healthcare standards in hospitals.
- Notification System:* A feature that alerts users about appointments, prescription updates, and critical system events.
- Patient Portal:* A web or mobile interface that allows patients to access health records, book appointments, and communicate with doctors.
- Pharmacy Management System (PMS):* A module that monitors medication inventory, prescriptions, and dispensation.
- Radiology Information System (RIS):* A system for managing radiology imaging reports and workflows.

- Role-Based Access Control (RBAC):* A security feature that assigns system access based on user roles.
- Scalability:* The ability of the HMS to expand and support increasing numbers of users and patient records.
- Scheduling System:* A module that facilitates appointment booking for

References

Medical Store Management Systems, outlining key functionalities and user interactions (Meera Academy). Additionally, research papers such as those on ResearchGate discuss the objectives and implementation of Pharmacy Management Systems, detailing how automation enhances accuracy and productivity (ResearchGate).(draw .io)

Pharmacy Management Systems, detailing how automation enhances accuracy and productivity (ResearchGate)and geek by geek . These references collectively provide a comprehensive understanding of the Medical Store Management System, covering theoretical concepts, practical implementations, and software development aspect