

PUNJAB UNIVERSITY COLLEGE OF INFORMATION TECHNOLOGY



SOFTWARE DESIGN & ARCHITECHTURE

ASSIGNMENT-01

HOSPITAL MANAGEMENT SYSTEM

Group Members:

- BSEF21M033 Imran Javed
- BSEF21M057 Muhammad Safee
- BSEF20A046 Rida Manzoor

Instructor Name: Dr. Fatima Sabir

Hospital Management System (WEB-BASED)



Modules:

- Patient Registration
- Appointment Scheduling
- Electronic Health Records (EHR)
- Billing and Invoice
- Staff management

Module 1: Patient Registration

Functional Requirements:

| Functional Req. ID | Functional Requirement | Description |
|---------------------------|-------------------------------------|--|
| PR_FR_01 | Register New Patient | Ability to register new patients into the system |
| PR_FR_02 | Capture Patient Demographics | Collect patient demographic information |
| PR_FR_03 | Record Contact Information | Capture patient contact details |
| PR_FR_04 | Document Insurance Information | Record patient insurance details and coverage |
| PR_FR_05 | Input Emergency Contact | Capture emergency contact information for patients |
| PR_FR_06 | Assign Unique Patient ID | Generate and assign a unique identifier for each patient |
| PR_FR_07 | Enter Medical History | Record basic medical history |
| PR_FR_08 | Specify Preferred Language | Allow patients to specify preferred communication language |
| PR_FR_09 | Capture Medical Alerts and Warnings | Document any medical alerts or warnings for patients |
| PR_FR_10 | Manage Patient Allergies | Record patient allergies and sensitivities |
| PR_FR_11 | Input Family Medical History | Document family medical history |
| PR_FR_12 | Record Patient Preferences | Capture patient preferences and special requirements |
| PR_FR_13 | Upload Identification Documents | Ability to upload patient identification documents |
| PR_FR_14 | Specify Primary Care Physician | Allow patients to designate their primary care physician |
| PR_FR_15 | Verify Patient Information | Ensure the accuracy of patient information during registration |

| Functional Req. ID | Functional Requirement | Description |
|--------------------|---|---|
| PR_FR_16 | Assign Bed or Room | For in-patient registrations, assign a bed or room |
| PR_FR_17 | Record Patient Consent | Document patient consent for treatment and procedures |
| PR_FR_18 | Capture Patient Photograph | Ability to capture and store patient photographs |
| PR_FR_19 | Link to Electronic Health Records (EHR) | Connect patient registration data to EHR for continuity |
| PR_FR_20 | Print Registration Forms | Generate printable registration forms for patients |
| PR_FR_21 | Allow Online Registration | Provide an online registration portal for patient consent |
| PR_FR_22 | Record Patient Vital Signs | Capture and document patient vital signs during registration |
| PR_FR_23 | Send Registration Confirmation | Automatically send confirmation of registration to patients |
| PR_FR_24 | Track Patient Registration Status | Monitor the status of patient registrations in real-time (pending, registered, etc) |
| PR_FR_25 | Validate Insurance Information | Verify insurance details provided by patients |
| PR_FR_26 | Support Multiple Registration Channels | Allow registration via phone, web, and in-person |
| PR_FR_27 | Display Privacy Policy | Present privacy policy for patient registration |

Non-Functional Requirements:

| Non-Functional Req. ID | Non Functional Requirement Name | Non-Functional Requirement Description |
|-------------------------------|--|---|
| PR_NFR_01 | Security | Ensure data confidentiality, accuracy, integrity & implement secure data transmission and storage |
| PR_NFR_02 | Usability | Intuitive user interface for the registration process |
| PR_NFR_03 | Performance | Fast registration processing times |
| PR_NFR_04 | Availability | Registration system accessible 24/7 |
| PR_NFR_05 | Compliance | Adhere to patient data privacy regulations. Comply with industry standards for patient registration |
| PR_NFR_06 | Scalability | Support for large volumes of patient registrations |
| PR_NFR_07 | Accessibility | Ensure accessibility for users with disabilities |
| PR_NFR_08 | Interoperability | Integration with other hospital systems |
| PR_NFR_09 | Disaster Recovery | Backup and recovery mechanisms in place |
| PR_NFR_10 | System Integration | Seamlessly integrate with existing hospital systems |
| PR_NFR_11 | Error Handling | Effective handling of errors and exceptions |
| PR_NFR_12 | Mobile Compatibility | Ensure compatibility with mobile devices |
| PR_NFR_13 | Documentation | Comprehensive documentation for registration processes |

Module 2: Appointment Scheduling

Functional Requirements:

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|---------------------------|---------------------------------|--|
| AS_FR_01 | Schedule New Appointment | Ability to schedule new appointments for patients |
| AS_FR_02 | Search for Available Slots | Users can search for available time slots for appointments |
| AS_FR_03 | Reserve Appointment Slot | Reserve appointment slots for specific patients |
| AS_FR_04 | Book Follow-up Appointment | Schedule follow-up appointments for patients |
| AS_FR_05 | Cancel Appointment | Allow users to cancel existing appointments |
| AS_FR_06 | Reschedule Appointment | Capability to reschedule appointments based on user request |
| AS_FR_07 | Record Patient Preferences | Capture preferences such as preferred doctor or location |
| AS_FR_08 | Track Appointment History | Maintain history of appointments for each patient |
| AS_FR_09 | Notify Patients of Appointments | Send reminders and notifications to patients about upcoming appointments |
| AS_FR_10 | Manage Multiple Schedules | Ability to handle schedules for multiple doctors or clinics |
| AS_FR_11 | Define Appointment Types | Specify different types of appointments (e.g., regular, urgent) |
| AS_FR_12 | Block Out Holidays and Leave | Prevent scheduling during holidays or when doctors are on leave |
| AS_FR_13 | Set Priority for Urgent Cases | Allow prioritization of urgent appointments over regular ones |
| AS_FR_14 | Allow Walk-in Appointments | Accommodate walk-in patients without prior scheduling |

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|---------------------------|---|---|
| AS_FR_15 | Assign Unique Appointment Confirmation Number | Generate unique confirmation numbers for each scheduled appointment |
| AS_FR_16 | View Appointment Calendar | Display appointment calendar with available slots and scheduled times |
| AS_FR_17 | Handle Overlapping Appointments | Manage situations where appointments overlap in time |
| AS_FR_18 | Define Appointment Durations | Set time duration for different types of appointments |
| AS_FR_19 | Capture Reason for Appointment | Collect the reason or purpose for scheduling each appointment |
| AS_FR_20 | Block Out Specific Time Slots | Block out specific time slots for maintenance or special events |
| AS_FR_21 | Notify Staff of New Appointments | Notify staff members about newly scheduled appointments |
| AS_FR_22 | Record Appointment Notes | Document important notes or instructions related to each appointment |
| AS_FR_23 | Generate Daily Appointment Reports | Produce reports summarizing daily appointment schedules |
| AS_FR_24 | Implement Waiting List | Manage a waiting list for fully booked appointment slots |
| AS_FR_25 | Customize Appointment Confirmation | Customize confirmation messages sent to patients |
| AS_FR_26 | Send Appointment Reminders | Send reminder notifications to patients before scheduled appointments |
| AS_FR_27 | Record Patient Arrival Time | Capture arrival time when patients check in for appointments |
| AS_FR_28 | Allow Online Appointment Booking | Offer an online portal for patients to book appointments |
| AS_FR_29 | Integrate with Patient Records | Seamlessly integrate appointment data with patient electronic records |

Non-Functional Requirements:

| Non-Functional Req. ID | Non Functional Requirement Name | Non-Functional Requirement Description |
|-------------------------------|---|--|
| AS_NFR_01 | Performance: System Responsiveness | Ensure the system responds quickly to user actions during scheduling |
| AS_NFR_02 | Reliability: System Stability | Ensure the appointment system operates reliably without frequent failures |
| AS_NFR_03 | Scalability: Handling Peak Loads | Scale the system to handle increased appointment bookings during peaks |
| AS_NFR_04 | Accessibility: Support for Disabilities | Provide accessibility features for users with disabilities |
| AS_NFR_05 | Interoperability: Integration | Integrate with other hospital systems for seamless data exchange |
| AS_NFR_06 | Performance: Appointment Processing | Ensure appointments are processed efficiently to minimize wait times |
| AS_NFR_07 | Availability: System Maintenance | Schedule system maintenance during off-peak hours to minimize disruptions |
| AS_NFR_08 | Compliance: Legal Requirements | Comply with legal requirements related to appointment scheduling |
| AS_NFR_09 | Usability: Training and Support | Provide training and support resources for users to use the system effectively |
| AS_NFR_10 | Security: User Authentication | Implement secure authentication mechanisms to verify user identities |

Module 3: Electronic Health Records (EHR)

Functional Requirements:

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|---------------------------|--------------------------------------|---|
| EHR_FR_01 | Create Patient Records | Allow authorized users to create electronic health records for patients. Integrate smoothly with module 1 |
| EHR_FR_02 | Record Patient Demographics | Capture patient demographics such as name, age, gender, and contact info |
| EHR_FR_03 | Document Medical History | Record comprehensive medical history including past illnesses and surgeries |
| EHR_FR_04 | Capture Vital Signs | Document patient vital signs such as blood pressure, temperature, and pulse |
| EHR_FR_05 | Record Allergies and Reactions | Document patient allergies and adverse reactions to medications |
| EHR_FR_06 | Document Medication History | Record patient medication history including current and past medications |
| EHR_FR_07 | Enter Diagnosis and Treatment Plans | Input diagnosis and treatment plans prescribed by healthcare providers |
| EHR_FR_08 | Document Laboratory and Test Results | Record results of laboratory tests, imaging studies, and other diagnostic tests |
| EHR_FR_09 | Upload Medical Images | Allow uploading and attachment of medical images such as X-rays and scans |
| EHR_FR_10 | Document Procedures and Surgeries | Record details of medical procedures and surgical interventions |
| EHR_FR_11 | Record Physician Notes | Allow physicians to add notes and observations regarding patient care |
| EHR_FR_12 | Document Family Medical History | Capture family medical history to assess hereditary health risks |
| EHR_FR_13 | Input Immunization Records | Record patient immunization history including vaccines received |

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|--------------------|--|---|
| EHR_FR_14 | Capture Social and Behavioral Factors | Document social and behavioral factors that may affect patient health |
| EHR_FR_15 | Document Lifestyle Factors | Record patient lifestyle choices such as diet, exercise, and smoking habits |
| EHR_FR_16 | Record Pregnancy and Obstetric History | Capture pregnancy history and obstetric details for female patients |
| EHR_FR_17 | Record Patient Education | Document patient education materials provided during healthcare visits |
| EHR_FR_19 | Enable Record Retrieval and Search | Allow users to retrieve and search patient records efficiently |
| EHR_FR_20 | Enable Record Modification | Permit authorized users to edit and update patient records as needed |
| EHR_FR_21 | Support Record Sharing | Facilitate sharing of patient records among authorized healthcare providers |
| EHR_FR_22 | Enable Record Archival | Archive patient records securely for long-term storage and retrieval |
| EHR_FR_23 | Provide Record Versioning | Maintain multiple versions of patient records to track changes over time |
| EHR_FR_24 | Enable Record Printing | Allow printing of patient records for physical documentation |
| EHR_FR_25 | Support Mobile Access | Enable access to electronic health records from mobile devices |
| EHR_FR_26 | Support Speech-to-Text Input | Enable speech-to-text functionality for data entry into patient records |
| EHR_FR_27 | Support Data Analytics | Provide analytics capabilities to analyze trends and patterns in patient data |
| EHR_FR_28 | Implement Alerts and Notifications | Generate alerts and notifications for critical events or reminders |
| EHR_FR_29 | Enable Electronic Prescriptions | Allow electronic prescription of medications directly from patient records |

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|--------------------|-------------------------|--|
| EHR_FR_30 | Facilitate Telemedicine | Integrate telemedicine features for virtual consultations and visits |

Non-Functional Requirements:

| Non-Functional Req. ID | Non Functional Requirement Name | Non-Functional Requirement Description |
|------------------------|---|--|
| EHR_NFR_01 | Security: Data Encryption | Encrypt patient health data to ensure confidentiality and privacy |
| EHR_NFR_02 | Performance: Response Time | Ensure fast response times for accessing and updating patient records |
| EHR_NFR_03 | Scalability: Handling Growth | Design the system to accommodate growth in the volume of patient records |
| EHR_NFR_04 | Accessibility: Support for Disabilities | Provide accessibility features for users with disabilities and Multilingual support. |
| EHR_NFR_05 | Interoperability: Data Exchange Formats | Support interoperability with other healthcare systems using standard formats |
| EHR_NFR_06 | Disaster Recovery: Backup Procedures | Implement backup and recovery procedures to protect patient records |
| EHR_NFR_07 | Performance: Concurrent Access | Support concurrent access by multiple users without performance degradation |
| EHR_NFR_08 | Availability: System Maintenance | Schedule system maintenance during off-peak hours to minimize disruptions |
| EHR_NFR_09 | Reliability: Error Handling | Handle errors gracefully and provide informative error messages |
| EHR_NFR_10 | Compatibility: Browser Support | Support major web browsers for accessing electronic health records |
| EHR_NFR_11 | Compliance: Regulatory Standards | Adhere to regulatory standards and certifications for healthcare IT systems |

Module 4: Billing and Invoicing

Functional Requirements:

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|---------------------------|------------------------------------|---|
| BIL_FR_01 | Generate Patient Invoices | Automatically generate invoices for patient services and treatments |
| BIL_FR_02 | Record Billing Information | Capture detailed billing information including services rendered, dates, and costs |
| BIL_FR_03 | Assign Billing Codes | Assign appropriate billing codes such as CPT or ICD codes to services |
| BIL_FR_04 | Calculate Charges | Calculate charges based on billing codes, service rates, and duration |
| BIL_FR_05 | Apply Discounts and Adjustments | Allow application of discounts, adjustments, and waivers to invoices |
| BIL_FR_06 | Record Payments | Record payments received from patients, insurance companies, or third parties |
| BIL_FR_07 | Generate Billing Statements | Create itemized billing statements for patients detailing charges |
| BIL_FR_08 | Support Multiple Payment Methods | Accept multiple payment methods such as cash, credit/debit cards, checks, and online payments |
| BIL_FR_09 | Generate Payment Receipts | Generate receipts for payments made by patients or other entities |
| BIL_FR_10 | Track Insurance Claims | Track and manage insurance claims including submission and processing |
| BIL_FR_11 | Verify Insurance Eligibility | Verify patient insurance eligibility and coverage before billing |
| BIL_FR_12 | Record Co-Payments and Deductibles | Record patient co-payments, deductibles, and out-of-pocket expenses |
| BIL_FR_13 | Apply Insurance Adjustments | Apply adjustments and write-offs based on insurance agreements and contracts |

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|---------------------------|---------------------------------|--|
| BIL_FR_14 | Manage Unpaid Balances | Track and manage unpaid balances, follow up with patients for payments |
| BIL_FR_15 | Handle Refunds and Overpayments | Process refunds for overpayments and erroneous charges to patients |
| BIL_FR_16 | Generate Financial Reports | Generate financial reports such as revenue, receivables, and aging reports |
| BIL_FR_17 | Export Billing Data | Export billing data in standard formats for accounting and reporting purposes |
| BIL_FR_18 | Support Batch Invoicing | Generate invoices in batch mode for multiple patients or services |
| BIL_FR_19 | Manage Billing Codes | Maintain a database of billing codes and update them as necessary |
| BIL_FR_20 | Implement Payment Gateway | Implement a secure payment gateway for processing online payments |
| BIL_FR_21 | Manage Accounts Receivable | Monitor and manage accounts receivable including aging and collections |
| BIL_FR_22 | Handle Foreign Currency Billing | Support billing and invoicing in multiple currencies for international patients |
| BIL_FR_23 | Allow Billing Adjustments | Allow authorized users to make adjustments to billing records as needed |
| BIL_FR_24 | Manage Third-Party Payers | Manage billing and invoicing for services covered by third-party payers |
| BIL_FR_25 | Record Payment Installments | Record payment installments for long-term payment plans and agreements |
| BIL_FR_26 | Support Electronic Invoicing | Support electronic invoicing and delivery of invoices to patients' email |
| BIL_FR_27 | Handle Referral Billing | Handle billing and invoicing for services referred by other healthcare providers |
| BIL_FR_28 | Implement Billing Workflow | Define and implement billing workflow for efficient processing of invoices |

| Functional Req. ID | Functional Requirement | Functional Requirement Description |
|--------------------|------------------------------------|--|
| BIL_FR_29 | Enable Billing Review and Approval | Allow review and approval of billing documents by authorized personnel |
| BIL_FR_30 | Capture Provider Signatures | Capture electronic signatures of healthcare providers on billing documents |
| | | |

Non-Functional Requirements

| Non-Functional Req. ID | Non Functional Requirement Name | Non-Functional Requirement Description |
|------------------------|---------------------------------|---|
| BILL_NFR_1 | Security | Ensure the security of patient billing information and payment transactions |
| BILL_NFR_2 | Usability | Provide an intuitive and user-friendly interface for billing staff |
| BILL_NFR_3 | Performance | Ensure fast performance for invoice generation, payment processing, and claims submission |
| BILL_NFR_4 | Scalability | Design the system to handle a large volume of invoices and payments |
| BILL_NFR_5 | Reliability | Ensure reliability of billing processes to prevent errors and delays |
| BILL_NFR_6 | Compatibility | Ensure compatibility with billing software, payment gateways, and insurance systems |
| BILL_NFR_7 | Data Integrity | Maintain data integrity and accuracy of billing records and financial transactions |
| BILL_NFR_8 | Audit Trails | Maintain audit trails for all billing transactions and financial activities |
| BILL_NFR_9 | Training and Support | Provide training and support for billing staff to effectively use the system |
| BILL_NFR_10 | Integration | Integrate with electronic health record systems and financial management software |

| Non-Functional Req. ID | Non Functional Requirement Name | Non-Functional Requirement Description |
|------------------------|---------------------------------|--|
| BILL_NFR_11 | Error Handling | Implement error handling mechanisms to detect and resolve billing errors |
| BILL_NFR_12 | Regulatory Compliance | Ensure compliance with billing laws, regulations, and reimbursement guidelines |
| BILL_NFR_13 | System Customization | Allow customization of billing workflows and reports to meet specific organizational needs |
| BILL_NFR_14 | Reporting | Generate reports for billing metrics, revenue analysis, and accounts receivable management |
| BILL_NFR_15 | Error Resolution | Provide mechanisms for resolving billing errors and discrepancies efficiently |
| BILL_NFR_16 | Data Encryption | Encrypt sensitive billing data to protect patient privacy and prevent unauthorized access |

Module 5: Staff Management

Functional Requirements

| Functional Req. ID | Functional Requirement Name | Functional RequirementThe system option |
|---------------------------|------------------------------------|--|
| STAFF_FR_1 | Staff Information Management | System should allow adding, updating, and removing staff information |
| STAFF_FR_2 | Role Assignment | Assign roles and permissions to staff members based on their duties |
| STAFF_FR_3 | Shift Management | Manage staff shifts, including scheduling, swapping, and tracking |
| STAFF_FR_4 | Attendance Tracking | Record and track staff attendance, including late arrivals and absences |
| STAFF_FR_5 | Leave Management | Allow staff to request and manage leaves, with approval workflow |
| STAFF_FR_6 | Performance Evaluation | Conduct regular performance evaluations for staff members |
| STAFF_FR_7 | Training and Certification | Record staff training sessions and certifications for skill development |
| STAFF_FR_8 | Salary Management | Manage staff salaries, including calculation, disbursement, and deductions |
| STAFF_FR_9 | Task Assignment | Assign tasks and responsibilities to staff members, with deadlines |
| STAFF_FR_10 | Skill Profiling | Maintain profiles of staff skills and expertise for resource allocation |
| STAFF_FR_11 | Employee Directory | Maintain an updated directory of all staff members, with contact information |
| STAFF_FR_12 | Overtime Management | Manage and track overtime hours worked by staff members |
| STAFF_FR_13 | Shift Rostering | Create and manage shift rosters for different departments and roles |

| Functional Req. ID | Functional Requirement Name | Functional RequirementThe system option |
|--------------------|-------------------------------|--|
| STAFF_FR_14 | Incentive Management | Provide incentives and rewards programs for high-performing staff |
| STAFF_FR_15 | Compliance Monitoring | Ensure staff compliance with organizational policies and regulations |
| STAFF_FR_16 | Task Prioritization | Prioritize tasks based on urgency, importance, and resource availability |
| STAFF_FR_17 | Staff Feedback | Collect feedback from staff members regarding the work environment and processes |
| STAFF_FR_18 | Team Collaboration | Facilitate collaboration among staff members working on common projects |
| STAFF_FR_19 | Performance Improvement Plans | Develop and implement improvement plans for underperforming staff |
| STAFF_FR_20 | Workload Balancing | Ensure equitable distribution of workload among staff members |
| STAFF_FR_21 | Workforce Diversity | Promote diversity and inclusion in the staff recruitment and management process |
| STAFF_FR_22 | Staff Wellness Programs | Implement wellness initiatives to support the health and well-being of staff |
| STAFF_FR_23 | Resource Allocation | Allocate resources, such as equipment and facilities, to staff members as needed |
| STAFF_FR_24 | Staff Retention Strategies | Develop strategies to retain talented staff and reduce turnover |
| STAFF_FR_25 | Staff Satisfaction Surveys | Conduct regular surveys to gauge staff satisfaction and identify areas for improvement |
| STAFF_FR_26 | Succession Planning | Plan for the replacement of key staff positions in case of vacancies |
| STAFF_FR_27 | Staff Incentive Programs | Design incentive programs to motivate staff and drive performance |
| STAFF_FR_28 | Staff Work-Life Balance | Ensure that staff have a healthy work-life balance to prevent burnout |

Non-Functional Requirements

| Non-Functional Req. ID | Non Functional Requirement Name | Non-Functional Requirement Description |
|-------------------------------|--|---|
| STAFF_NFR_1 | Security | Ensure the confidentiality and integrity of staff data |
| STAFF_NFR_2 | Usability | Provide a user-friendly interface for staff management tasks |
| STAFF_NFR_3 | Performance | Ensure fast response times and minimal system downtime |
| STAFF_NFR_4 | Scalability | Design the system to handle a growing number of staff members |
| STAFF_NFR_5 | Reliability | Ensure the system is reliable and available when needed |
| STAFF_NFR_6 | Compatibility | Ensure compatibility with different devices and browsers |
| STAFF_NFR_7 | Data Backup and Recovery | Implement regular backups and a robust recovery mechanism |
| STAFF_NFR_8 | Data Privacy | Adhere to data privacy regulations and protect staff information |
| STAFF_NFR_9 | Training and Support | Provide training and support resources for staff using the system |
| STAFF_NFR_10 | Error Handling | Implement effective error-handling mechanisms to prevent system failures |
| STAFF_NFR_11 | Performance Monitoring | Monitor system performance and address any bottlenecks or issues |
| STAFF_NFR_12 | User Feedback Mechanism | Provide a mechanism for staff to provide feedback on system usability and functionality |