

Orthopedic Medical Supplies Management System

Team 6

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Abstract

In orthopedic medical environments, the efficient management of high-value consumables—such as implants and surgical instruments—is vital for patient safety and hospital operations. However, many small and medium-sized hospitals still rely on manual or fragmented inventory practices, leading to critical issues such as stockouts, overstocking, and a lack of traceability for sensitive items. To address these challenges, this project proposes OrthoLink, an integrated web-based inventory management system designed to automate and streamline the supply chain within the hospital.

This report details the complete software engineering process for OrthoLink, ranging from requirement elicitation to detailed system design. Key features of the proposed system include a real-time inventory dashboard, an automated expiration date alert system, and a mandatory electronic approval workflow for high-risk items. The system architecture is supported by a comprehensive RESTful API design and a user-friendly interface to ensure seamless adoption. By enforcing Role-Based Access Control (RBAC) and maintaining immutable audit logs, OrthoLink ensures administrative transparency and prevents unauthorized disbursements. The design specification provided in this report demonstrates how these features are architected to minimize human error, reduce operational costs, and ultimately enhance the quality of medical services.

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1. Problem Description

1.1 Background and Current Situation

In orthopedic hospitals, managing the inventory and distribution of various **medical consumables**—such as implants, sutures, sterilized gauze, syringes, and surgical instruments—is a critical operational task. However, many hospitals still rely on **manual or spreadsheet-based management systems**, which often result in issues such as **overstocking, shortages, data inconsistency, and the absence of approval records**. These inefficiencies not only disrupt daily operations but also compromise patient safety and administrative transparency.

1.2 Related Work

Existing literature and global standards emphasize the importance of systematic medical inventory management. **Volland et al. [1]** highlight in their literature review on hospital material logistics that efficient supply chain management is crucial for reducing costs and improving service quality in healthcare environments.

Additionally, the **World Health Organization (WHO) [2]** underscores the necessity of global regulatory frameworks to ensure the safety and performance of medical devices. Furthermore, the **U.S. FDA's Unique Device Identification (UDI) System [3]** establishes strict standards for tracking medical devices to prevent errors and ensure traceability.

Despite these established standards and the clear need for rigorous inventory control, many small and medium-sized hospitals still lack integrated software solutions. They often rely on fragmented manual processes that fail to meet the logistical efficiency described in [1] or the safety compliances mandated by [2] and [3].

1.3 Key Problems

The current management practices lead to several major issues:

- **Operational Inefficiency:** Overstocking, expired items, and duplicate orders increase unnecessary costs and waste, a persistent issue in hospital logistics.
- **Risk to Patient Safety:** Insufficient real-time stock information causes critical delays in surgeries and treatment procedures.

- **Data Unreliability:** Manual data entry and the absence of automated workflows reduce data reliability and fail to meet modern traceability standards.
- **Lack of Governance:** The lack of structured approval processes for high-cost and high-risk items leads to reduced transparency and accountability within the hospital's inventory management.

1.4 Necessity of the Solution

To ensure safety, audit readiness, cost efficiency, and transparent approval workflows, a digitalized inventory management system is essential. The proposed system aims to replace manual and fragmented management with an integrated, web-based solution that can be readily adopted by small- and medium-sized hospitals. By introducing this system, hospitals can achieve real-time visibility of inventory, enforce approval-based control for sensitive items, and maintain reliable audit logs for all critical transactions.

1.5 Actors & Responsibility

Actor	Description	Responsibility
Nurse	[General Role] Handles daily inbound/outbound operations, monitors expirations, and requests high-value consumables. [Inventory Admin Role (Senior)] Manages inventory policies, adjustments, and reporting.	[General] Operational management [Inventory Admin] Oversight/Audit
Doctor	Approves or rejects requests for high-cost or high-risk consumables.	Approval authority
System (automated)	Generates periodic alerts (expiration, low stock) and maintains audit logs.	Automation & logging

2. Functional Requirements Specification

ID	Requirement	Acceptance Criteria (AC)
FR-01	Item Registration / Query / Update	Each item must have a unique itemCode (e.g., ITEM-2025-0001) and include details such as category, specification, expiration date, storage location, and Approval policy (e.g. general, high cost, high risk), minimum stock quantity (minQuantity). The system must support create, update, and delete operations.
FR-02	Inbound / Outbound Record Management	All inventory movements should be recorded at the lotNumber level. The system should allow all transaction history inquiry including warehousing, shipping, stock adjustment (e.g. disposal, due diligence, damage).
FR-03	Electronic Approval Workflow	The approval process must follow the sequence: Request → Approve/Reject → Disbursement. Disbursement is not permitted before approval. Each stage must be logged.
FR-04	Automated Approval Criteria	The system shall trigger the approval workflow strictly based on the 'Approval Policy' attribute (e.g., 'Approval Required' or 'Auto-Approval') explicitly configured for each item by the administrator. The system must not permit disbursement of items marked as 'Approval Required' without a doctor's electronic approval.
FR-05	Role-Based Access Control (RBAC)	Roles include Doctor (approval), Nurse (request), Inventory Manager (inbound/outbound), and Admin (policy management). Screen and API access must be restricted by role.
FR-06	Approval Notification	When the request, approval, or disbursement status changes, the system must send a notification via the UI to the relevant users.

FR-07	Audit Log History	All operations such as requests, approvals, and disbursements must be recorded with user, timestamp, action, result, and reason. Logs must be immutable.
FR-08	Statistics and Report Generation	<p>The system must visualize key operational indicators using specific chart types and provide data export capabilities.</p> <p>AC-8.1: Inbound/Outbound Trend (Grouped Bar Chart) The dashboard shall display a Grouped Bar Chart showing the monthly volume of Inbound (Blue) vs. Outbound (Green) items for the last 6 months.</p> <p>AC-8.2: Approved Workflow Status (Pie Chart) The dashboard shall display a Pie Chart representing the distribution of current approval statuses (e.g., Rejected, Pending, Approved, Outbound Completed) to identify bottlenecks.</p> <p>AC-8.3: Monthly Usage Trend (Vertical Bar Chart) The system shall provide a Vertical Bar Chart illustrating the total quantity of items used on a monthly basis over the selected period (e.g., last 11 months).</p> <p>AC-8.4: Approval Duration Trend (Line Chart) The system shall visualize the average time required for approval processing using a Line Chart, tracking efficiency changes over months.</p> <p>AC-8.5: Approved vs. Rejected Count (Grouped Bar Chart) The system shall display a Grouped Bar Chart comparing the count of Approved vs. Rejected requests monthly to monitor rejection rates.</p> <p>AC-8.6: Usage by Category (Donut/Pie Chart) The system shall visualize the proportion of inventory usage by item category (e.g., General, Syringes, High Risk) using a Donut or Pie Chart.</p> <p>AC-8.7: Data Export Users must be able to export the visualized data and underlying tables via the "Export CSV" or "PDF Report" buttons located on the dashboard header.</p>

FR-09	Administration Tools	The system shall provide tools for managing item policies, categories, and user permissions. All changes must be recorded in history logs.
FR-10	Low Stock Alert Based on Safety Stock (minQuantity)	<p>The system must detect and notify users when an item's stock level falls below the defined minimum safety stock quantity (minQuantity).</p> <p>AC-10.1: The administrator must be able to set and modify each item's minimum safety stock quantity during item registration (FR-01) or via the management tool (FR-09).</p> <p>AC-10.2: Upon completion of an item's dispatch, if the total stock quantity of that item becomes equal to or less than the defined minimum safety stock quantity, the system must immediately send a "Low Stock" alert (via UI) to both the inventory manager (nurse) and the administrator.</p> <p>AC-10.3: On the inventory status screen, items with stock levels at or below the minimum safety stock quantity must be visually highlighted as "Low Stock" (e.g., with a red marker).</p>
FR-11	Inventory Adjustment (Physical Count, Disposal, Damage/Loss)	<p>The system must provide an inventory adjustment feature to reconcile discrepancies between actual stock and system-recorded stock.</p> <p>AC-11.1: The inventory manager (nurse) must be able to adjust the stock quantity for a specific lotNumber.</p> <p>AC-11.2: A reason code must be selected during adjustment (e.g., Disposal-Expired, Disposal-Damaged, Adjustment-Loss, Adjustment-PhysicalCount).</p> <p>AC-11.3: The adjusted quantity (increase or decrease) and a detailed comment explaining the reason must be entered as required fields.</p> <p>AC-11.4: All inventory adjustment records must be immediately logged in both the Movement record (FR-02) and the Audit Log (FR-07), and the change must be reflected in the current Lot quantity.</p>

FR-12	Real-Time Inventory Dashboard	<p>The system must provide a real-time dashboard that allows users to view key inventory and approval statuses across the entire hospital at a glance.</p> <p>AC-12.1: The dashboard must be displayed as the default screen upon login.</p> <p>AC-12.2: The dashboard must display the following four Key Performance Indicators (KPIs) in real time (NFR-09), each compared to the previous month:</p> <ol style="list-style-type: none"> 1. Total Inventory Items (vs last month) 2. Pending Approvals (vs last month) 3. This Month's Outbound Transactions (vs last month) 4. Expiring Soon (within 30 days) (vs last month) <p>AC-12.3: The dashboard must include both the Inbound/Outbound Trend Chart and the Approval Workflow Status Chart as defined in FR-08.</p> <p>AC-12.4: When the user clicks on the Pending Approvals or Expiring Soon KPI widgets, the system must perform a drill-down navigation to the corresponding detailed list screens.</p> <p>AC-12.5: The dashboard must include item name search, notification view, and export (data download) functionalities.</p>
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3. Domain Specification

This section provides a detailed specification of the domain for the Orthopedic Medical Supplies Management System. It outlines the key concepts, entities, business rules, constraints, and relationships within the system. The domain model is derived from the problem description and functional requirements, focusing on inventory management, approval workflows, and audit transparency in orthopedic hospitals. This specification serves as a foundation for requirement analysis and design, ensuring alignment with real-world hospital operations.

3.1 Domain Overview

The domain encompasses the management of medical supplies in orthopedic hospitals, including consumables like implants, sutures, sterilized gauze, syringes, and surgical instruments. Key areas include:

- Item Management: Tracking and maintaining details of medical items, including registration, updates, and policies for approval.
- Inventory Movements: Recording inbound (warehousing) and outbound (shipping, adjustments) transactions at the lot level to ensure traceability.
- Approval Workflow: Structured processes for requesting, approving/rejecting, and disbursing high-cost or high-risk items, with notifications and logs.
- User Roles and Access: Role-based controls for doctors, nurses, inventory managers, and administrators to enforce security and accountability.
- Monitoring and Reporting: Alerts for low stock, audit logs for all transactions, and statistical reports for operational insights.

The system aims to replace manual/spreadsheet-based processes with an integrated web-based solution, emphasizing real-time visibility, cost efficiency, and compliance.

3.2 Key Entities

The domain consists of the following core entities, each with attributes derived from functional requirements (FR-01 to FR-11):

- Item: Represents a medical supply.
 - Attributes: itemCode (unique identifier, e.g., ITEM-2025-0001), category (e.g., implant, suture), specification, expirationDate, storageLocation, approvalPolicy (general, high-cost, high-risk), minQuantity (safety stock threshold).
 - Operations: Create, read, update, delete (CRUD) via FR-01.
- Lot: A batch of items for traceability in inventory movements.
 - Attributes: lotNumber (unique per batch), itemCode (foreign key to Item), quantity, transactionType (inbound, outbound, adjustment), timestamp.
 - Operations: Record movements like warehousing, shipping, disposal, damage (FR-02, FR-11).
- Request: An initiation for item disbursement.
 - Attributes: requestID (unique), lotNumber, requester (user ID, e.g., Nurse), reason, status (pending, approved, rejected, disbursed), timestamp.
 - Operations: Submit request, check policy (FR-03, FR-04).
- Approval: The decision on a request.
 - Attributes: approvalID (unique), requestID (foreign key), approver (user ID, e.g., Doctor), decision (approve/reject), reason, timestamp.
 - Operations: Approve/reject, log decision (FR-03, FR-07).

- User: System users with roles.
 - Attributes: userID, role (Doctor, Nurse, Inventory Manager, Admin), permissions (e.g., approve for Doctor, request for Nurse).
 - Operations: Role-based access control (FR-05).
- Log: Immutable records for audits.
 - Attributes: logID, userID, action (request, approve, disburse, adjust), result, reason, timestamp.
 - Operations: Automatic logging for all critical actions (FR-07).
- Notification: Alerts for status changes or low stock.
 - Attributes: notificationID, recipient (userID), type (approval change, low stock), message, timestamp.
 - Operations: Send via UI (FR-06, FR-10).
- Report/Statistic: Aggregated data for dashboards.
 - Attributes: reportType (bar chart, pie chart, export), period (e.g., last 6 months), metrics (stock levels, approval ratios).
 - Operations: Generate visuals and exports (FR-08).

3.3 Business Rules

Business rules define how entities interact and enforce domain logic:

- Item Registration (BR-01): Each item must have a unique itemCode and a defined approvalPolicy. minQuantity must be set during registration or update (FR-01, FR-09).
- Inventory Adjustment (BR-02): Adjustments (e.g., disposal-expired, damage) require a reasonCode and are only allowed for Inventory Manager role. Stock updates must trigger low stock checks (FR-11, FR-10).
- Approval Process (BR-03): Requests for high-cost/high-risk items must follow Request → Approve/Reject → Disbursement sequence. Disbursement is blocked until approval. Policy changes apply immediately (FR-03, FR-04).
- Low Stock Alert (BR-04): If stock \leq minQuantity after outbound/adjustment, send immediate UI notification to Nurse and Admin. Highlight low stock items in red on inventory screens (FR-10).
- Audit Logging (BR-05): All operations (requests, approvals, adjustments) must log user, timestamp, action, result, and reason. Logs are immutable and viewable only by Admin (FR-07).
- Role-Based Access (BR-06): Doctors approve requests; Nurses request/disburse; Inventory Managers handle inbound/outbound; Admins manage policies and users (FR-05).
- Reporting (BR-07): Dashboards must visualize bar charts (last 6 months stock) and pie charts (approval statuses). Exports in CSV/PDF from separate Reports menu (FR-08).

3.4 Constraints

Constraints ensure data integrity, security, and performance:

- Data Integrity: itemCode and lotNumber must be unique. Expiration dates must be future timestamps. minQuantity ≥ 0 .
- Security: RBAC restricts API/screen access (e.g., no Nurse access to policy changes). Logs are immutable (no delete/update).
- Performance: Real-time stock queries must respond in <1 second. System supports up to 50 concurrent users in a medium-sized hospital.
- Technical: Web-based, browser-compatible (Chrome, Firefox). Notifications via UI only (no email/SMS in initial version).
- Business: High-cost items (approvalPolicy = high-cost) require Doctor approval. Adjustments for damage/loss must include photographic evidence upload (optional extension).

3.5 Relationships

Relationships between entities are modeled as follows (can be visualized in UML Class Diagram in Design Specification):

- Item - Lot: One-to-Many (One Item can have multiple Lots).
- Request - Approval: One-to-One (Each Request has one Approval decision).
- Request - Lot: Many-to-One (Multiple Requests can reference the same Lot).
- User - Request/Approval/Log: One-to-Many (One User can initiate/approve/log multiple actions).
- Item - Notification: One-to-Many (One Item can trigger multiple low stock Notifications).
- Aggregation: Reports aggregate data from Logs and Lots for statistics.

This domain specification provides a clear blueprint for the system, bridging requirements to design. It can be refined based on stakeholder feedback.

4. Non-functional Requirements Specification

ID	Requirement	Criteria / Target
NFR-01	Performance	The average response time of major screens shall be ≤ 1.5 seconds .
NFR-02	Availability	The system shall operate under a 9x5 service schedule with a target of zero critical failures during demonstrations.

NFR-03	Security	Passwords shall be hashed using BCrypt , and the system shall enforce Role-Based Access Control (RBAC) and maintain audit logs for all critical actions.
NFR-04	Auditability & Traceability	All state changes must be recorded as immutable logs to ensure full traceability.
NFR-05	Reliability	Approval and disbursement transactions shall guarantee atomic commits to prevent partial updates or data loss.
NFR-06	Scalability	The system shall maintain the same Service Level Agreement (SLA) performance even when the number of items increases tenfold.
NFR-07	Compatibility	The system shall be compatible with the latest two versions of Chrome and Edge browsers .
NFR-08	Standards & Coding Conventions	All APIs must follow the RESTful architecture , be documented using OpenAPI , and comply with defined commit message conventions .
NFR-09	Data Freshness (Real Time)	The dashboard (FR-12) and all inventory-related screens must reflect the latest server data within 3 seconds after any inbound, outbound, or adjustment transaction is committed.

5. Scenarios

Use Case Scenario: UC-01 — General Consumable Inbound Registration

Use Case Name	General Consumable Inbound Registration
Objective	The nurse registers newly delivered general consumables in the system using lot numbers printed on the products.
Actor(s)	Nurse
Precondition	The application is running, and the delivery note and item information are available in the system.
Main Flow	<ol style="list-style-type: none">1. The nurse logs into the system.2. Select the <i>Inbound Registration</i> menu.3. Clicks <i>Update Inventory</i> and enters item name, lot number, quantity, and expiration date.4. The system validates the input and updates inventory records.5. The system displays a success message and returns to the main screen.
Alternative Flow (A1)	<p>A1. Registration of new items</p> <ol style="list-style-type: none">1. If the item to be received does not exist in the system, the nurse will go to 'Register New Item'.2. The nurse selects the approval policy for the item (Pre-approval required, no pre-approval required) along with basic information such as item name, specification, and category, and registers it by entering the safety inventory quantity (minQuantity) for out-of-stock notification. (reflects FR-01)3. Once the item has been registered, return to the warehousing registration process (default flow 3) and enter the lot information.

Exception Flow (E1–E3)	<p>E1. Missing Required Fields: The system prompts the user to input missing values.</p> <p>E2. Invalid Quantity: If quantity ≤ 0, the system displays a warning and rejects the entry.</p> <p>E3. Duplicate Lot Number: The system rejects registration if the lot number already exists.</p>
Special Requirements	<ul style="list-style-type: none"> - The lot number must match the manufacturer's unique code from the delivery note. - All inbound data must be recorded in the Audit Log.

Use Case Scenario: UC-02 — General Consumable Disbursement

Use Case Name	General Consumable Disbursement
Objective	When the nurse requests general consumables, the system automatically approves and processes the disbursement.
Actor(s)	Nurse
Precondition	The item is classified as a general consumable, and sufficient stock exists.
Main Flow	<ol style="list-style-type: none"> 1. The nurse logs into the system. 2. Selects the <i>Disbursement Request</i> menu. 3. Enters the requested item and quantity. 4. The system verifies that approval is not required and automatically approves the request. 5. The nurse confirms the auto-approved request and completes disbursement. 6. The system records the transaction and returns to the main screen.
Alternative Flow (A1)	(None)
Exception Flow (E1)	E1. Insufficient Stock: If the requested quantity exceeds available stock, the system displays a warning and blocks the request.

Special Requirements	Automatically approved items must still be recorded in the Audit Log with the label “Auto-Approved.”
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Use Case Scenario: UC-03 — High-Value Consumable Approval Request and Disbursement

Use Case Name	High-Value Consumable Approval Request and Disbursement
Objective	When the nurse requests high-value medical consumables (e.g., artificial joints, bone cement), the doctor must approve before disbursement.
Actor(s)	Nurse, Doctor
Precondition	The item is classified as a high-value or high-risk item requiring approval.
Main Flow	<ol style="list-style-type: none"> 1. The nurse registers a disbursement request. 2. The system identifies that approval is required and sets status to <i>Pending Approval</i>. 3. The doctor receives an approval notification. 4. The doctor reviews the request and approves or rejects it. 5. Upon approval, the nurse receives a notification. 6. The nurse disburses the approved item. 7. The system records all actions in the Audit Log.
Alternative Flow (A1)	A1. Delayed Decision Notification: If no decision is made within one hour, the system automatically sends a reminder to the doctor.
Exception Flow (E1)	E1. Rejection: Managed under UC-04 .
Special Requirements	The approval workflow must be handled as a single transaction , with rollback on intermediate failure.

Use Case Scenario: UC-04 — Rejection Process

Use Case Name	Rejection Process
Objective	The doctor reviews a pending request and rejects it with a reason.
Actor(s)	Doctor, Nurse
Precondition	A pending approval request exists, created by the nurse.
Main Flow	<ol style="list-style-type: none"> 1. The doctor opens the <i>Approval Inbox</i>. 2. Reviews the request details and clicks <i>Reject</i>. 3. Enters a rejection reason and saves. 4. The system updates the request status to <i>Rejected</i>. 5. The nurse receives a rejection notification.
Alternative Flow (A1)	(None)
Exception Flow (E1)	E1. Missing Reason: The system prevents saving if no rejection reason is entered.
Special Requirements	<ul style="list-style-type: none"> - Rejection reasons must be recorded in the Audit Log and cannot be modified. - The rejection message must appear in the nurse's notification panel.

Use Case Scenario: UC-05 — Expiration Date Alert

Use Case Name	Expiration Date Alert
Objective	The system automatically checks expiration dates for all consumable lots and notifies the nurse of expiring items.
Actor(s)	Nurse, System
Precondition	Each item includes an expiration date (<code>expDate</code>).
Main Flow	<ol style="list-style-type: none"> 1. The nurse clicks the 'Expired (N) case' KPI widget on the main dashboard. 2. The system displays the 'Notify Expired Items' screen 3. The list shows the item name, ITEM code, Lot number, quantity, location, expiration date, and the remaining number of days (for example, "28 days left"). 4. The nurse checks the items to be discarded, and then clicks the 'Treat' button on the item. 5. The system takes this Lot information (item, Lot number, quantity) and connects it to the Disposal-Expired flow of the 'Inventory Adjustment (UC-09)' scenario.
Alternative Flow (A1)	<p>A1. Automatic Notification:</p> <p>If <i>Auto Notification</i> is enabled, the System notifies the expiring lot list to the nurse each morning.</p>
Exception Flow	(None)
Special Requirements	<ul style="list-style-type: none"> - A visual warning (color bar) must be displayed according to the number of remaining days. - The 'Processing' button should be connected to the 'Inventory Adjustment' function (FR-11).

Use Case Scenario: UC-06 — Prevention of Unauthorized Disbursement

Use Case Name	Prevention of Unauthorized Disbursement
Objective	Prevent disbursement of high-value or high-risk items before approval is completed.
Actor(s)	Nurse, Doctor
Includes	VerifyApprovalStatus (System)
Precondition	A pending approval request exists and has not yet been approved.
Main Flow	<ol style="list-style-type: none"> 1. The nurse opens the <i>Disbursement Requests</i> screen. 2. The system shows the current status (Pending / Approved / Rejected). 3. The <i>Disburse</i> button is disabled for <i>Pending</i> requests. 4. If the nurse attempts to proceed, a popup displays: "<i>Disbursement is only allowed after doctor approval.</i>" 5. When approved, the button becomes active for disbursement.
Alternative Flow (A1–A2)	<p>A1. Real-Time Status Update: Approval status updates immediately upon doctor action.</p> <p>A2. Emergency Use: In urgent cases, the nurse clicks <i>Post-Report</i>, provides a reason, and the request becomes <i>Emergency Use (Post-Approval Pending)</i>. The doctor later approves it retroactively.</p>
Exception Flow (E1)	<p>E1. Approval Desynchronization: If the UI shows <i>Approved</i> but the server update is delayed, the system blocks the action and displays "<i>Approval data not synchronized.</i>"</p>
Special Requirements	<ul style="list-style-type: none"> - Approval completion is determined solely by <code><Request.status = APPROVED></code>. - Unauthorized disbursements must be blocked both in UI and API. - The <i>VerifyApprovalStatus</i> sub-use case must be logged automatically by the System.

Use Case Scenario: UC-07 — Statistics and Report Generation

Use Case Name	Statistics and Report Generation
Objective	The administrator visualizes monthly usage, approval time, and rejection rate, and generates reports.
Actor(s)	Administrator, System
Precondition	Inbound, approval, and disbursement data exist.
Main Flow	<ol style="list-style-type: none"> 1. The administrator logs into the system. 2. Open the <i>Statistics / Reports</i> menu. 3. Selects a time period (monthly / quarterly). 4. The system aggregates usage volume, approval duration, rejection rate, and inventory turnover. 5. Displays results as bar or line charts. 6. The administrator clicks <i>Export CSV</i> or <i>Generate PDF Report</i>. 7. The system generates the file and provides a download link.
Alternative Flow (A1)	A1. Item Filtering: The administrator filters data by item category (e.g., high-value).
Exception Flow (E1)	E1. No Data: If no records exist, the system displays “No Data Available” and cancels report generation.
Special Requirements	<ul style="list-style-type: none"> - Data aggregation and file generation handled exclusively by System. - Report generation time \leq 2 seconds. - All reports must be recorded in the Audit Log.

Use Case Scenario: UC-08 — Low Stock (Safety Stock Quantity) Notification

Use Case Name	Low Stock (Safety Stock Quantity) Notification
Objective	Automatically notify the responsible staff when an item's stock level falls below the predefined minimum safety stock quantity (minQuantity) , to prevent stock-out situations.
Actor(s)	System , Nurse, Administrator
Precondition	Each item has a predefined minQuantity (safety stock) value set by the administrator. (<i>FR-10.1</i>)
Main Flow	<ol style="list-style-type: none"> 1. The Nurse completes a disbursement transaction (<i>UC-02</i> or <i>UC-03</i>). 2. The System immediately recalculates the current total stock quantity of the dispatched item. 3. The System compares the recalculated quantity with the item's minQuantity value. 4. If the current total stock quantity \leq minQuantity, the System generates a *“Low Stock Alert.” (<i>FR-10.2</i>) 5. Both the Nurse (Inventory Role) and Administrator receive a “Low Stock: [Item Name]” alert via the UI notification panel. 6. When the Nurse opens the <i>Inventory Status</i> screen, the corresponding item is visually highlighted as *“Low Stock.” (<i>FR-10.3</i>) 7. The System records the event in the Audit Log for traceability.
Alternative Flow (A1)	A1. Automatic UI Notification: If the administrator has enabled the UI alert setting, the System also sends notifications to the administrator and nurse immediately after the alert is generated.
Exception Flow (E1)	E1. Safety Stock Not Configured: If minQuantity is set to 0 or NULL , the System skips the low stock check for that item.
Special Requirements	<ul style="list-style-type: none"> - The low stock check must be triggered automatically after every inbound or outbound transaction. - The “Low Stock” indicator (e.g., red highlight) must be visually distinct from the “Expiring Soon” indicator (e.g., yellow highlight). - All alerts and visual updates must be reflected in real time and recorded in the Audit Log.

Use Case Scenario: UC-09 — Inventory Adjustment (Disposal, Damage, Physical Count)

Use Case Name	Inventory Adjustment (Disposal, Damage, Physical Count)
Purpose	The nurse adjusts the system's inventory quantity to match the actual stock based on expiration, damage, loss, or results from a regular physical count.
Actor	Nurse (with inventory management role)
Preconditions	The target Lot exists in the system, and the nurse is aware of the reason for adjustment (e.g., expiration, damage, physical count result).
Basic Flow (Expired Disposal)	<ol style="list-style-type: none"> 1. The nurse checks items with expiration alerts on the Inventory Status screen (UC-05). 2. The nurse selects the Inventory Adjustment menu. 3. The nurse selects the target lotNumber and chooses the reason Disposal-Expired (expired disposal). (FR-11.2) 4. The nurse enters the quantity to decrease (e.g., 10 units) and adds a detailed comment (e.g., "Batch expired on 2025-11-01 disposed"). (FR-11.3) 5. The system confirms the adjustment and decreases the lot quantity by 10. 6. The system logs the transaction in both Movement (cause: Disposal-Expired) and AuditLog. (FR-11.4) 7. The system displays a confirmation message for successful inventory adjustment.
Alternative Flow (A1) – Physical Count Adjustment	<ol style="list-style-type: none"> 1. After a regular physical count, the nurse selects the Inventory Adjustment menu. 2. The nurse selects the target lotNumber and chooses the reason Adjustment-PhysicalCount (physical count adjustment). 3. Upon finding that the actual count (98) is 2 less than the system count (100), the nurse enters "-2" as the adjustment quantity. 4. The nurse adds a detailed comment (e.g., "Adjusted after regular count on 2025-11-07") and saves. 5. The system updates the lot quantity to 98 and records the adjustment in Movement (qty: -2, cause: Adjustment-PhysicalCount).

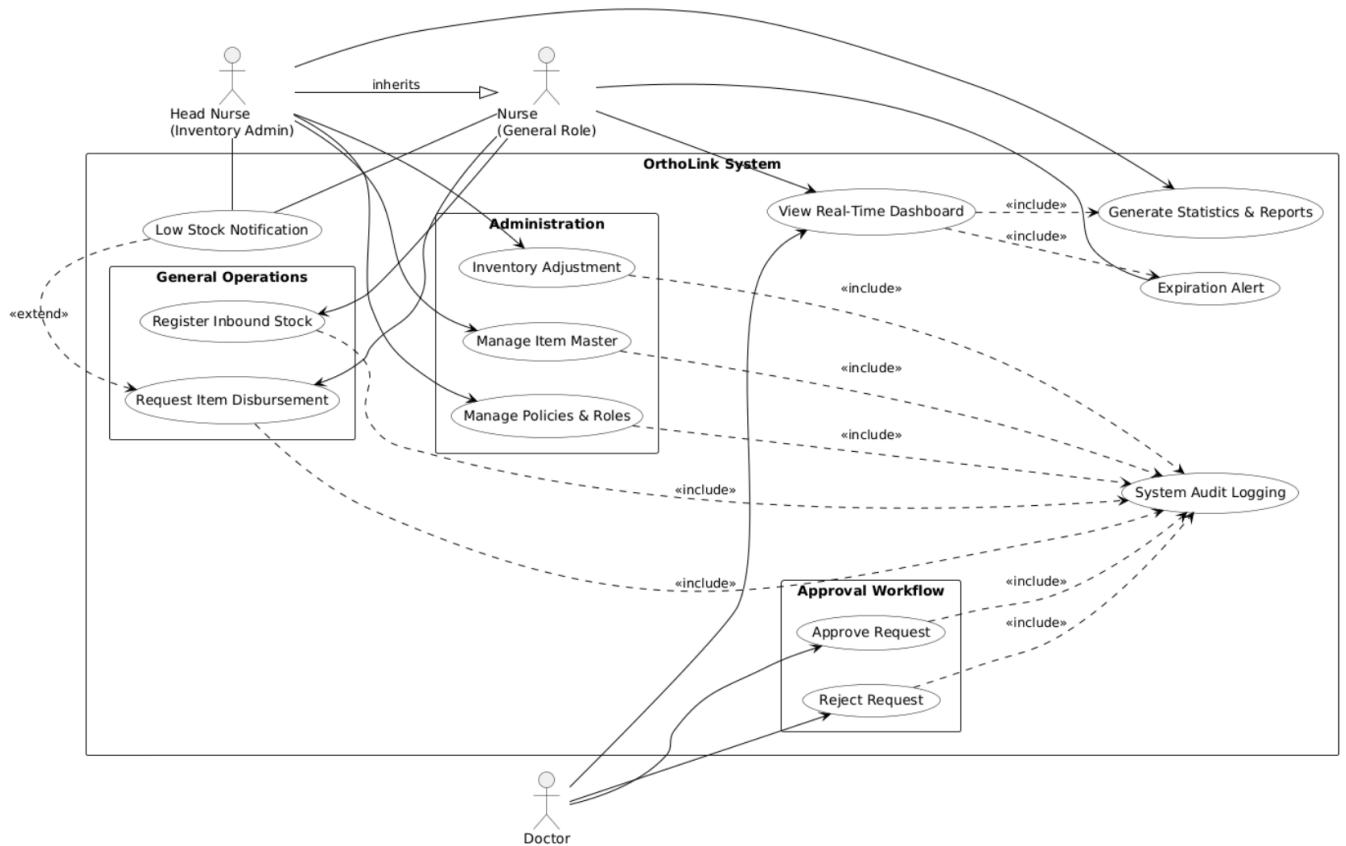
Alternative Flow (A2) – Damage/Loss Handling	<p>1. The nurse finds a damaged item and selects the Inventory Adjustment menu.</p> <p>2. The nurse selects the target lotNumber and chooses Disposal-Damaged (damaged disposal) or Adjustment-Loss (loss).</p> <p>3. The nurse enters “-1” as the quantity and adds a comment (e.g., “Ampoule broken during transport”) before saving.</p>
Exception Flow (E1)	<p>E1. Missing Reason Input: If the reason code (FR-11.2) or detailed comment (FR-11.3) is missing, the system must block the save action and prompt the user to provide the missing input.</p>
Special Requirements	<ul style="list-style-type: none"> - All decrease adjustments must trigger the Low Stock Alert (FR-10) check. - All disposal and loss records must be clearly traceable for audit purposes.

Use Case Scenario: UC-10 — Real-Time Inventory Dashboard View and Approval Management

Use Case Name	Real-Time Inventory Dashboard View and Approval Management
Purpose	Nurses, administrators, or doctors access the system to monitor inventory and approval status in real time through four key performance indicators (KPIs) and charts, and navigate to handle pending approval items.
Actors	Nurse, Administrator, Doctor
Preconditions	The user has successfully logged into the system.
Basic Flow	<ol style="list-style-type: none"> 1. Upon login, the system displays the Inventory Management Dashboard as the default screen. (FR-12.1) 2. The dashboard header displays four KPI widgets—Total Inventory Items, Pending Approvals, This Month's Outbound Transactions, and Expiring Soon—updated in real time. (FR-12.2) 3. The dashboard footer displays two charts: Inbound/Outbound Trend (Bar Chart) and Approval Workflow Status (Pie Chart). (FR-12.3, FR-08) 4. The user clicks on the “Pending Approvals (N)” KPI widget. 5. The system navigates to the Approval Request List screen and displays all requests currently in the Pending Approval state. (FR-12.4) 6. If the actor is a Doctor, they can review specific requests from the list and perform Approve (UC-03) or Reject (UC-04) actions.
Alternative Flow (A1) – Check Expiring Items	<ol style="list-style-type: none"> 1. The user clicks on the “Expiring Soon (N)” KPI widget on the dashboard. 2. The system navigates to the Expiring Item Alert screen (UC-05).

Alternative Flow (A2) – Export Report	<p>1. The user clicks the “Export” button at the top of the dashboard.</p> <p>2. The system generates and provides a CSV/PDF download of the current dashboard data or a selected report. (FR-08.3)</p>
Exception Flow	None
Special Requirements	All data displayed on the dashboard must comply with NFR-09 (Data Freshness) standards.

6. Use Case Diagram



6.1 Actor Definitions & Relationships

The system is designed around three primary actors: **Nurse**, **Head Nurse**, and **Doctor**, reflecting the operational hierarchy of the hospital.

- The **Nurse (General Role)** is responsible for daily operational tasks such as **Request Item Disbursement** and **Register Inbound Stock**. They also monitor the **View Real-Time Dashboard** for immediate status updates.
- The **Head Nurse (Inventory Admin)** represents a senior role that **inherits** all functionalities of the Nurse actor. In addition to general tasks, the Head Nurse manages administrative functions including **Manage Item Master**, **Inventory Adjustment**, **Manage Policies & Roles**, and **Generate Statistics & Reports**.
- The **Doctor** holds the approval authority, performing **Approve Request** or **Reject Request** actions for high-value or high-risk items.

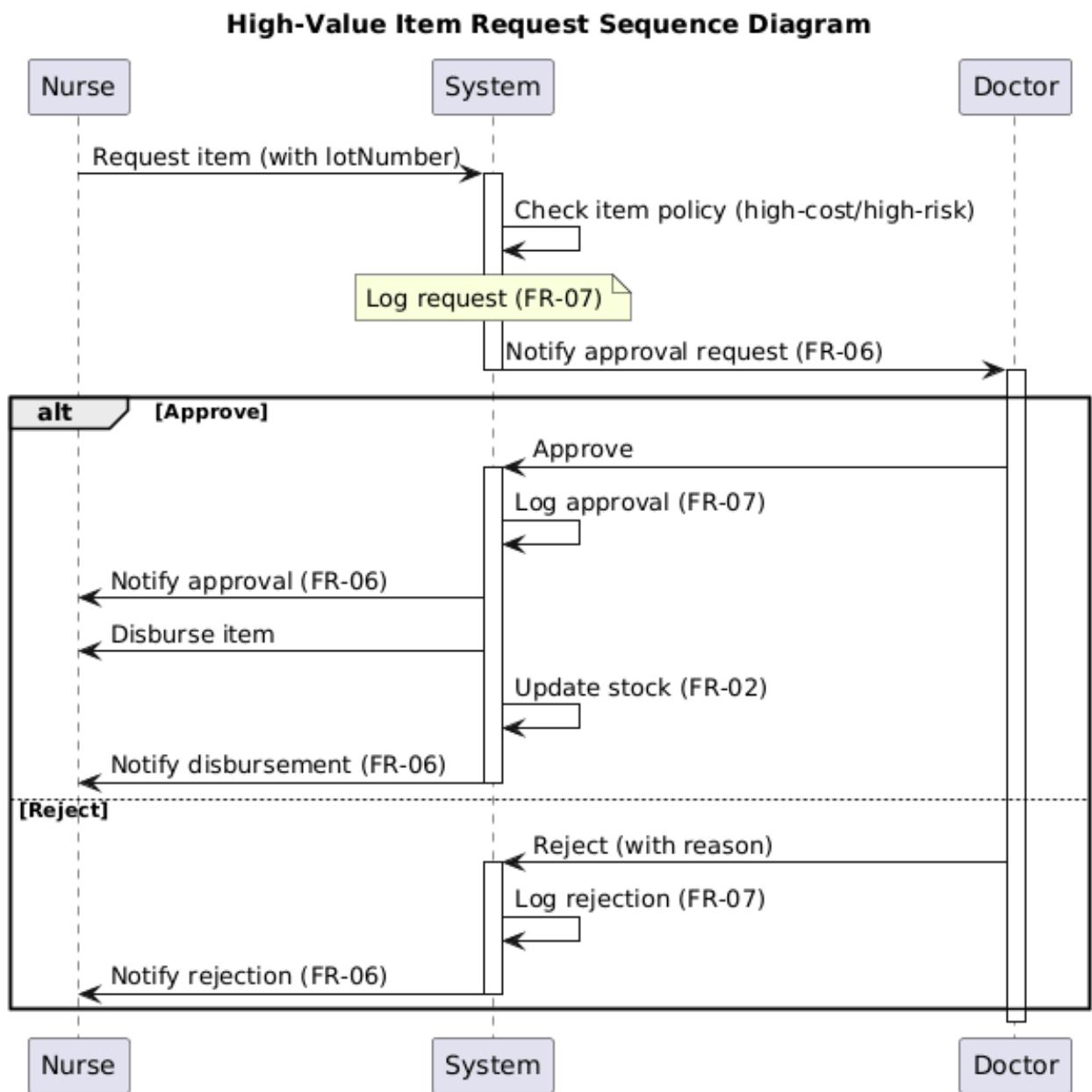
6.2 Operational Logic & System Dependencies

- **Auditability:** To ensure accountability and traceability, every critical operation—including inbound/outbound transactions, approvals, adjustments, and policy changes—automatically <>include<> the **System Audit Logging** use case.
- **Alert Mechanism:** The **Low Stock Notification** use case is defined as an <>extend<> relationship to **Request Item Disbursement**. This means the alert is triggered conditionally only when the stock level falls below the minimum threshold during a disbursement request. These alerts are delivered to both the Nurse and Head Nurse.
- **Real-Time Monitoring:** The **View Real-Time Dashboard** use case <>include<> components such as **Expiration Alert** and **Generate Statistics & Reports**, providing users with an integrated view of inventory health and operational metrics.

The Audit Log use case serves as the central shared component for accountability, referenced by multiple use cases through <>include<> relationships. This ensures that every critical operation—such as registration, request, approval, or reporting—is automatically recorded for transparency and future auditing.

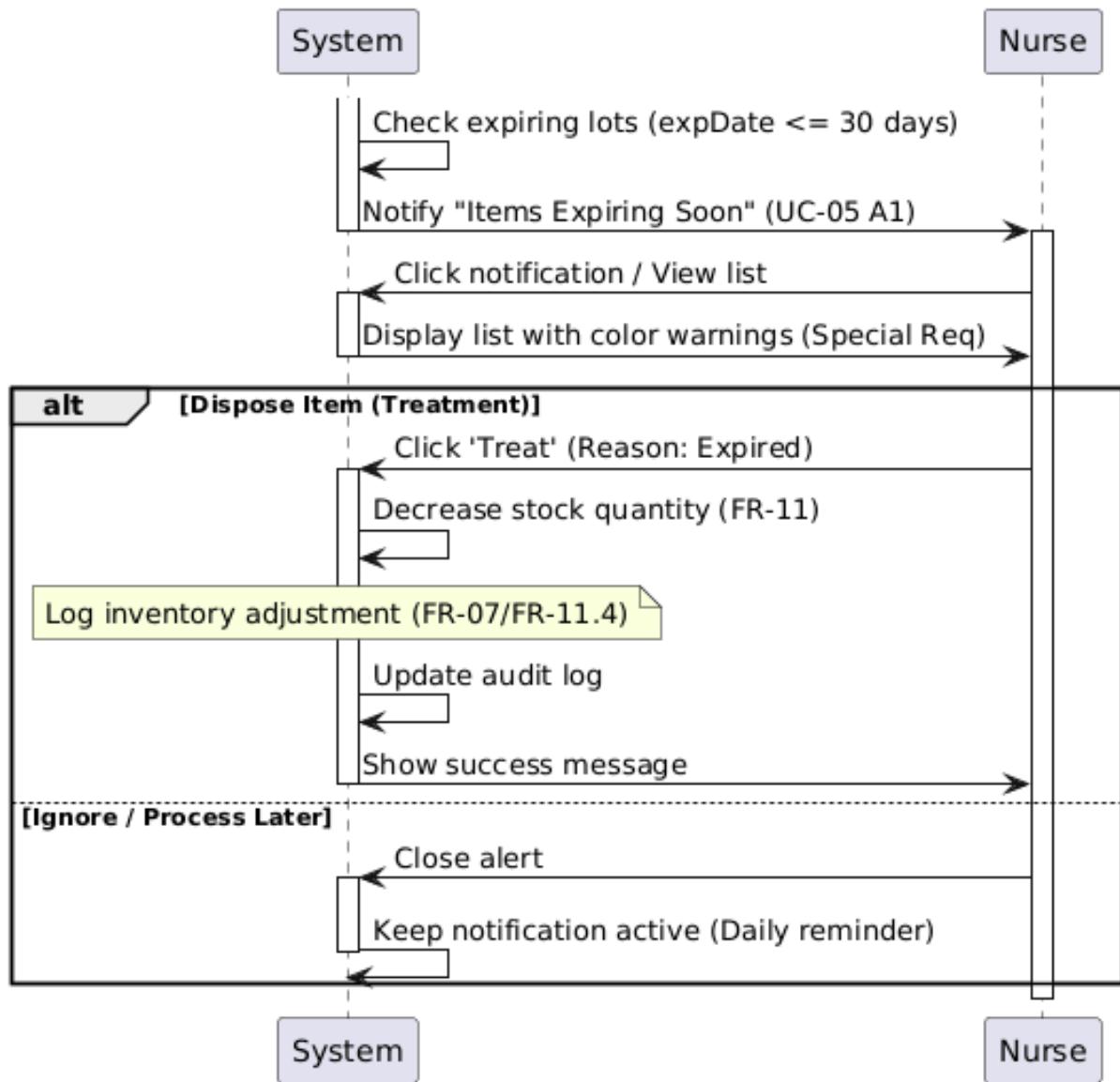
7. Sequence Diagram

7.1 High-Value Item Request Sequence Diagram

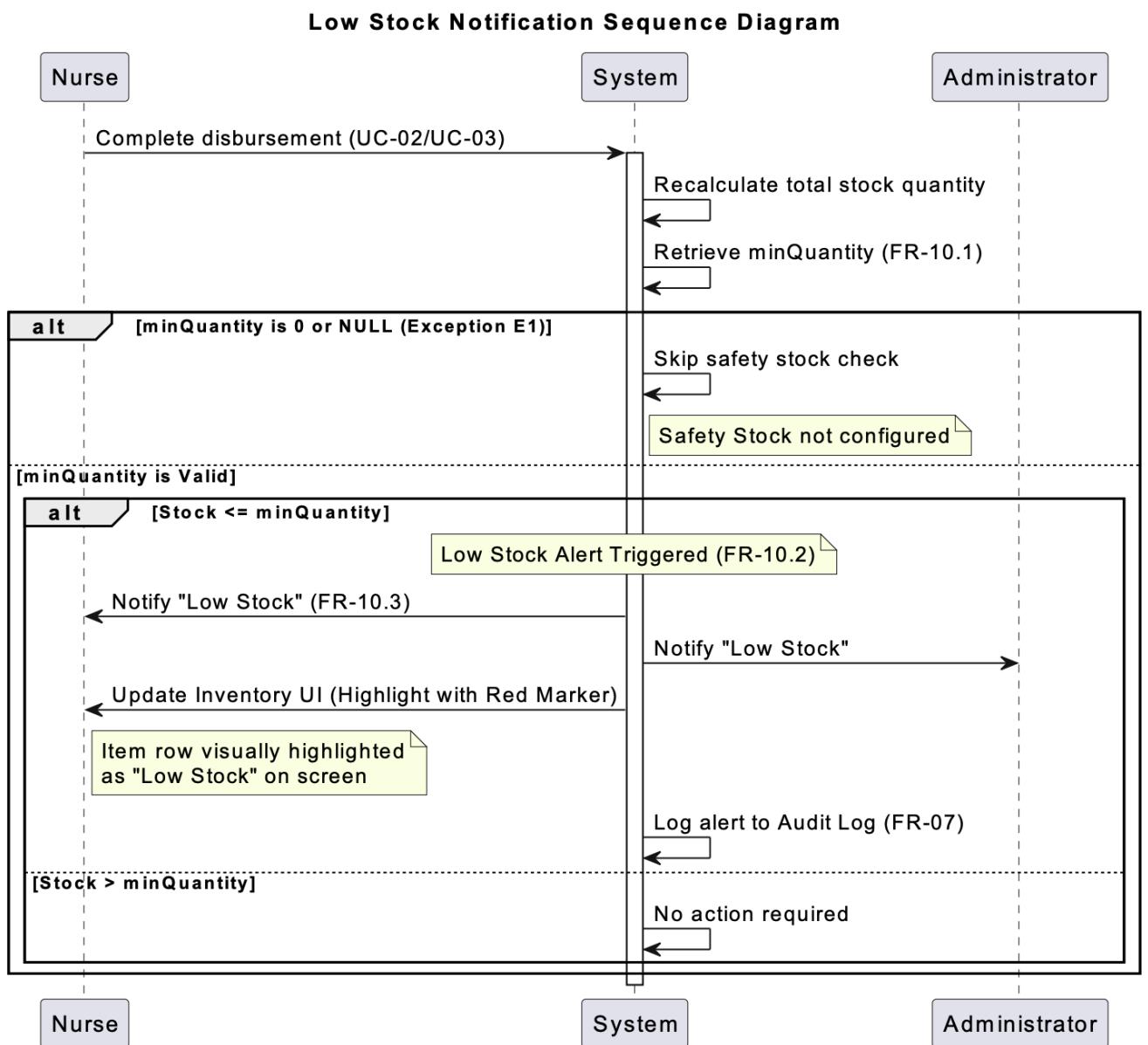


7.2 Expiration Date Alert & Disposal Process

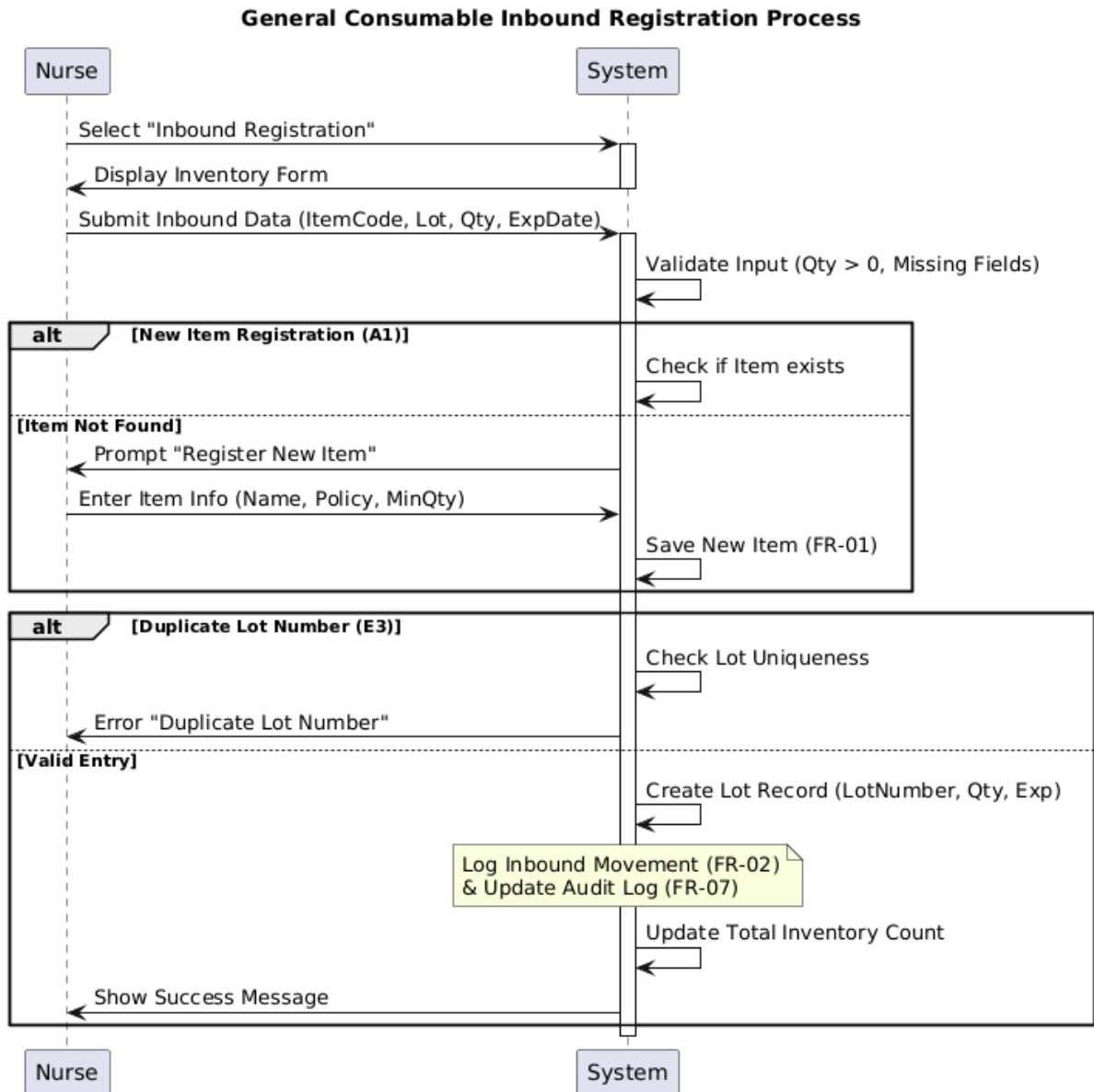
Expiration Date Alert & Disposal Process



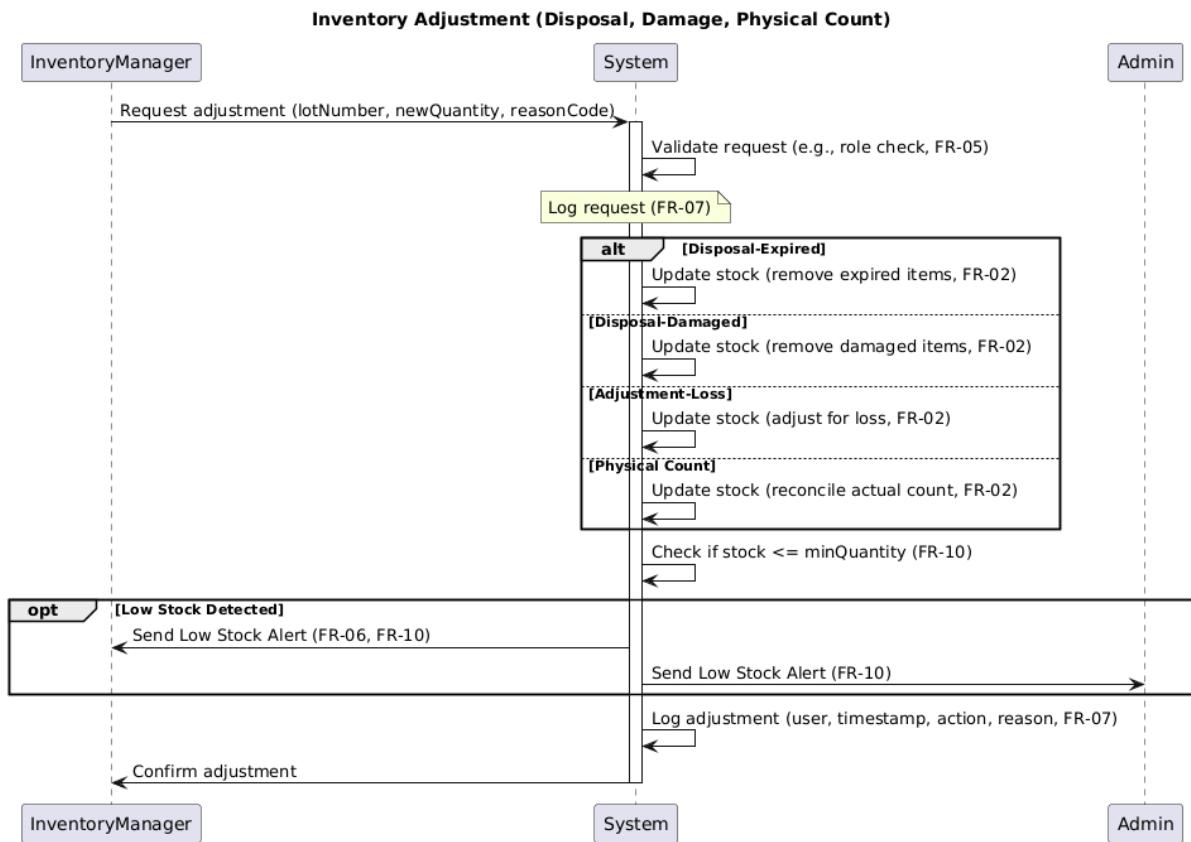
7.3 Low Stock Notification Sequence Diagram



7.4 General Consumable Inbound Registration Process

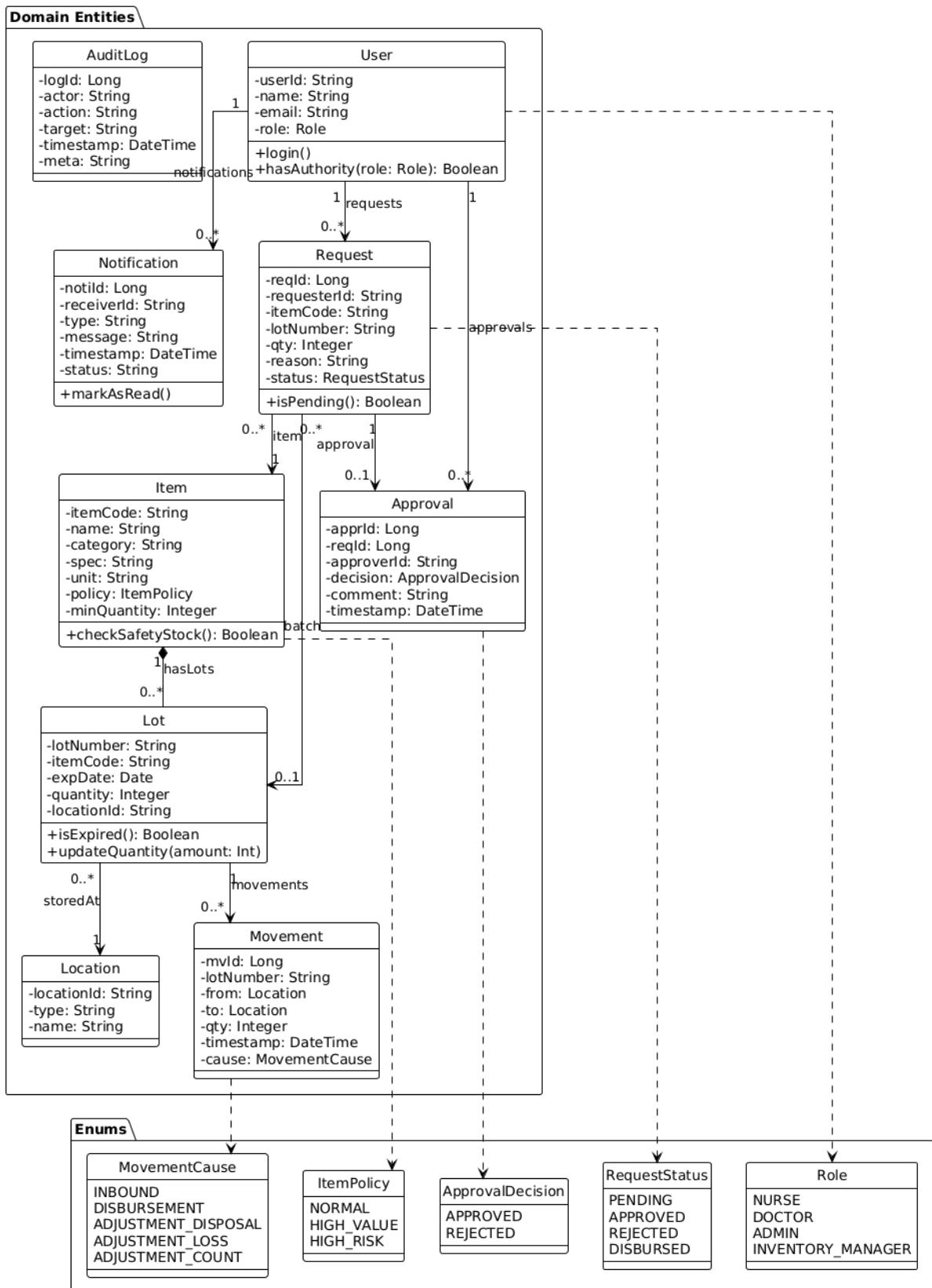


7.5 Inventory Adjustment(Disposal, Damage, Physical Count)



8. Class Diagram

Class Diagram: OrthoLink Domain Model



The Class Diagram illustrated above defines the core domain model of the OrthoLink system. This static view represents the key entities, attributes, and relationships required to support the functional requirements specified in Section 2. The design focuses on data integrity, traceability, and extensibility.

The key components of the domain model are described as follows:

- User and Role Management (RBAC): The system implements Role-Based Access Control (RBAC) through the User class and Role Enum. While the system technically distinguishes between 'Nurse' and 'Inventory Manager' roles for permission granularity, the domain model reflects the operational reality where the Inventory Manager role is typically assigned to a senior nurse, granting them additional authority for inventory adjustments and reporting.
- Item and Lot Structure (Expiration Management): To effectively manage medical consumables with expiration dates, the system decouples item master data (Item) from specific inventory batches (Lot).
 - 1:N Relationship: A one-to-many relationship exists between Item and Lot. This allows a single product type (e.g., "Bone Cement") to have multiple batches with different expiration dates and quantities.
 - FIFO Support: This structure enables the system to track stock at the lotNumber level, facilitating First-In-First-Out (FIFO) management and precise expiration alerts.
- Request and Approval Workflow: The Request entity manages the lifecycle of disbursement requests. For high-value or high-risk items, the request must be validated by a Doctor.
 - Approval Decision: The Approval class utilizes an ApprovalDecision Enum (defined as APPROVED or REJECTED) instead of a simple boolean value. This design choice provides semantic clarity and enhances extensibility, allowing for the potential addition of future states (e.g., 'HOLD' or 'RETURN') without altering the database schema.
 - Rejection Handling: A rejection is recorded as an Approval object with the status REJECTED, ensuring that denied requests are logged as explicitly as approved ones.
- Auditability and Traceability: To satisfy the Non-Functional Requirements for security and auditability, all critical state changes are captured:
 - AuditLog: Records user actions, timestamps, and targets for every request, approval, and modification.
 - Movement: Tracks the physical flow of stock (Inbound, Disbursement, Adjustment) linked to specific locations.

9. Interface Design

Interface Design-1

Category	Description
Function	loginUser
Request Structure	RequestBody userId: string password: string
Return	SuccessStatus Code: 200 OK { "user": { "id": "nurse01", "name": "Kim Nurse", "role": "NURSE" }, "message": "Login successful", "token": { "access": "access_token_example", "refresh": "refresh_token_example" }} ErrorStatus Code: 401 Unauthorized { "message": "Invalid credentials"}
Parameters	userId: The unique identifier for the user (e.g., Nurse, Doctor, Admin). password: The user's password for authentication.
API endpoint	POST (/api/auth/login)

Interface Design-2

Category	Description
Function	getDashboardKPI
Request Structure	Headers- Authorization: Bearer <JWT Token>
Return	<p>SuccessStatus Code: 200 OK { "totalInventory": 1234, "pendingApprovals": 23, "monthlyOutbound": 456, "expiringSoon": 18, "comparison": { "totalInventory": "+5%", "pendingApprovals": "-2%" }}</p> <p>ErrorStatus Code: 500 Internal Server Error { "message": "Failed to fetch KPI data"}</p>
Parameters	Headers: JWT token issued upon login.
API endpoint	GET (/api/dashboard/kpi)

Interface Design-3

Category	Description
Function	registerInbound
Request Structure	Headers- Authorization: Bearer <JWT Token> RequestBody- itemCode: string lotNumber: string quantity: int expirationDate: date (YYYY-MM-DD) locationId: string
Return	SuccessStatus Code: 201 Created { "message": "Inbound registration successful", "lotId": 101} ErrorStatus Code: 400 Bad Request { "error": "Duplicate Lot Number"}
Parameters	itemCode: Unique code of the medical consumable. lotNumber: Manufacturer's unique batch number. quantity: Number of items to be registered. expirationDate: Expiry date of the lot. locationId: Storage location identifier.
API endpoint	POST (/api/inventory/inbound)

Interface Design-4

Category	Description
Function	requestDisbursement
Request Structure	Headers- Authorization: Bearer <JWT Token> RequestBody itemCode: string lotNumber: string quantity: int reason: string
Return	Success (Auto-Approved) Status Code: 200 OK { "status": "APPROVED", "message": "Disbursement completed (Auto-Approved)" } Success (Pending Approval) Status Code: 202 Accepted { "status": "PENDING", "message": "Request submitted for doctor approval" }
Parameters	itemCode: The code of the item requested. quantity: Amount required. reason: Purpose of use (e.g., Surgery, Treatment).
API endpoint	POST (/api/inventory/request)

Interface Design-5

Category	Description
Function	approveRequest
Request Structure	Headers- Authorization: Bearer <JWT Token> PathParameter reqId: int requestBody decision: string ("APPROVE" or "REJECT") comment: string
Return	SuccessStatus Code: 200 OK { "reqId": 501, "status": "APPROVED", "updatedAt": "2025-11-23T10:00:00Z" } ErrorStatus Code: 403 Forbidden { "message": "User does not have approval authority" }
Parameters	reqId: The ID of the disbursement request. decision: The doctor's decision. comment: Reason for rejection or optional comments for approval.
API endpoint	PUT (/api/approval/{reqId})

Interface Design-6

Category	Description
Function	adjustInventory
Request Structure	Headers- Authorization: Bearer <JWT Token> RequestBody lotNumber: string adjustQty: int (negative for decrease, positive for increase) reasonCode: string (e.g., "DISPOSAL_EXPIRED", "LOSS") comment: string
Return	SuccessStatus Code: 200 OK { "message": "Inventory adjusted successfully", "currentQty": 45} ErrorStatus Code: 400 Bad Request { "message": "Detailed comment is required for this reason code"}
Parameters	lotNumber: Target lot for adjustment. adjustQty: Quantity to add or subtract. reasonCode: Standardized code for the adjustment reason (FR-11). comment: Mandatory detailed explanation.
API endpoint	POST (/api/inventory/adjust)

Interface Design-7

Category	Description
Function	getLowStockItems
Request Structure	Headers- Authorization: Bearer <JWT Token>
Return	SuccessStatus Code: 200 OK [{ "itemCode": "ITEM-2025-001", "name": "Gauze Bandage", "currentTotal": 20, "minQuantity": 30 }]
Parameters	None
API endpoint	GET (/api/inventory/alerts/low-stock)

Interface Design-8

Category	Description
Function	getStatistics
Request Structure	Headers- Authorization: Bearer <JWT Token> QueryString- period: string ("monthly" or "quarterly")
Return	SuccessStatus Code: 200 OK { "usageTrend": [{"month": "2025-10", "count": 150}, {"month": "2025-11", "count": 180}], "approvalStatus": { "approved": 80, "rejected": 5, "pending": 15 } }
Parameters	period: The time range for the statistics (FR-08).
API endpoint	GET (/api/reports/statistics)

10. Detailed Design

DT-1: User Authentication

Category	Description
Class Name	AuthService
Function	loginUser
Process	This API handles user authentication by verifying the submitted ID and password against the database. It enforces security standards by validating the password using the BCrypt hashing algorithm (compliant with NFR-03). Upon successful authentication, the API returns the user's profile information, including their specific role for Role-Based Access Control (RBAC), and issues JWT Access and Refresh tokens for session management.
Logic	CLASS AuthService INHERITS APIView FUNCTION post(request) userId = request.data.userId password = request.data.password TRY user = UserRepository.findById(userId) CATCH UserNotFoundException RETURN 401 Unauthorized IF NOT BCrypt.checkpw(password, user.passwordHash) THEN RETURN 401 Unauthorized accessToken = TokenProvider.createAccessToken(user) refreshToken = TokenProvider.createRefreshToken(user) RETURN 200 OK ({user, token})

DT-2: Real-Time Dashboard

Category	Description
Class Name	DashboardService
Function	getDashboardKPI
Process	This API retrieves and calculates the four Key Performance Indicators (KPIs) required for the Real-Time Inventory Dashboard (FR-12). It aggregates current data to determine the total number of inventory items, the count of pending approval requests, total outbound transactions for the current month, and the number of items expiring within 30 days. Additionally, it computes the percentage change for each metric compared to the previous month to facilitate trend analysis.
Logic	<pre> CLASS DashboardService INHERITS APIView FUNCTION get(request) totalInventory = ItemRepository.count() pendingApprovals = RequestRepository.countByStatus("PENDING") monthlyOutbound = MovementRepository.countOutboundByMonth(currentMonth) expiringSoon = LotRepository.countExpiringWithin(30) // Calculate percentage changes vs last month inventoryChange = CalcChange(totalInventory, lastMonthInventory) pendingChange = CalcChange(pendingApprovals, lastMonthPending) RETURN 200 OK ({totalInventory, pendingApprovals, ...}) </pre>

DT-3: Inbound Registration

Category	Description
Class Name	InventoryService
Function	registerInbound
Process	This API processes the inbound registration of medical consumables (UC-01). It ensures data integrity by validating the uniqueness of the manufacturer's lotNumber. Upon validation, it creates a new Lot record in the database, records the warehousing history in the Movement table with the cause 'INBOUND', and updates the AuditLog (FR-07) to guarantee full traceability of the transaction.
Logic	<pre> CLASS InventoryService INHERITS APIView FUNCTION post(request) IF LotRepository.exists(request.data.lotNumber) THEN RETURN 400 Bad Request BEGIN TRANSACTION lot = NEW Lot(itemCode, lotNumber, quantity, expDate, location) LotRepository.save(lot) movement = NEW Movement(lot, type="INBOUND", qty=quantity) MovementRepository.save(movement) AuditLogService.log(user, action="INBOUND_REGISTER") COMMIT RETURN 201 Created </pre>

DT-4: Disbursement Request

Category	Description
Class Name	RequestService
Function	requestDisbursement
Process	<p>This API processes disbursement requests by strictly evaluating the item's policy (FR-04). For items with a 'NORMAL' policy, it executes an automatic approval workflow that immediately deducts stock and logs the transaction (UC-02). Conversely, for items classified as 'HIGH_VALUE' or 'HIGH_RISK', it generates a Request record with a 'PENDING' status and sends an approval notification to the Doctor (UC-03). Finally, it triggers a 'Low Stock' check immediately after processing to ensure inventory levels are maintained.</p>
Logic	<pre> CLASS RequestService INHERITS APIView FUNCTION post(request) item = ItemRepository.findByCode(request.data.itemCode) IF item.policy == "NORMAL" THEN InventoryService.decreaseStock(lot, qty) MovementRepository.save(type="DISBURSEMENT", status="AUTO") AuditLogService.log(action="AUTO_DISBURSEMENT") AlertService.checkLowStock(item.code) RETURN 200 OK ELSE req = NEW Request(item, status="PENDING", reason) RequestRepository.save(req) NotificationService.sendToRole("DOCTOR", "New Request") RETURN 202 Accepted </pre>

DT-5: Approval Management

Category	Description
Class Name	ApprovalService
Function	approveRequest
Process	This API allows a Doctor to approve or reject a pending request (FR-03). It validates the user's role. If approved, it updates the request status to APPROVED, deducts the inventory quantity from the specified Lot, and creates a Movement record. If rejected, it updates the status to REJECTED. Both actions are logged in AuditLog and notifications are sent to the requester (FR-06).
Logic	<pre> CLASS ApprovalService INHERITS APIView FUNCTION put(request, reqId) req = RequestRepository.findById(reqId) IF request.data.decision == "APPROVE" THEN req.status = "APPROVED" InventoryService.decreaseStock(req.lot, req.qty) MovementRepository.save(type="DISBURSEMENT", cause="APPROVED") ELSE req.status = "REJECTED" req.comment = request.data.comment RequestRepository.save(req) AuditLogService.log(action="DECISION", target=reqId) NotificationService.send(req.requester, "Decision Made") RETURN 200 OK </pre>

DT-6: Inventory Adjustment

Category	Description
Class Name	InventoryService
Function	adjustInventory
Process	This API handles manual inventory adjustments (UC-09) due to expiration, damage, or physical count discrepancies. It validates that a comment is provided. It updates the Lot quantity and creates a Movement record with the specific reasonCode. It triggers a "Low Stock" check if the quantity decreases.
Logic	<pre> CLASS InventoryService INHERITS APIView FUNCTION post(request) IF request.data.comment IS EMPTY THEN RETURN 400 Bad Request lot = LotRepository.findByLotNumber(request.data.lotNumber) lot.quantity += request.data.adjustQty LotRepository.save(lot) movement = NEW Movement(type="ADJUSTMENT", cause=reasonCode) MovementRepository.save(movement) AuditLogService.log(action="ADJUST", reason=reasonCode) IF request.data.adjustQty < 0 THEN AlertService.checkLowStock(lot.itemCode) RETURN 200 OK </pre>

DT-7: Low Stock Alert

Category	Description
Class Name	AlertService
Function	getLowStockItems
Process	This API retrieves a list of items where the current total stock quantity is less than or equal to the defined minQuantity (Safety Stock) (FR-10). This data is used to display the "Low Stock Alert" widget on the dashboard and highlight items in the inventory list.
Logic	<pre>CLASS AlertService INHERITS APIView FUNCTION get(request) // Query items where totalQty <= minQuantity lowStockItems = ItemRepository.findLowStockItems() result = [] FOR item IN lowStockItems DO result.append({ code: item.code, current: item.totalQuantity, min: item.minQuantity }) RETURN 200 OK (result)</pre>

DT-8: Statistics & Reports

Category	Description
Class Name	ReportService
Function	getStatistics
Process	This API aggregates data for the "Statistics and Reports" feature (FR-08). It processes Movement and Approval logs to generate data for the usage trend bar chart and the approval workflow status pie chart. It ensures the data is suitable for visualization on the dashboard.
Logic	<pre> CLASS ReportService INHERITS APIView FUNCTION get(request) period = request.query_params.get('period') usageTrend = MovementRepository.aggregateUsage(period) approvalStats = RequestRepository.countByStatus(period) RETURN 200 OK ({ "usageTrend": usageTrend, "approvalStatus": { "approved": approvalStats.approved, "rejected": approvalStats.rejected, "pending": approvalStats.pending } }) </pre>

11. UI

OrthoLink

- ➊ 대시보드
- ➋ 품목 관리
- ➌ 입고 관리
- ➍ 출고 관리
- ➎ 내 요청 현황
- ➏ 승인 관리
- ➐ 사용자 관리
- ➑ 정책 설정

재고 관리 대시보드

Q 품목 검색...

총 재고 품목
1,234
▲ +12.5% vs 지난달

승인 대기
23
▼ -5.2% vs 지난달

이번 달 출고
456
▲ +8.3% vs 지난달

만료 예정 (30일)
18
▲ +3 vs 지난달

입출고 추이
최근 6개월 입출고 현황

월	입고	출고
6월	350	320
7월	280	250
8월	400	380
9월	380	350
10월	450	420
11월	380	350

승인 워크플로우 현황
이번 달 승인 처리 통계

카테고리	비율
반려	5%
승인 대기	10%
승인 완료	85%
출고 완료	0%

① 만료 예정 품목 알림
30일 이내 만료 예정 품목 목록

Pain Relief Patch ITEM-2025-0156

Lot: LOT-2025-01-0234 | 수량: 25 | 위치: 선반 C-3

만료일: 2025-11-20 (19일 남음)

만료 진행도 (0일 기준): 17일 경과

Hyaluronic Acid Injection ITEM-2025-0312

Lot: LOT-2025-02-0069 | 수량: 8 | 위치: 냉장고 A-1

만료일: 2025-12-05 (28일 남음)

만료 진행도 (0일 기준): 2일 경과

Steroid Injection ITEM-2025-0287

Lot: LOT-2025-03-0124 | 수량: 12 | 위치: 냉장고 B-2

만료일: 2025-12-15 (09일 남음)

만료 진행도 (0일 기준): -8일 경과

Calcium Supplement ITEM-2025-0423

Lot: LOT-2025-04-0156 | 수량: 30 | 위치: 선반 D-1

만료일: 2025-12-25 (04일 남음)

만료 진행도 (0일 기준): -10일 경과

② 재고 부족 품목 알림
만천재고(minQuantity) 이하로 떨어진 품목 목록 (FR-10)

Gauze Bandage ITEM-2025-0234

카테고리: 일반 소모품 | 재고율: 28%

위치: 선반 B-1

발생: 2025-11-07 14:20 (출고(REQ-2025-0045))

현재 재고: 28개

부족: 72개 (만천재고: 100개)

Surgical Gloves (M) ITEM-2025-0189

카테고리: 일반 소모품 | 재고율: 30%

위치: 선반 A-2

발생: 2025-11-07 15:45 (출고(REQ-2025-0048))

현재 재고: 15개

부족: 35개 (만천재고: 50개)

Injection Needle 23G ITEM-2025-0567

카테고리: 의료기기 | 재고율: 53%

위치: 캐비닛 C-4

발생: 2025-11-07 11:30 (출고(REQ-2025-0042))

현재 재고: 42개

부족: 38개 (만천재고: 80개)

Alcohol Swab ITEM-2025-0892

카테고리: 일반 소모품 | 재고율: 54%

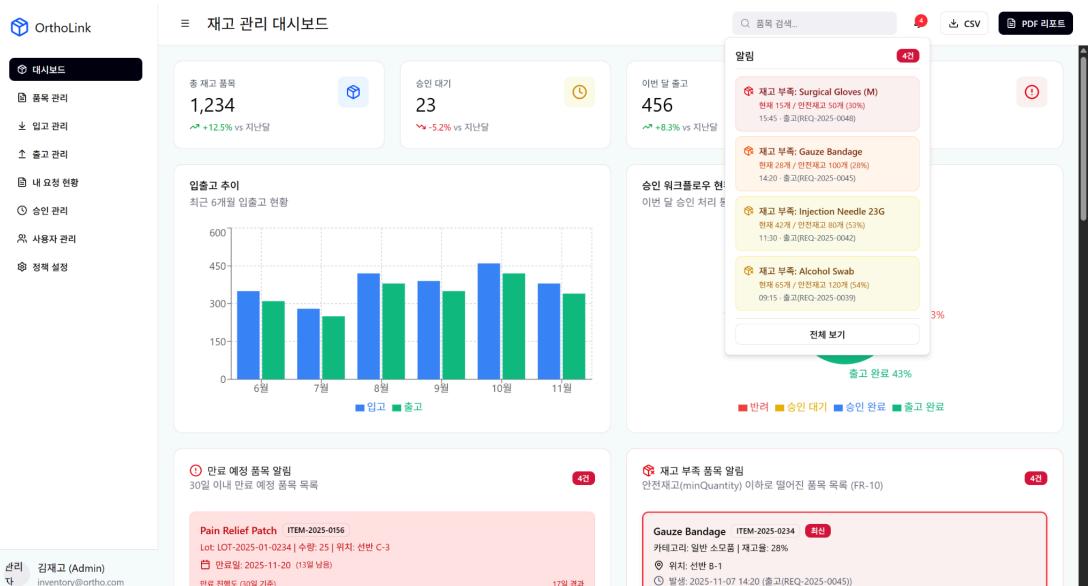
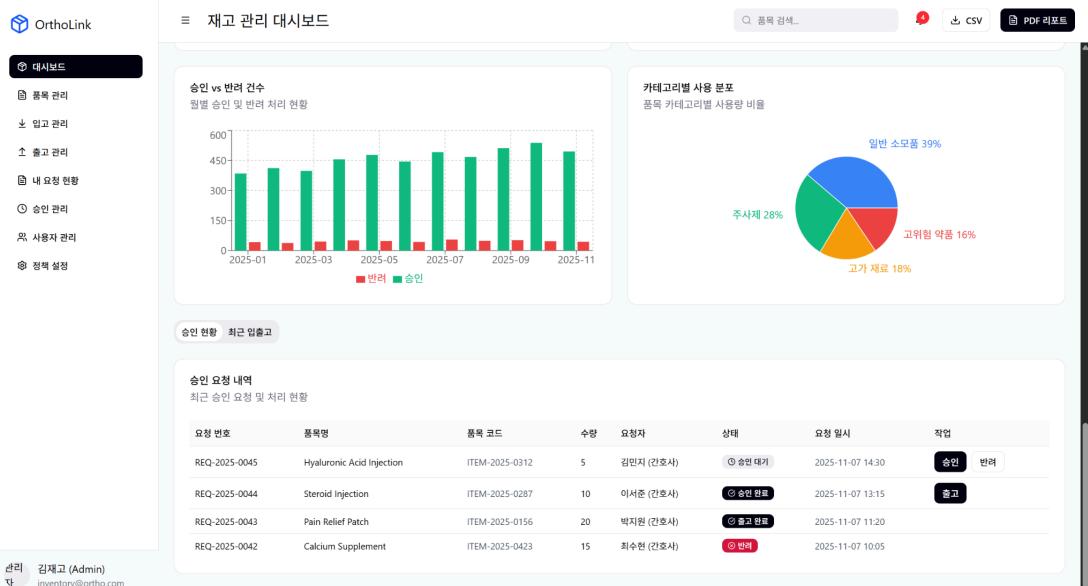
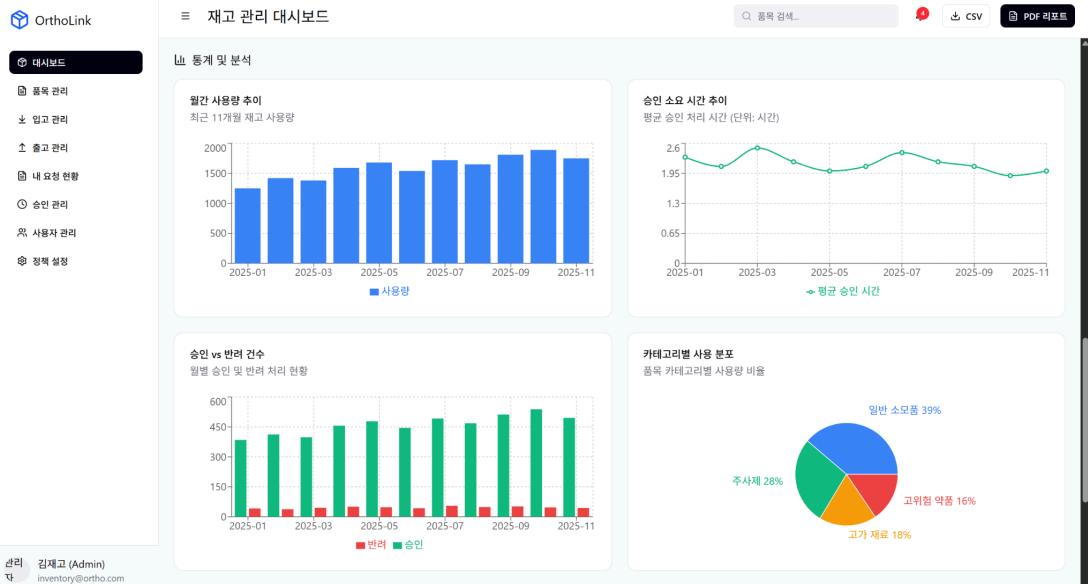
위치: 선반 D-2

발생: 2025-11-07 09:15 (출고(REQ-2025-0039))

현재 재고: 65개

부족: 55개 (만천재고: 120개)

관리 김재교 (Admin)
Inventory@ortho.com



The screenshot displays the OrthoLink software interface, specifically the Inventory Management (품목 관리) section. The top navigation bar includes the OrthoLink logo, a search bar for '품목 검색...', and a red circular icon with a question mark. On the left sidebar, there are links for 대시보드 (Dashboard), 품목 관리 (Inventory Management, highlighted in black), 입고 관리 (Receipt Management), 출고 관리 (Delivery Management), 내 요청 현황 (My Request Status), 승인 관리 (Approval Management), 사용자 관리 (User Management), and 정책 설정 (Policy Settings). The main content area has a title '품목 관리' (Inventory Management) and a sub-section '품목 관리' (Inventory Management). It features a search bar for '품목명 또는 품목코드로 검색...' (Search by Product Name or Product Code), a '전체 카테고리' (All Categories) dropdown, and two buttons: '재고 조정' (Stock Adjustment) and '+ 품목 등록' (Add Product). Below these are sections for '등록 품목 목록' (Registered Product List) and '총 5개 품목' (Total 5 products). A table lists the following products:

품목코드	품목명	카테고리	규격	보관위치	승인정책	현재재고	최소재고	Lot 수	작업	
ITEM-2025-0001	Hyaluronic Acid Injection	주사제	1ml/Ampule	냉장고 A-1	승인 필요	120	50	3		
ITEM-2025-0002	Steroid Injection	주사제	2ml/Vial	냉장고 B-2	승인 필요	45	30	2		
ITEM-2025-0003	Pain Relief Patch	일반 소모품	10cm x 14cm	선반 C-3	자동 승인	98	100	2		
ITEM-2025-0004	Calcium Supplement	주사제	10ml/Ampule	냉장고 A-2	자동 승인	85	60	2		
ITEM-2025-0005	Surgical Gloves	일반 소모품	Size M, Latex-free	선반 D-1	자동 승인	42	200	1		

The screenshot displays the OrthoLink software interface, specifically the Inventory Management module. The top navigation bar includes the OrthoLink logo, a search bar, and a user profile icon. On the left, a sidebar provides access to various modules: Dashboard, Product Management, Import/Export, Audit Log, Internal Audit, User Management, and Configuration.

The main content area is titled "Product Management" and shows a list of products. Each product entry includes the product code, name, and a brief description. A modal window titled "Reorder Processing" is open, prompting the user to enter a lot number or select a product. It also includes fields for specifying the quantity and handling expiration dates.

On the right side, there is a table listing inventory items with columns for part number, current stock, minimum stock, lot number, and actions. The table includes rows for various medical supplies like Hyaluronic Acid, Steroid Injection, Pain Relief Patch, Calcium Supplement, and Surgical Gloves.

The screenshot displays the OrthoLink software interface with the following key components:

- Header:** OrthoLink logo, navigation menu (품목 관리, 대시보드, 입고 관리, 출고 관리, 내 요청 현황, 승인 관리, 사용자 관리, 정책 설정), search bar (품목 검색...), and a red circular icon.
- Main Navigation:** 품목 관리 (highlighted in dark blue), 품목 등록/수정/삭제 및 재고 조정.
- Sub-navigation:** 품목 목록, 재고 조정 이력.
- Search Bar:** 품목 명 또는 품목코드로 검색...
- Product List:** 품목 목록 (5개 품목).

품목 코드	품목 명
ITEM-2025-0001	Hyaluronic Acid Inj.
ITEM-2025-0002	Steroid Injection
ITEM-2025-0003	Pain Relief Patch
ITEM-2025-0004	Calcium Supplement
ITEM-2025-0005	Surgical Gloves
- Modal Window:** 신규 품목 등록.

세로운 품목을 등록합니다. 모든 필수 항목(*)을 입력해주세요.

품명 * 예: Hyaluronic Acid Injection

카테고리 *	규격/사양
카테고리 선택	예: 2ml, 10mg/vial

기본 보관 위치 * 최소 재고량 *

예: 냉장고 A-1, 선반 B-3	0
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제고가 이 수령 이하로 들어오면 일정이 발송됩니다.

승인 정책 *

자동 승인	일반 소모품 - 즉시 출고 가능
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취소 품목 등록
- Table:** 품목 목록 (승인 필요, 승인 필요, 자동 승인, 자동 승인).

승인정책	현재재고	최소재고	Lot 수	작업
승인 필요	120	50	3	
승인 필요	45	30	2	
자동 승인	90	100	2	
자동 승인	85	60	2	
자동 승인	42	200	1	
- Footer:** 관리자 김재고 (Admin), 이메일: info@ortholink.com, 버전: 2.0.0.

OrthoLink

대시보드

품목 관리

임고 관리

출고 관리

내 요청 현황

승인 관리

사용자 관리

정책 설정

김재고 (Admin)
inventory@ortho.com

품목 관리

품목 등록/수정 및 재고 조정

품목 목록 재고 조정 이력

품목 정보 수정

품목 코드: ITEM-2025-0001

품목명: Hyaluronic Acid Injection

카테고리: 1ml/Ampule

주사제

기본 보관 위치: 냉장고 A-1

최소 재고량: 50

재고가 이 수량 이하로 줄어들면 알림이 발생합니다.

승인 정책: 승인 필요 (고기/고위험 품목 - 관리자 승인 후 출고)

승인정책	현재재고	최소재고	Lot 수	작업
승인 필요	120	50	3	
승인 필요	45	30	2	
자동 승인	98	100	2	
자동 승인	85	60	2	
자동 승인	42	200	1	

취소 **저장**

OrthoLink

대시보드

품목 관리

임고 관리

출고 관리

내 요청 현황

승인 관리

사용자 관리

정책 설정

김재고 (Admin)
inventory@ortho.com

품목 관리

품목 등록/수정 및 재고 조정

품목 목록 재고 조정 이력

Lot 상세 재고

Hyaluronic Acid Injection (ITEM-2025-0001)

현재 총 재고	최소 재고량	보관 위치	승인 정책
120	50	냉장고 A-1	승인 필요

Lot별 재고 현황

Lot Number	수령	만료일	보관 위치	상태
LOT-2025-05-0123	50	2026-05-15	냉장고 A-1	정상
LOT-2025-06-0845	70	2026-06-20	냉장고 A-1	정상

닫기

승인정책	현재재고	최소재고	Lot 수	작업
승인 필요	120	50	3	
승인 필요	45	30	2	
자동 승인	98	100	2	
자동 승인	85	60	2	
자동 승인	42	200	1	

OrthoLink

대시보드

품목 관리

임고 관리

출고 관리

내 요청 현황

승인 관리

사용자 관리

정책 설정

김재고 (Admin)
inventory@ortho.com

재고 조정 이력

총 2건의 조정 기록 (감사 추적 가능)

조정 ID	일시	Lot Number	품목명	사유	조정수량	이전/이후	상세사유	담당자
ADJ-2025-001	2025-11-06 14:20	LOT-2025-03-0234	Pain Relief Patch	실사 조정	-2	100 → 98	Adjusted after regular count on 2025-11-06	김재고 (간호사)
ADJ-2025-002	2025-11-05 09:30	LOT-2025-04-0089	Steroid Injection	만료 폐기	-5	50 → 45	Batch expired on 2025-11-01 disposed	박지원 (간호사)

OrthoLink

- 대시보드
- 품목 관리
- 입고 관리**
- 출고 관리
- 내 요청 현황
- 승인 관리
- 사용자 관리
- 정책 설정

입고 관리

신규 입고 품목을 등록하고 재고를 업데이트합니다.

품목 선택
기존 품목 선택

로트번호 *
LOT-2025-XX-XXXX

남용서의 제조사 고유 코드와 일치해야 합니다.

만료일 *
yyyy-mm-dd

수량 *
0

보관 위치 *
냉장고 A-1

초기화 입고 등록

관리 김재고 (Admin)
inventory@ortho.com

OrthoLink

- 대시보드
- 품목 관리
- 입고 관리**
- 출고 관리
- 내 요청 현황
- 승인 관리
- 사용자 관리
- 정책 설정

입고 관리

신규 입고 품목을 등록하고 재고를 업데이트합니다.

품목 선택
기존 품목 선택

로트번호 *
LOT-2025-XX-XXXX

남용서의 제조사 고유 코드와 일치해야 합니다.

만료일 *
yyyy-mm-dd

신규 품목 등록

새로운 품목을 등록합니다. 모든 필수 항목(*)을 입력해주세요.

품목 코드 *
ITEM-2025-2719

고유한 품목 코드입니다. 자동 생성되지만 수정 가능합니다.

품목명 *
예: Hyaluronic Acid Injection

카테고리 *
카테고리 선택
예: 2ml, 10mg/vial

규격/사양
기본 보관 위치 *
예: 냉장고 A-1, 선반 B-3
최소 재고량 *
0

제고가 이 수량 이하로 줄어지면 알림이 발생합니다.

승인 정책 *
승인 정책 선택

취소 품목 등록

관리 김재고 (Admin)
inventory@ortho.com

OrthoLink

- 대시보드
- 품목 관리
- 출고 관리**
- 입고 관리
- 내 요청 현황
- 승인 관리
- 사용자 관리
- 정책 설정

출고 요청

품목 출고를 요청하고 재고를 업데이트합니다.

이 품목은 일반 소모품으로 자동 승인됩니다. 요청 즉시 출고 처리됩니다.

품목 선택 *
Disposable Gloves 자동승인

Disposable Gloves
승인 방식: 자동 승인

Lot 번호 선택 *
LOT-2025-GL-0034
재고: 300개 | 만료: 2026-03-20 | 위치: 선반 B-1

현재 재고	만료일	보관 위치	Lot 번호
300개	2026-03-20	선반 B-1	LOT-2025-GL-0034

출고 수량 *
10
최대 출고 가능 수량: 300개

출고 사유 / 용도
출고 사유 또는 용도를 입력하세요 (선택사항)

초기화 출고 요청 (자동 승인)

관리 김재고 (Admin)
inventory@ortho.com

OrthoLink

출고 관리

품목 출고를 요청하고 재고를 업데이트합니다.

이 품목은 일반 소모품으로 자동 승인됩니다. 요청 즉시 출고 처리됩니다.

품목 선택 *

Medical Gauze (4x4) 자동승인

Lot 번호 선택 *

LOT-2024-GA-0089
제조: 45개 | 유통: 2025-06-15 | 위치: 선반 A-3

현재 재고
45개

출고 수량 *

28

최대 출고 가능 수량: 45개

출고 사유 / 용도

출고 사용 또는 용도를 입력하세요 (선택사항)

취소 출고 요청 (자동 승인)

초기화 출고 요청 (자동 승인)

관리 김재교 (Admin)
inventory@ortho.com

OrthoLink

출고 관리

출고 요청

품목 출고를 요청하고 재고를 업데이트합니다.

이 품목은 관리자 승인이 필요합니다. 요청 후 승인이 완료되면 출고 처리됩니다.

품목 선택 *

Steroid Injection 승인필요

Lot 번호 선택 *

LOT-2025-ST-0045
제조: 25개 | 유통: 2025-09-10 | 위치: 냉장고 A-1

현재 재고
25개

출고 수량 *

20

최대 출고 가능 수량: 25개

출고 사유 / 용도

출고 사용 또는 용도를 입력하세요 (선택사항)

취소 출고 요청 (승인 필요)

초기화 출고 요청 (승인 필요)

관리 김재교 (Admin)
inventory@ortho.com

OrthoLink

출고 관리

출고 요청

품목 출고를 요청하고 재고를 업데이트합니다.

이 품목은 관리자 승인이 필요합니다. 요청 후 승인이 완료되면 출고 처리됩니다.

품목 선택 *

Steroid Injection 승인필요

Lot 번호 선택 *

LOT-2025-ST-0045
제조: 25개 | 유통: 2025-09-10 | 위치: 냉장고 A-1

현재 재고
25개

출고 수량 *

20

최대 출고 가능 수량: 25개

출고 사유 / 용도

출고 사용 또는 용도를 입력하세요 (선택사항)

취소 출고 요청

초기화 출고 요청 (승인 필요)

관리 김재교 (Admin)
inventory@ortho.com

OrthoLink

내 출고 요청 현황

출고 요청의 승인 상태를 확인하고 승인된 요청을 불출 처리합니다.

불출 처리 안내:

승인 완료된 요청만 불출이 가능합니다. 승인 대기 중인 요청은 의사/관리자의 승인 후 불출할 수 있습니다. 긴급한 경우 '긴급 사용' 버튼을 클릭하여 사용 승인으로 처리할 수 있습니다.

전체	승인 대기	승인 완료	불출 완료	반려	긴급 사용
6	2	1	1	1	1

전체 6 승인 대기 2 승인 완료 1 불출 완료 반려 긴급 사용

전체 요청
모든 출고 요청 목록입니다.

요청번호	품목명	수량	요청일시	상태	작업
REQ-2025-0045	Hyaluronic Acid Injection ITEM-2025-0312	5개	2025. 11. 7. 오후 3:40:39	① 승인 대기	불출 ↗ 긴급 사용
REQ-2025-0046	Steroid Injection ITEM-2025-0287	10개	2025. 11. 7. 오후 4:40:39	① 승인 대기	불출 ↗ 긴급 사용
REQ-2025-0044	Hyaluronic Acid Injection ITEM-2025-0312	3개	2025. 11. 7. 오후 12:40:39	② 승인 완료	불출
REQ-2025-0043	Steroid Injection ITEM-2025-0287	8개	2025. 11. 6. 오후 5:40:39	③ 반려	반려됨
REQ-2025-0042	Bone Cement ITEM-2025-0523	1개	2025. 11. 4. 오후 5:40:39	④ 불출 완료	완료
REQ-2025-0041	Pain Relief Patch ITEM-2025-0156	20개	2025. 11. 5. 오후 5:40:39	⑤ 긴급 사용	사후 승인 대기

관리 김재고 (Admin)
inventory@ortho.com

OrthoLink

내 출고 요청 현황

출고 요청의 승인 상태를 확인하고 승인된 요청을 불출 처리합니다.

불출 처리 안내:

승인 완료된 요청만 불출이 가능합니다. 승인 대기 중인 요청은 의사/관리자의 승인 후 불출할 수 있습니다. 긴급한 경우 '긴급 사용' 버튼을 클릭하여 사용 승인으로 처리할 수 있습니다.

전체	승인 대기	승인 완료	불출 완료	반려	긴급 사용
6	2	1	1	1	1

전체 6 승인 대기 2 승인 완료 1 불출 완료 반려 긴급 사용

승인 대기 중인 요청
의사/관리자의 승인을 기다리는 요청입니다. 불출 버튼은 승인 후 활성화됩니다.

요청번호	품목명	수량	요청일시	상태	작업
REQ-2025-0045	Hyaluronic Acid Injection ITEM-2025-0312	5개	2025. 11. 7. 오후 3:40:39	① 승인 대기	불출 ↗ 긴급 사용
REQ-2025-0046	Steroid Injection ITEM-2025-0287	10개	2025. 11. 7. 오후 4:40:39	① 승인 대기	불출 ↗ 긴급 사용

관리 김재고 (Admin)
inventory@ortho.com

OrthoLink

내 출고 요청 현황

출고 요청의 승인 상태를 확인하고 승인된 요청을 불출 처리합니다.

불출 처리 안내:

승인 완료된 요청만 불출이 가능합니다. 승인 대기 중인 요청은 의사/관리자의 승인 후 불출할 수 있습니다. 긴급한 경우 '긴급 사용' 버튼을 클릭하여 사용 승인으로 처리할 수 있습니다.

전체	승인 대기	승인 완료	불출 완료	반려	긴급 사용
6	2	1	1	1	1

전체 6 승인 대기 2 승인 완료 1 불출 완료 반려 긴급 사용

승인 완료 요청
승인되어 불출 가능한 요청 목록입니다.

요청번호	품목명	수량	요청일시	상태	작업
REQ-2025-0044	Hyaluronic Acid Injection ITEM-2025-0312	3개	2025. 11. 7. 오후 12:40:39	② 승인 완료	불출

관리 김재고 (Admin)
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OrthoLink

내 요청 현황

내 출고 요청 현황

출고 요청의 승인 상태를 확인하고 승인된 요청을 불출 처리합니다.

불출 처리 안내:

승인 완료된 요청만 불출이 가능합니다. 승인 대기 중인 요청은 의사/관리자의 승인 후 불출할 수 있습니다. 긴급한 경우 '긴급 사용' 버튼을 클릭하여 사후 승인으로 처리할 수 있습니다.

전체	승인 대기	승인 완료	불출 완료	반려	긴급 사용
6	2	1	1	1	1

전체 6 승인 대기 2 승인 완료 1 불출 완료 반려 긴급 사용

불출 완료

불출이 완료된 요청 목록입니다.

요청번호	품목명	수량	요청일시	상태	작업
REQ-2025-0042	Bone Cement ITEM-2025-0523	1개	2025.11.4. 오후 5:40:39	불출 완료	완료

관리 김재고 (Admin)
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내 요청 현황

내 출고 요청 현황

출고 요청의 승인 상태를 확인하고 승인된 요청을 불출 처리합니다.

불출 처리 안내:

승인 완료된 요청만 불출이 가능합니다. 승인 대기 중인 요청은 의사/관리자의 승인 후 불출할 수 있습니다. 긴급한 경우 '긴급 사용' 버튼을 클릭하여 사후 승인으로 처리할 수 있습니다.

전체	승인 대기	승인 완료	불출 완료	반려	긴급 사용
6	2	1	1	1	1

전체 6 승인 대기 2 승인 완료 1 불출 완료 반려 긴급 사용

반려된 요청

반려 처리된 요청 목록입니다.

요청번호	품목명	수량	요청일시	상태	작업
REQ-2025-0043	Steroid Injection ITEM-2025-0287	8개	2025.11.6. 오후 5:40:39	반려	반려됨

관리 김재고 (Admin)
inventory@ortho.com

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내 요청 현황

내 출고 요청 현황

출고 요청의 승인 상태를 확인하고 승인된 요청을 불출 처리합니다.

불출 처리 안내:

승인 완료된 요청만 불출이 가능합니다. 승인 대기 중인 요청은 의사/관리자의 승인 후 불출할 수 있습니다. 긴급한 경우 '긴급 사용' 버튼을 클릭하여 사후 승인으로 처리할 수 있습니다.

전체	승인 대기	승인 완료	불출 완료	반려	긴급 사용
6	2	1	1	1	1

전체 6 승인 대기 2 승인 완료 1 불출 완료 반려 긴급 사용

긴급 사용 요청

사후 승인 대기 중인 긴급 사용 목록입니다.

요청번호	품목명	수량	요청일시	상태	작업
REQ-2025-0041	Pain Relief Patch ITEM-2025-0156	20개	2025.11.5. 오후 5:40:39	긴급 사용	사후 승인 대기

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- 대시보드
- 품목 관리
- 입고 관리
- 출고 관리
- 내 요청 현황
- 승인 관리**
- 사용자 관리
- 정책 설정

승인 관리

출고 요청을 검토하고 승인/반려 처리합니다.

2건
의 요청이 1시간 이상 대기 중입니다. 신속한 검토가 필요합니다.

1건
의 응급 불출 건이 사후 승인 기한(72시간) 내에 처리되어야 합니다. 즉시 검토가 필요합니다.

승인 대기	사후 승인 대기	승인 완료	불출 완료	반려
3	3	1	1	1

사전 승인 대기 3 | 사후 승인 대기 3 | 승인 완료 1 | 불출 완료 반려

사전 승인 대기 중인 요청
출고 전 검토 및 승인/반려 처리가 필요한 요청 목록입니다.

요청번호	품목명	수량	요청자	요청일시	경과시간	상태	작업
REQ-2025-0045	Hyaluronic Acid Injection ITEM-2025-0312	5개	김민지 간호사	2025. 11. 7. 오후 3:41:52	△ 2시간 0분 경과	○ 승인 대기	승인 반려
REQ-2025-0046	Steroid Injection ITEM-2025-0287	10개	이서준 간호사	2025. 11. 7. 오후 4:41:52	△ 1시간 0분 경과	○ 승인 대기	승인 반려
REQ-2025-0047	Bone Cement ITEM-2025-0523	2개	박지원 간호사	2025. 11. 7. 오후 5:11:52	30분 경과	○ 승인 대기	승인 반려

관리 김재고 (Admin)
inventory@ortho.com

OrthoLink

- 대시보드
- 품목 관리
- 입고 관리
- 출고 관리
- 내 요청 현황
- 승인 관리**
- 사용자 관리
- 정책 설정

승인 관리

출고 요청을 검토하고 승인/반려 처리합니다.

2건
의 요청이 1시간 이상 대기 중입니다. 신속한 검토가 필요합니다.

1건
의 응급 불출 건이 사후 승인 기한(72시간) 내에 처리되어야 합니다. 즉시 검토가 필요합니다.

승인 대기	사후 승인 대기	승인 완료	불출 완료	반려
3	3	1	1	1

사전 승인 대기 3 | 사후 승인 대기 3 | 승인 완료 1 | 불출 완료 반려

사후 승인 대기 (응급 불출)
응급 상황으로 사전 승인 없이 불출된 품목입니다. 불출 후 72시간 이내 사후 승인이 필요합니다.

요청번호	품목명	수량	요청자	불출일시	승인 기한	상태	작업
REQ-2025-0050	Bone Cement ITEM-2025-0523	1개	한지우 간호사	2025. 11. 4. 오후 7:41:52	△ 1시간 59분 남음	○ 응급 불출 (사후승인 대기)	사후 승인 반려
REQ-2025-0049	Hyaluronic Acid Injection ITEM-2025-0312	3개	최민수 간호사	2025. 11. 5. 오후 5:41:52	23시간 남음	○ 응급 불출 (사후승인 대기)	사후 승인 반려
REQ-2025-0048	Emergency Splint Kit ITEM-2025-0721	2개	문서연 간호사	2025. 11. 7. 오전 7:41:52	2월 13시간 남음	○ 응급 불출 (사후승인 대기)	사후 승인 반려

관리 김재고 (Admin)
inventory@ortho.com

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- 대시보드
- 품목 관리
- 입고 관리
- 출고 관리
- 내 요청 현황
- 승인 관리**
- 사용자 관리
- 정책 설정

승인 관리

출고 요청을 검토하고 승인/반려 처리합니다.

2건
의 요청이 1시간 이상 대기 중입니다. 신속한 검토가 필요합니다.

1건
의 응급 불출 건이 사후 승인 기한(72시간) 내에 처리되어야 합니다. 즉시 검토가 필요합니다.

승인 대기	사후 승인 대기	승인 완료	불출 완료	반려
3	3	1	1	1

사전 승인 대기 3 | 사후 승인 대기 3 | 승인 완료 1 | 불출 완료 반려

승인 완료 요청
승인되어 불출 대기 중인 요청 목록입니다.

요청번호	품목명	수량	요청자	요청일시	경과시간	상태	작업
REQ-2025-0044	Hyaluronic Acid Injection ITEM-2025-0312	3개	최수현 간호사	2025. 11. 7. 오후 12:41:52	5시간 0분 경과	○ 승인 완료	불출

관리 김재고 (Admin)
inventory@ortho.com

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승인 관리

승인 관리
출고 요청을 검토하고 승인/반려 처리합니다.

주의 의 요청이 1시간 이상 대기 중입니다. 신속한 검토가 필요합니다.

○ 1건 의 응급 불출증이 사후 승인 기한(72시간) 내에 처리되어야 합니다. 즉시 검토가 필요합니다.

승인 대기	3	시후 승인 대기	3	승인 완료	1	불출 완료	1	반려	1
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사전 승인 대기 1 | 사후 승인 대기 3 | 승인 완료 1 | 불출 완료 | 반려

불출 완료
승인 후 불출이 완료된 요청 목록입니다.

요청번호	품목명	수량	요청자	요청일시	경과시간	상태
REQ-2025-0042	Bone Cement ITEM-2025-0523	1개	강예진 간호사	2025. 11. 4. 오후 5:41:52	72시간 0분 경과	불출 완료

관리 김재고 (Admin)
inventory@ortho.com

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승인 관리

승인 관리
출고 요청을 검토하고 승인/반려 처리합니다.

주의 의 요청이 1시간 이상 대기 중입니다. 신속한 검토가 필요합니다.

○ 1건 의 응급 불출증이 사후 승인 기한(72시간) 내에 처리되어야 합니다. 즉시 검토가 필요합니다.

승인 대기	3	시후 승인 대기	3	승인 완료	1	불출 완료	1	반려	1
-------	---	----------	---	-------	---	-------	---	----	---

사전 승인 대기 3 | 사후 승인 대기 3 | 승인 완료 1 | 불출 완료 | 반려

반려된 요청
반려 처리된 요청 목록입니다.

요청번호	품목명	수량	요청자	요청일시	경과시간	상태
REQ-2025-0043	Steroid Injection ITEM-2025-0287	8개	정민호 간호사	2025. 11. 6. 오후 5:41:52	24시간 0분 경과	반려

관리 김재고 (Admin)
inventory@ortho.com

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사용자 관리

사용자 관리
역할 기반 접근 제어 (RBAC) 및 사용자 권한 관리

○ 간호사 (Nurse)
일상적인 입출고 관리, 막로 모니터링, 고가 소모품 요청
Operational management

○ 의사 (Doctor)
고기/고위험 소모품 승인 또는 반려
Approval authority

○ 재고 관리자 (Inventory Manager)
재고 정책 관리, 조정, 보고 (보통 선임 간호사)
Oversight & audit

2 명

○ 시스템 자동화:
OrthoLink는 만료 예정, 재고 부족 알림을 자동으로 생성하고, 모든 입출고 및 승인 활동에 대한 감사 로그를 유지합니다.

사용자 목록 2 / 5 표시

검색 **역할 필터**

이름	이메일	역할	부서	최근 로그인	로그인 상태	작업
김지영	jiyoung.kim@hospital.com	재고 관리자 (Inventory Manager)	정형외과	2025-11-07 09:30	로그인 중	편집 삭제
이수진	sujin.lee@hospital.com	간호사 (Nurse)	정형외과	2025-11-07 10:15	로그인 중	편집 삭제
박민호	minho.park@hospital.com	의사 (Doctor)	정형외과	2025-11-07 08:45	오프라인	편집 삭제
최은혜	eunhye.choi@hospital.com	간호사 (Nurse)	정형외과	2025-11-06 16:20	오프라인	편집 삭제
정현우	hunwoo.jung@hospital.com	의사 (Doctor)	정형외과	2025-10-28 14:30	오프라인	편집 삭제

○ 사용자 추가

관리 김재고 (Admin)
inventory@ortho.com

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≡ 사용자 관리

작업 기반 접근 세이프 (NSA) 및 사용자 관리 헬퍼

○ 간호사 (Nurse)

일상적인 입출고 관리, 막로 모니터링, 고가 소모품 요청
Operational management

2 명

○ 의사 (Doctor)

고가/고위험 소모품 승인 또는 반려
Approval authority

2 명

○ 재고 관리자 (Inventory Manager)

재고 정책 관리, 조정, 보고 (보통 선임 간호사)
Oversight & audit

1 명

사용자 정보 수정

사용자의 정보와 역할을 수정합니다.

이름 *

이메일 *

역할 *

제고 관리자 (Inventory Manager)
제고 정책 관리, 조정, 보고 (보통 선임 간호사)

권한:
Oversight & audit

부서 *

정형외과

취소 수정

근로기록	로그인 상태	작업
25-11-07 09:30	로그인 중	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
25-11-07 10:15	로그인 중	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
2025-11-07 08:45	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
2025-11-06 16:20	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
2025-10-28 14:30	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제

사용자 추가

OrthoLink

≡ 사용자 관리

작업 기반 접근 세이프 (NSA) 및 사용자 관리 헬퍼

○ 간호사 (Nurse)

일상적인 입출고 관리, 막로 모니터링, 고가 소모품 요청
Operational management

2 명

○ 의사 (Doctor)

고가/고위험 소모품 승인 또는 반려
Approval authority

2 명

○ 재고 관리자 (Inventory Manager)

제고 정책 관리, 조정, 보고 (보통 선임 간호사)
Oversight & audit

1 명

사용자 삭제 확인

정말로 김지영 사용자를 삭제하시겠습니까?

이 작업은 되돌릴 수 없으며, 모든 감사 로그에 기록됩니다.

취소 삭제

이름	이메일	역할	부서	최근 로그인	로그인 상태	작업
김지영	jyyoung.kim@hospital.com	제고 관리자 (Inventory Manager)	정형외과	2025-11-07 09:30	로그인 중	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
이수진	sujin.lee@hospital.com	간호사 (Nurse)	정형외과	2025-11-07 10:15	로그인 중	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
박민호	minho.park@hospital.com	의사 (Doctor)	정형외과	2025-11-07 08:45	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
최은혜	eunhye.choi@hospital.com	간호사 (Nurse)	정형외과	2025-11-06 16:20	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
정현우	hyunwoo.jung@hospital.com	의사 (Doctor)	정형외과	2025-10-28 14:30	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제

사용자 추가

OrthoLink

≡ 사용자 관리

작업 기반 접근 세이프 (NSA) 및 사용자 관리 헬퍼

○ 간호사 (Nurse)

일상적인 입출고 관리, 막로 모니터링, 고가 소모품 요청
Operational management

2 명

○ 의사 (Doctor)

고가/고위험 소모품 승인 또는 반려
Approval authority

2 명

○ 재고 관리자 (Inventory Manager)

제고 정책 관리, 조정, 보고 (보통 선임 간호사)
Oversight & audit

1 명

새 사용자 추가

시스템에 새로운 사용자를 추가합니다. 모든 필수 항목(*)을 입력해주세요.

이름 *

이메일 *

역할 *

역할 선택

부서 *

정형외과

취소 추가

근로기록	로그인 상태	작업
25-11-07 09:30	로그인 중	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
25-11-07 10:15	로그인 중	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
2025-11-07 08:45	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
2025-11-06 16:20	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제
2025-10-28 14:30	오프라인	<input checked="" type="checkbox"/> 편집 <input checked="" type="checkbox"/> 삭제

사용자 추가

12. Conclusion

This report has presented the comprehensive software engineering process for **OrthoLink**, an integrated medical supplies management system designed specifically for small and medium-sized orthopedic hospitals. The project was initiated to address critical operational inefficiencies, such as manual inventory tracking errors, lack of traceability for high-value implants, and the absence of structured approval workflows.

The proposed solution successfully translates complex domain requirements into a robust architectural design. Key achievements of this project include:

1. **Enhanced Operational Visibility:** By implementing a **Real-Time Dashboard (FR-12)**, the system provides immediate insights into critical metrics such as low-stock alerts and expiration warnings, enabling proactive inventory control.
2. **Strengthened Governance and Safety:** The mandatory **Electronic Approval Workflow (FR-03)** for high-cost and high-risk items ensures that no sensitive material is disbursed without doctor authorization, directly contributing to patient safety and audit readiness.
3. **Data Integrity and Accountability:** Through the strict enforcement of **Role-Based Access Control (RBAC)** and immutable **Audit Logging (FR-07)**, the system guarantees transparency for every transaction, from inbound registration to final usage or disposal.

In conclusion, OrthoLink demonstrates how digital transformation can optimize the medical supply chain. By replacing fragmented manual practices with a centralized, automated system, hospitals can significantly reduce operational costs, minimize waste, and focus resources on their primary mission: patient care. Future enhancements may include the integration of AI-driven demand forecasting and mobile application support to further improve accessibility and automation.

13. Reference

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- [3] U.S. Food and Drug Administration (FDA) Unique Device Identification System (UDI System) documents
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14. The Role of Each Member

Name	Role	Assigned Responsibilities
Lee Jeongyun	System Analyst	Analysis & Requirements <ul style="list-style-type: none">Defined problem description and project background.Elicited and specified Functional (FR) & Non-functional Requirements (NFR)Developed the Domain Model and business rules.
Kwon Daehun	System Architect	System Modeling <ul style="list-style-type: none">Designed Use Case scenarios and diagrams.Constructed Sequence Diagrams for dynamic behavior analysis.Designed the Class Diagram for static structure.
Joo Youngjin	Implementation Lead	Detailed Design & UI <ul style="list-style-type: none">Designed RESTful API interfaces and detailed internal logic.Created High-Fidelity User Interface (UI) designs.Finalized the report structure, conclusion, and references.