Swinburne University of Technology

School of Science, Computing and Engineering Technologies

ASSIGNMENT AND PROJECT COVER SHEET

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Assignment 1: Requirements Specification

SWE30003 - Software Architecture and Design

Case study: Long Chau Pharmacy Management System (LC-PMS)

Swinburne University of Technology

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1. Introduction

This document presents the Software Requirements Specification (SRS) for the Long Chau Pharmacy Management System (LC-PMS). Long Chau Pharmacy, a subsidiary of FPT Retail, stands as one of Vietnam's largest and most recognized pharmacy chains, with an extensive network of over 2,000 stores across all 63 provinces.

The primary aim of this SRS is LC-PMS, which is a strategic initiative designed to solve operational challenges to support continued growth in user activities of Long Chau. This specification will serve as a foundational guide for the subsequent design, development, and implementation phases of the LC-PMS. The project's primary aim is to guarantee the final product aligns with Long Chau Pharmacy's strategic objectives. These objectives include bolstering operational efficiency, providing exceptional customer service, and strengthening its position as a leading force within the Vietnamese healthcare industry.

2. Project overview

2.1 Project type

The *Long Chau Pharmacy Management System* (LC-PMS) is classified as **a contract development project**. Long Chau Pharmacy acts as the client, and Swinsoft Consulting is the contracted external supplier tasked with designing and implementing a customized system to meet Long Chau's operational and strategic needs.

2.2 Project goals

The goals of this project are to:

- Build a digital foundation that supports the long-term vision of Long Chau pharmacy: to become a national leader in health and pharmaceutical services.
- Transform the way Long Chau manages customers, products, and services across all its branches and digital platforms, moving away from manual and disconnected processes.
- Enhance the operational efficiency by reducing manual work, minimizing errors.
- Support business expansion for Long Chau's growing network of pharmacy branches.
- Improve customer experience to retain existing customers and attract new ones faster.

2.3 Project objectives

- **Enhance convenience through the development of a website, mobile app to** allow customers to search for products, verify availability at specific locations, upload prescriptions, or directly and easily interact at pharmacy counters.

- **Implement tools to help staff track and process incoming orders efficiently**, **manage the digital approval of prescriptions** by licensed pharmacists, and organize delivery or pickup options to ensure faster, more reliable order fulfilment.
- **Establish a synchronized inventory system** that provides accurate, real-time stock information across all branches, preventing the sale of out-of-stock products.
- **Generate detailed reports** on product sales, customer demand patterns, and overall branch performance to help decision-makers forecast demand, plan promotions, and optimize operations.
- **Implement a secure system with role-based permissions** to clearly define what cashiers, pharmacists, branch managers, and warehouse personnel can view and do, while protecting sensitive customer health and financial data.
- **Deliver automated notifications** to customers regarding their order status, prescription approvals, payment confirmations, and promotional campaigns through reliable channels such as SMS, email, or in-app alerts.
- **Create a scalable system** capable of supporting the company's growth and integrating with future external services, such as third-party delivery partners or digital health platforms.

2.4 Domain vocabulary

This section defines domain-specific terms and system concepts relevant to the *Long Chau Pharmacy Management System* (LC-PMS).

2.4.1 Actors

Term	**Definition**
Customer	An individual who interacts with Long Chau Pharmacy to purchase products, seek advice, or use its services, either in-store or via digital platforms.
Cashier	A Long Chau Pharmacy staff member primarily responsible for handling customer payments, processing transactions, and issuing receipts at the point of sale.
Pharmacist	A licensed healthcare professional responsible for dispensing medications, validating prescriptions, providing drug information, and counseling patients.
Branch manager	A Long Chau Pharmacy staff member

	responsible for overseeing the daily operations, staff, and performance of a specific pharmacy branch.
Warehouse personnel	Long Chau Pharmacy staff responsible for managing stock in central storage facilities, including receiving, storing, and dispatching products to branches.

Table 1. Actors

2.4.2 Operational terminology

Term	**Definition**
Branch	A physical retail location of Long Chau Pharmacy.
Prescription	An official instruction from a qualified healthcare professional (e.g. doctor) authorizing a pharmacist to dispense a specific medicinal product and dosage to a patient.
Prescription validation	The process by which a licensed pharmacist verifies the authenticity, legality, and clinical appropriateness of a prescription before dispensing medication.
Order	A customer's request to purchase one or more products, placed online, via app, or in-store.
Order fulfilment	The end-to-end process of receiving, processing, validating, and completing a customer's order.
Report	A structured presentation of data generated by the LC-PMS, providing insights into sales, customer demand, inventory levels, and operational performance for management decision-making.
Receipt	A document confirming a transaction, including items, price, payment method, and purchase date. This document is linked to a database hosted by Vietnam’s department of

	taxation.
Payment method	The means by which a customer pays, e.g., cash, card, or e-wallet.
Product	Any item offered for sale by Long Chau Pharmacy, including medicines, health supplements, medical devices, personal care items, etc.
Medicine	A specific type of product, typically a drug or other preparation, used for the treatment or prevention of disease.
Inventory	The complete list of medicinal products, health-related items, and other goods stocked by Long Chau Pharmacy, including quantities and locations.

Table 2. Operational terminology

2.5 Assumptions

- Swinsoft Consulting already had branding and user interface guidelines. These guidelines was built based on Nielsen's usability heuristics in 1998 [1].
- Each Long Chau branch has fully-operated hardwares (e.g. computers, smartphones, Internet connection…)
- Each Long Chau branch receives a high volume of customers (~150 - 200 visits/ day) for purchasing medicine on a daily basis.
- Staff have basic computer literacy (i.e., they can use a keyboard and mouse), however, in most cases, they will use smartphones.
- Long Chau Pharmacy employs different types of staff, including cashiers, pharmacists, warehouse personnel, and branch managers.
- Internet connectivity is assumed to be stable at all branches for real-time data synchronization.
- Pharmacists are certified and have legal authority to validate prescriptions through the system.
- It is assumed that the LC-PMS operates within Vietnam, and complies with Vietnamese data protection, healthcare and tax regulations.
- An order is associated with a transaction only. That is, we do not allow multiple payments for an order.

2.6 Project scope

The scope of the Long Chau Pharmacy Management System (LC-PMS) is defined to address the core operational and customer engagement needs of the pharmacy. The following table outlines the features and functionalities categorized as "Must-have," "Nice-to-have," and "Not-in-scope" for the initial deployment of the system.

Feature	**Must-have**	**Nice-to-have**	**Not-in-scope**
Product search and availability checking	x		
Prescription upload and digital validation	x		
Online and in-store order placement	x		
Real-time inventory tracking	x		
Multiple payment methods	x		
Automatic receipt generation	x		
Secure, role-based access control for internal management	x		
Scalable architecture	x		
Data security for health records and financial information	x		
Customer notifications via SMS, email, in-app alerts	x		
Demand forecast and promotion planning using advanced analytics		x	
Integration with third-party delivery services		x	
Integration with digital health platforms		x	
Detailed user interface design		x	

Integration with hospital EMR/HMR systems			x
AI-based prescription analysis			x
Physical hardware setup (POS, servers, etc.)			x
Physical store development			x

Table 3. Project scope

3. Problem domain

3.1 Pain points

The existing processes at Long Chau pharmacies are characterized by several inefficiencies and limitations:

- **Manual and disconnected processes**: Manual workflows cause delays in critical processes like order processing and inventory checks, leading to longer customer wait times.
- **Slow service delivery:** The reliance on manual processes and disconnected systems contributes to slow service times for customers.
- **Frequent product unavailability:** Fragmented systems lack integration, resulting in frequent stockouts and poor inventory visibility.
- **Operational inefficiencies:** Prescription handling is inefficient due to manually validations.
- **Customer dissatisfaction:** Customer engagement is low due to the absence of real-time notifications and a unified digital presence.
- **Delayed or miscommunicated order fulfilment:** Payment and receipt systems are inconsistent across branches, lacking centralized record-keeping.

These issues are consistent with broader challenges observed in retail and clinical pharmacy operations globally, where system integration and digital transformation are critical enablers of efficiency and patient safety.

3.2 Domain entities

- Customer
- Locations/ Branches

- Inventory
- Product
- Prescription
- Order
- Transactions
- Staff
- Notifications

3.3 Actors

The LC-PMS will serve the following primary actors:

- **Customer**: Individuals who interact with the pharmacy chain to search for products, upload prescriptions, place orders, and make payments.
- **Cashier**: Taking responsibility for finalizing transactions, handling payments, and issuing receipts. Require fast and reliable access to order and inventory data.
- **Pharmacist**: Licensed professionals who validate prescriptions, ensure drug compliance, and supervise medicine exclusion.
- **Branch manager**: Manages day-to-day pharmacy activities, tracks sales results, and maintains regulatory standards. Needs access to reports and comprehensive system data.
- **Warehouse personnel**: Ensure smooth inventory management by overseeing stock levels, distributing supplies among branches, and monitoring shipments.

3.4 Tasks

1. Search for products
2. Place order
3. Process and validate prescriptions
4. Coordinate order fulfilment (delivery and pickup)
5. Handle customer payments
6. Maintain and track inventory
7. Generate and analyze operational reports
8. Manage notifications & promotional campaigns

4. Data model

4.1 Domain model

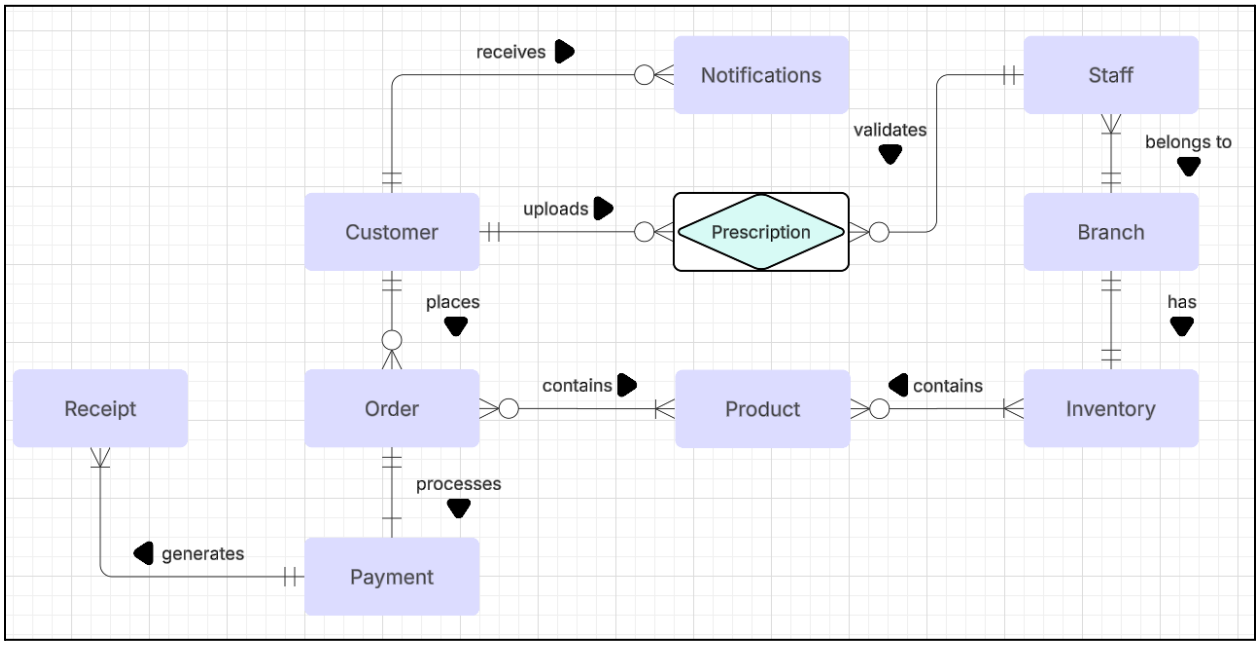

Figure 1. Domain model

4.2 Entity descriptions

- **Customer:** An individual who interacts with Long Chau Pharmacy's services. Customers can search for products, upload prescriptions, place orders online or in-store, and receive notifications.
- **Branch:** A physical retail location of Long Chau Pharmacy. Each branch has its own staff and manages its own local inventory.
- **Inventory:** Represents the stock level of a specific product at a particular branch and provides real-time information on product availability, prevents the sale of out-of-stock items, and assists managers with stock control and replenishment.
- **Product:** Any item offered for sale by Long Chau Pharmacy, including prescription medications, over-the-counter drugs, health supplements, and other health-related goods.
- **Prescription:** A digital record of a medical prescription, either uploaded as an image by a customer or scanned in-store by staff. Each prescription must be reviewed and validated by a licensed pharmacist before the associated medication can be dispensed.
- **Order:** A customer's formal request to purchase one or more products. An order can be initiated online, or created by staff at a pharmacy counter.

- **Payment:** A record of a financial transaction associated with an order. Each order is linked to a corresponding payment record to confirm the purchase is complete.
- **Staff:** An employee of Long Chau Pharmacy who uses the LC-PMS. Staff members interact with the system to assist customers, process orders, validate prescriptions, manage inventory, and generate reports.
- **Notification:** An automated message sent by the system to a customer or staff member. Notifications are used to provide timely updates on order status, prescription approvals, payment confirmations, and to disseminate information about promotional campaigns.
- **Receipt:** A digital confirmation document generated upon successful payment for an order.

5. Functional requirements & task descriptions

5.1 Search for products

Task: Search for products	
Purpose	To find health-related products, medicines, or services available at Long Chau Pharmacy, both online and in-store
Frequency	Very frequent. Occurs multiple times during a typical user session (customer browsing online/in-app) or customer interaction (staff assisting in-store).
Trigger/ Precondition	When customer accesses LC-PMS online platforms
Critical	Volume of product searches can reach 200 - 300 queries/ minute, causing potential delays in product information display.
Sub-tasks:	**Example solutions:**
1. Enter search term **Problem:** The customer may enter a misspelled search term or ambiguous keyword.	System offers autocomplete suggestions to help narrow the search.
2. Display search results	System displays search results based on customer's query
3. Filter results	System shows applicable filters based on the

	ongoing search, such as price range, intended patient type, etc.
4. View product details	Displays comprehensive product information, highlight stock availability
5. Add product to cart **Problem:** Customers want to purchase a specific quantity (e.g. 6 pills) instead of the full product (e.g. 1 bottle with 30 pills).	The system allows customers to select a custom quantity of the product, offering flexible purchasing options. If the medicine is sold only in bulk, the system could suggest alternative products available in smaller quantities or offer partial pack options where applicable.
Variants:	
1a. Customer searches in-store with staff assistance	Staff uses LC-PMS and find the medicine name on the system
5a. Product is out of stock **Problem:** The selected product is out of stock at the customer's preferred branch, leading to frustration.	System shows the availability at nearby branches and offers the option to place an order for delivery when the product is back in stock.

Table 4. Task description for "Search for products" task

5.2 Place order

Task: Place order	
Purpose	To enable customers to finalize the purchase of selected products through online platforms (website/app) and to allow pharmacy staff to efficiently create and process orders for customers at pharmacy counters.
Frequency	150 - 200 customers/ day/ branch
Trigger/ Precondition	Customer has added desired products to their shopping cart (online/ in-store) and proceeds to checkout.
Critical	Order volumes exceed **50 - 100 orders/ minute** across all branches and platforms
Sub-tasks:	**Example solutions:**

1. Verifies items, quantities, prices in cart/summary. **Problem**: Incorrect selection.	The system displays a clear, editable order summary.
2. Chooses delivery or in-store pickup	The system presents clear fulfilment choices with details (time, location).
3. Provides/confirms contact, delivery/pickup info.	For logged-in customers, the system pre-fills saved information (profile details, default addresses), allowing for quick confirmation or editing. For guest checkouts or new customers (or staff inputting details), the system provides clear input fields.
4. Upload prescriptions (if order includes prescription medication)	The system clearly flags items in the cart that require a prescription. It then provides an interface for uploading a new prescription image/document or selecting from the customer's list of previously uploaded and validated prescriptions.
5. Apply promotional codes (optional) **Problem**: A promotional code might be invalid or expired, or the user might be unsure how to apply their loyalty points.	The system provides a dedicated field for entering promotional codes and validates them in real-time, showing success or error messages, with the order total updating dynamically to reflect any discounts.
6. Final order review and confirmation	The system presents a clear, all-inclusive final order summary page. A distinct button requires an explicit action from the user to commit to the purchase. Important terms and conditions related to the purchase may also be displayed or linked on this page.
Variants:	
1a. Staff-assisted order placement (in-store). A pharmacy staff member uses the LC-PMS at the counter to create or finalize an order for a customer.	The staff interface for order creation is optimized for speed and efficiency, allowing for rapid product lookup, customer account search/creation, and streamlined navigation through the order steps.

2a. Order modification before payment	The system allows users to easily navigate back to the shopping cart or relevant sections of the checkout process to make necessary changes, with the order summary and totals updating accordingly.
4a. User already uploaded their prescription and approved by pharmacist **Problem:** Requires uploading prescription again will make the customer unsatisfied	Users are allowed to use their approved prescription to directly proceed to the next step, without uploading new prescriptions.

Table 5. Task description for "Place order" task

5.3 Process and validate prescriptions

Task: Process and validate prescriptions	
Purpose	To assess and approve or reject submitted prescriptions based on legality, completeness, and patient safety, ensuring only valid and appropriate medications are dispensed.
Frequency	Performed frequently throughout the day; average 10-20 prescriptions/ hour
Trigger/ Precondition	A prescription is uploaded by a customer through the online platforms, or scanned in-store at the pharmacy. The prescription enters the pharmacist's review queue.
Critical	During peak hours, multiple prescriptions (30+) arrive simultaneously, causing overload and risk of delayed medication fulfillment.
Sub-tasks:	**Example solutions:**
1. Receive uploaded prescription **Problem:** Unclear scans may reduce accuracy.	System allows pharmacists to view a high-resolution preview with zoom tools.
2. Verify prescription validity **Problem:** The prescription may be expired, forged, or issued by an unlicensed doctor/ hospital.	System checks the date of issue against system-defined limits. Verifies the prescription's digital ID (if it has) against digital prescriptions' national

	database, and alerts the pharmacist if it's invalid.
3. Approve or reject prescription. **Problem:** Decisions must be justified and traceable to compliance with legal requirements.	The pharmacist must select "Approve" or "Reject" and provide a reason if rejecting. The action is timestamped and saved in the audit log.
4. Notify customer of result.	System sends notifications to the customers about the prescription's status
Variants:	
2a. Prescription is paper-based (handwritten) and does not have prescription ID (in the national database) **Problem:** Cannot verify the validity of the prescription on the online database.	Pharmacists manually check the prescription to check its validity

Table 6. Task description for "Process and validate prescriptions" task

5.4 Coordinate order fulfilment (delivery and pickup)

Task: Coordinate order fulfilment (delivery and pickup)	
Purpose	To ensure that customer orders are processed, prepared, and delivered or made available for pickup in a timely and efficient manner, with accurate tracking throughout the process.
Frequency	Performed frequently, depending on customer demand and order volume. On average, this task is performed **20 - 50 orders/ hour** during busy hours or sales events.
Trigger/ Precondition	A customer has successfully placed an order, either online or in-store. The order is ready for fulfillment, either through delivery or at the pharmacy for pickup.
Critical	10 - 20 orders process at the same time
Sub-tasks:	**Example solutions:**
1. Review order details	The system reviews the order and confirms

Problem: Items may be out of stock.	item availability in real-time, notifying the staff if any products are unavailable or require substitution.
2. Prepare order for pickup or delivery **Problem:** Order preparation may be delayed due to missing or incorrect items.	The system generates an order fulfillment list for the staff, detailing items to be packed and flagged for delivery or pickup, ensuring that nothing is missed.
3. Assign delivery personnel or notify pickup **Problem:** Delays in assigning the order to delivery personnel or notifying customers about pickup can lead to dissatisfaction.	The system automatically assigns the order to available delivery staff and sends the customer a notification with delivery or pickup details, including estimated time.
4. Track order progress	Systems update the order status in real-time
5. Notify customer	Send notifications to users (SMS/ app/ email/…) about order status
Variants:	
3a. Order involves third-party delivery **Problem:** The order requires third-party delivery services, which may introduce potential delays or miscommunication due to the external vendor's handling of the delivery process.	System integrates with third-party delivery platforms to allow real-time tracking. The system sends automatic updates to the customer with estimated delivery times

Table 7. Task description for "Coordinate order fulfillment" task

5.5 Handle customer payments

Task: Handle customer payments	
Purpose	To securely process customer payments for orders through various accepted methods (cash, credit/debit cards, e-wallets), update order status, and generate receipts for customers and internal records.
Frequency	Average 150 - 200 customers/ day/ branch
Trigger/ Precondition	An order has been confirmed by the customer (online/app) or by staff (in-store) and is ready for payment.

Critical	10 - 15 customers/ branch process payments simultaneously.
Sub-tasks:	**Example solutions:**
1. Select payment method	System clearly displays all supported payment methods (e.g., specific card types, e-wallet providers, cash for in-store).
2. Enter payment details (for non-cash transactions) **Problem**: Risk of data entry errors or insecure handling of sensitive information.	System uses a secure, encrypted connection to a payment gateway for online transactions. For in-store card/e-wallet payments, system integrates with compliant payment terminals that handle sensitive data directly.
3. Process payment transaction **Problem**: Payment declined due to insufficient funds, incorrect details, bank issues, or system errors.	System provides real-time feedback on transaction status. Clear error messages are displayed if payment fails, with guidance on next steps
4. Confirm payment and update order status **Problem:** Discrepancy between payment confirmation and order status update.	System ensures atomic transaction updates: order status is updated reliably upon successful payment confirmation. A unique transaction ID is recorded.
5. Generate and issue receipt **Problem:** Vietnamese regulations mandate that receipts be linked to the national tax database.	Upon successful payment, the receipt is submitted to the tax database and a copy will be sent to the customer.
Variants:	
1a. Cash payment (in-store only)	Staff enter the amount received. System calculates change due and records the cash transaction.
5a. VAT invoice preference **Problem:** Customer wants to have a “red invoice” (VAT invoice)	System allows staff to input customer's email or phone number to send a digital VAT invoice.

Table 8. Task description for “Handle customer payments” task

5.6 Maintain and track inventory

Task: Maintain and track inventory	
Purpose	To ensure stock levels are correct, expired items are removed, and products are available across all branches.
Frequency	Performs daily when stock arrives, items are sold, or audits are done.
Trigger/ Precondition	Stock delivery, sales, or scheduled audits.
Critical	During health emergencies or big sales periods.
Sub-tasks:	**Example solutions:**
1. Receive and update stock	Staff check deliveries and update the system.
2. Flag expiring products **Problem:** Products nearing expiration are not flagged in time, leading to wasted stock.	System warns staff when items are near expiry.
3. Transfer stock between branches	System identifies products nearing their expiration date, alerts staff, and prompts action.
Variants:	
2a. Stock levels not updated after sale **Problem:** Inventory may be off if not updated after sales.	System triggers a re-sync for stock levels after each sale or transaction to ensure inventory is updated immediately.

Table 9. Task description for “Maintain and track inventory” task

5.7 Generate and analyze operational reports

Task: Generate and analyze operational reports	
Purpose	To provide management with detailed reports about product sales, customer demand patterns, and overall performance across branches, helping with decision-making, demand forecasting, and promotion planning.

Frequency	Performed daily, weekly, monthly, quarterly, or on-demand, as required by management.
Trigger/ Precondition	When a branch manager or authorized personnel requests a report, or when a scheduled report generation occurs.
Critical	During monthly or quarterly planning cycles when management must assess performance, forecast demand, or respond to operational issues across branches
Sub-tasks:	**Example solutions:**
1. Select report type **Problem:** Managers may struggle to find specific data points if parameters are not intuitive or comprehensive.	Manager interface enables report type selection (sales, inventory, demand), date range definition, and filtering by branch or product category.
2. Generate report: **Problem:** Generating complex reports can be slow, impacting manager productivity and timely decision-making.	The system queries the centralized database to compile the requested data, applying necessary aggregations and calculations based on the selected parameters.
3. Display report:	The system presents the generated reports in an easily digestible format.
4. Export report	Export report in common formats (e.g., PDF, CSV).

Table 10. Task description for "Generate and analyze operational reports" task

5.8 Manage notifications & promotional campaigns

Task: Manage notifications & promotional campaigns	
Purpose	To notify customers about order status, prescription approvals, payment confirmations, and promotional campaigns through methods such as SMS, email, or in-app alerts.
Frequency	This task is event-driven (for transaction-related notifications) and scheduled (for promotional campaigns).

Trigger/ Precondition	When an event requires informing the customer (e.g. order placed, prescription approved, payment received), or when a new promotional campaign is launched.
Critical	During high-order volume periods or time-sensitive campaigns (e.g. holiday sales, urgent stock notifications).
Sub-tasks:	**Example solutions:**
1. Identify trigger event	The system monitors key internal events (e.g., order status updates, prescription validation completion, payment success) that necessitate customer communication.
2. Notification type and channel **Problem:** Incorrect or inefficient channel selection might lead to notifications being missed or ignored by customers.	Based on the trigger event and customer preferences, the system determines the appropriate type of notification (transactional or promotional) and preferred channel (SMS, email, or in-app alerts).
3. Compose message	Composes a tailored message, incorporating relevant details such as order numbers, new status, prescription approval/rejection reasons, or promotional offers to enhance user experience and personalization
4. Send notification	The system dispatches the message through the selected communication methods to the customer
5. Track and manage notification status	The system records the status of notification and provides logs for auditing purposes
6. Manage promotional campaigns (optional)	The system provides a module for staff to create and manage promotional campaigns (e,g., define audience and message content)
Variants:	
2a. Customer preference settings **Problem**: Without preference to notification variants, customer may have feel annoyed with certain types of notification	Customers can control alert types, choosing which notifications to receive, such as order updates or campaign promotions.

Table 11. Task description for “Manage notifications & promotional campaigns” task

6. Workflows

6.1 Customer: Ordering process

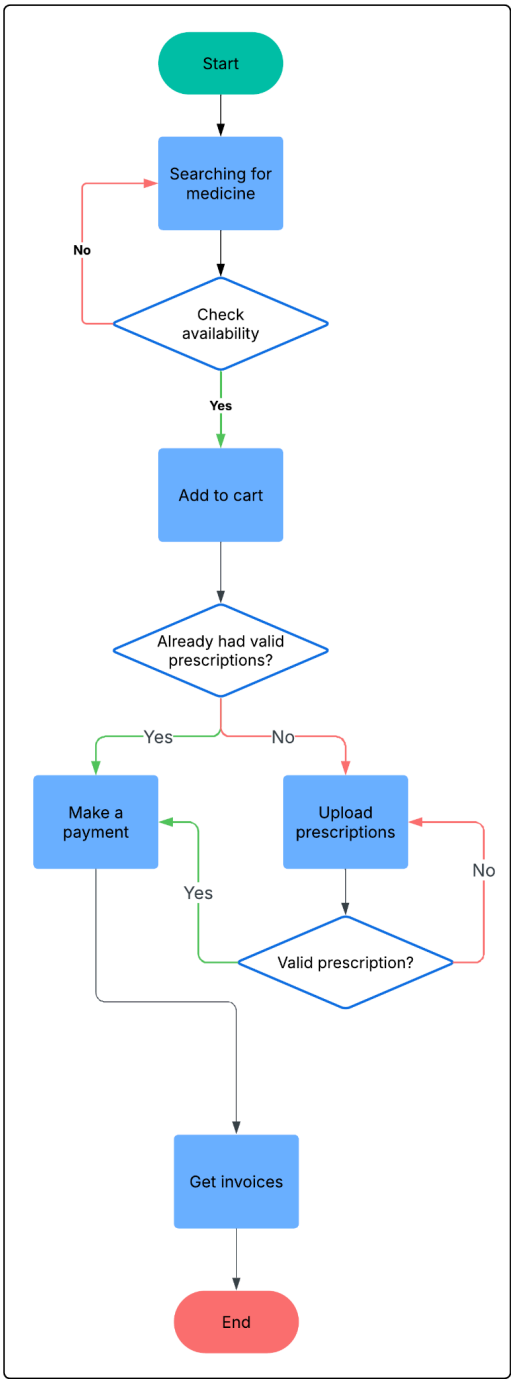

Figure 2. Workflow for high-level task: Place order

6.2 Staff: Fulfill and process orders

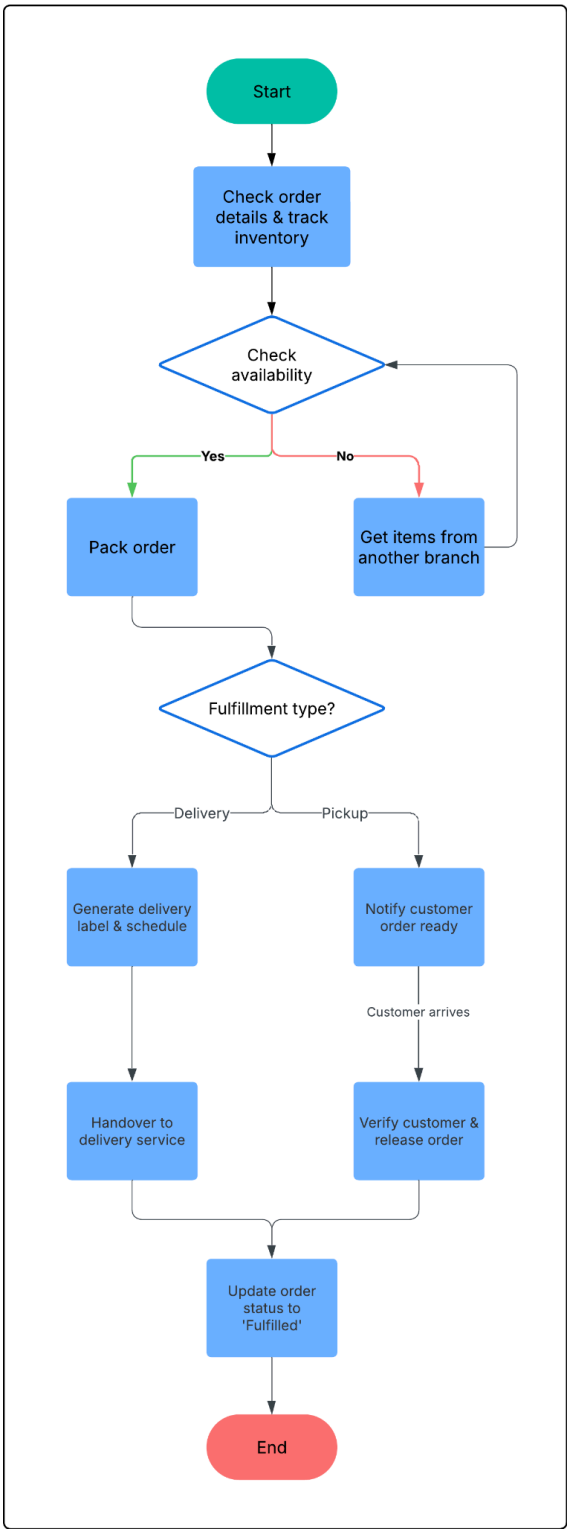

Figure 3. Workflow for high-level task: Fulfill and process orders

6.3 Staff: Generate and analyze operational reports

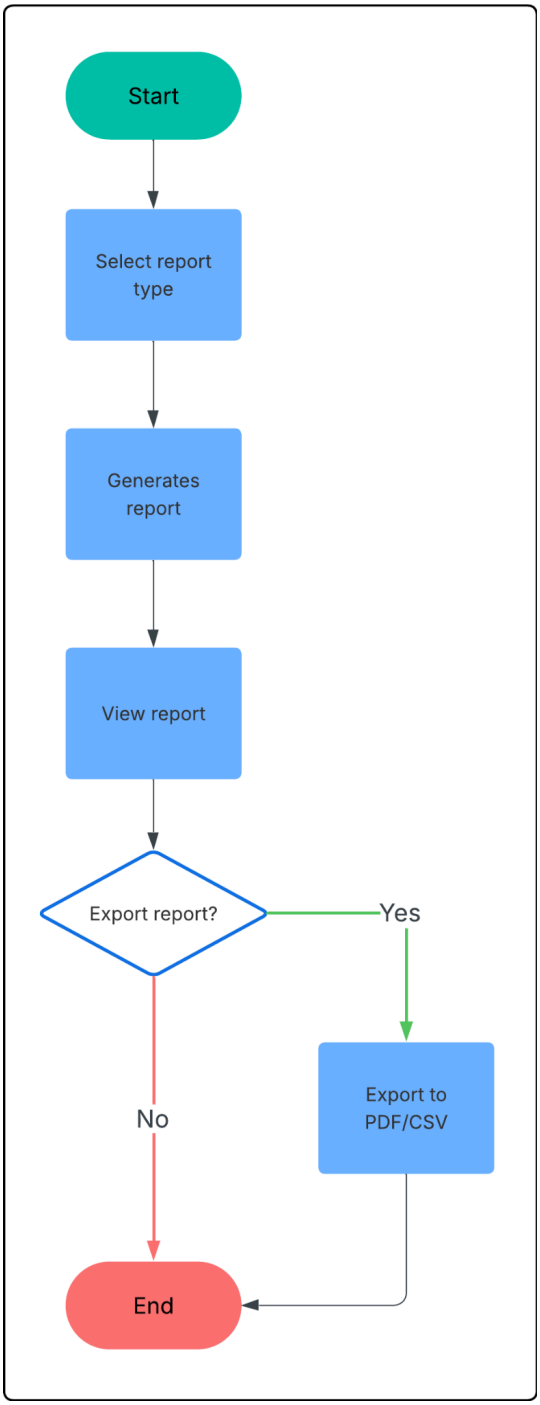

Figure 4. Workflow for high-level task: Fulfill and process orders

7. Quality attributes

7.1 Security

Dealing with sensitive customer health records and financial information means that security is a critical priority for the LC-PMS. The system must be designed and developed to prevent unauthorized access and fraudulent activities, while also ensuring data privacy laws and audit requirements.

In order to meet this quality attribute, the system must:

- **Enforce secure, role-based access control for all internal users:** Access to sensitive customer health records (e.g. prescription history, customer details) and financial data must be restricted based on roles (actors) and their specific responsibilities, preventing unauthorized viewing or modification
- **Protect sensitive customer health records and financial information:** All data transmissions must utilize industry-standard encryption protocols (e.g. TLS 1.2 or higher). Sensitive data stored in database must also be encrypted (e.g. AES-256). Payment will be processed in compliance with PCI-DSS standard.
- **Log all significant actions and events:** Actions involving the 4 CRUD functionalities to sensitive information must be recorded in an immutable audit log, including detailed info of actor and action. Logs shall be retained for a minimum of 5 years as per typical healthcare compliance standards.

7.2 Reliability

A reliable system is crucial to ensure continuous operations and build customer trust, especially in a fast-paced environment like a pharmacy where slow service and data inconsistencies can lead to customer dissatisfaction and operational inefficiencies.

In order to meet this quality attribute, the system must:

- **Achieve an uptime of 99.5% during Long Chau's operating hours** (typically 7 AM to 10 PM daily), excluding planned maintenance windows. Unplanned downtime shall not exceed **30 minutes per month.**
- **Real-time inventory tracking** must be ensured so that stock information is synchronized across all branches. All transactional data must be immediately consistent across read replicas, **no less than 3 seconds.**
- In the event of a **system failure** *(e.g. power outage, server crash)*, the system must be able to recover and restore full functionality within **15 - 30 minutes**, with little to none transactional data loss (<10% loss data rate) from the point of failure.

7.3 Portability

Typically, staff members in Long Chau pharmacy use their smartphones to complete their tasks, but sometimes they may use PCs or laptops. Hence, the Long Chau pharmacy management system (LC-PMS) must be easily transferable between diverse hardware and software environments to achieve portability. This ensures the system's accessibility and functionality across a range of devices and operating systems for both customer and staff use.

To meet this quality attribute, the system must:

- **Be accessible and fully operational on widely used web browsers and mobile platforms:** The LC-PMS customer portal website will maintain compatibility with the two most recent major releases of Chrome, Firefox, Safari, and Edge. Similarly, the mobile application must be fully functional and accessible on devices utilizing the two latest major versions of both Android and iOS operating systems.
- **Internal system interfaces must be accessible and function seamlessly on standard desktop and mobile devices utilized within pharmacy branches:** Users, including staff members, should experience consistent and efficient task completion across different devices. The system should perform effectively and provide a uniform user experience on desktop computers with Windows 10/11, as well as on mobile devices like tablets and smartphones running Android or iOS. Role-specific tasks must be accessible and smoothly executable on all mentioned platforms.

7.4 Scalability

Provided the business' growth trajectory and various branching factors, the LC-PMS must be scaled to handle increasing volumes, available inventories, and transactional loads across all branches and platforms.

In order to meet this quality attribute, the system must:

- **Operate in a cloud-based platform** with auto-scaling capabilities. When the CPU or memory usage exceeds 75% threshold for 2 consecutive minutes, the infrastructure will be automatically scaled in no more than 5 minutes.
- **Handle a minimum of 50,000 transactions per hour** (e.g, product searches, order submissions, payments).
- **Support at least 2,500 concurrent users** (including mobile, web, and in-store systems).

7.5 Usability

The system must address Long Chau's current inefficiencies and disconnected processes to improve daily operations, reduce manual work and enhance staff productivity as well as customer satisfaction.

In order to meet this quality attribute, the system must be developed **following Swinsoft Consulting's user-interface design guidelines.**

8. Other requirements

In addition to functional and quality attributes outlined above, the LC-PMS is required to meet the following product and design-level requirements.

8.1 Product-level requirements

These requirements specify the overall capabilities the software product must provide:

- The system stores and manages all data input by users (e.g., customer details, product information, order history).
- Data entry fields have relevant validation performed to ensure data accuracy and consistency.
- The system displays relevant information/data to users upon request (e.g., real-time inventory tracking, customer order status).
- The system generates and displays various detailed reports as required by management (e.g., product sales, customer demand patterns, overall performance across branches).
- The system automatically generates receipts for all transactions, suitable for both customers and internal records.

8.2 Design-level requirements

These requirements adhere to specific design decisions or constraints established upon the system's implementation:

- The LC-PMS user interface design adheres to Swinsoft Consulting's UI/UX design guidelines and Long Chau's existing branding guidelines.
- The system architecture is scalable to support future growth and potential integrations.
- The system implements strong data security measures to protect sensitive customer health records and financial information.
- The system supports multiple payment methods, including cash, credit/debit cards, and e-wallets.
- The prescription handling process is fully digital, allowing pharmacists to receive and validate prescriptions directly within the system.

9. Requirements validation

To ensure accuracy, completeness of the requirements established within the requirement document, a multi-faceted validation approach needs to be undertaken. This process involved engaging with various stakeholders and considering different perspectives on the system's potential implementation.

9.1 CRUD check

A conceptual Create, Read, Update, Delete (CRUD) check was performed against the identified domain entities and major user tasks to ensure comprehensive coverage of data operations. This helps confirm the completeness and consistency of the functional requirements. **The full CRUD check table is provided in Appendix A for reference.**

9.2 Possible solutions

9.2.1 Customer-oriented: Cloud-based web application with mobile access

This solution involves the development of the entire LC-PMS system as a centralized, cloud-based web application, accessible via both web browsers and mobile applications. This approach aligns with Long Chau’s strategic objectives and trajectory growth to enhance operational efficiency and support business expansion by implementing a scalable and modern solution for the network.

Customers can use the mobile app or website to search for products, upload prescriptions, place orders, track delivery, and receive receipts and notifications in real-time. The interface is designed with responsiveness in mind to support both PCs, mobile phones using Android and iOS platforms. Staff (pharmacists, cashiers, warehouse personnel, and branch managers) access the system through secure web portals with role-based access. Pharmacists can validate prescriptions digitally, inventory staff can update stock across branches in real-time, and managers can generate reports on the go. All data operations (orders, payments, receipts, inventory updates) are synchronized instantly across branches. The system integrates with the national tax invoice system for real-time e-receipt submission and audit trail compliance.

This solution ensures real-time data synchronization across all branches, enabling accurate stock tracking, fast prescription validation, and seamless customer service. Customers benefit from a consistent, intuitive experience whether they use a mobile app or desktop browser to search products, place orders, or receive updates. The cloud infrastructure supports auto-scaling during peak demand, improving system reliability and responsiveness. Moreover, centralized data storage allows for compliance with national tax and healthcare regulations.

9.2.2 Staff-oriented: Web-based internal application with centralized database

This solution focuses on building a web-based internal application primarily used by Long Chau Pharmacy staff, with customer interactions being staff-assisted (in-store). A centralized database hosted on a private or hybrid cloud supports real-time data access across all branches.

Customers interact with the system through staff members. For example, a customer visits the store and tells a cashier or pharmacist what they need, and the staff uses the system to search products, upload prescriptions, place orders, and issue receipts. Staff operate the system via desktop terminals or store-owned mobile devices. Inventory is centrally managed but updated manually by staff upon receiving shipments or fulfilling orders. Notifications (e.g. order status, prescription validation) are initiated by staff through predefined system templates.

The main advantage of this solution is its operational familiarity and control. It leverages staff-led interactions to ensure that processes like prescription validation, order fulfillment, and payment handling remain precise and compliant, particularly for customers less comfortable with digital self-service. The centralized database allows real-time updates across all branches while preserving a consistent and auditable transaction history. By simplifying the interface to internal users only, development complexity is reduced, and training for staff becomes more focused.

10. Requirements verification

The requirements of the Long Chau Pharmacy Management System (LC-PMS) are designed to be strongly verifiable, ensuring that each functional and non-functional specification can be objectively tested through well-defined acceptance criteria, traceability matrices, and systematic validation procedures.

- **Tasks & Support approach for functional requirements**: Functional requirements are described using the Tasks & Support method. This breaks down user tasks into explicit sub-tasks with Problems and Solutions that describe observable system behaviors.
- **Quantifiable metrics for quality attributes**: For non-functional requirements, each requirement is paired with specific, measurable metrics. For some attributes that are hard to verify using metrics like usability, the system should be designed in compliance with the guidelines provided by Swinsoft Consulting.

Quality attributes are highly verifiable thanks to thorough development of quantifiable methods.

- **Security**: Metrics like specific encryption protocols (e.g., TLS 1.2, AES-256) and audit log retention (e.g. "5 years") are verifiable.

- **Reliability**: Metrics such as "uptime of 99.5%" and "recovery within 15-30 minutes" are verifiable through monitoring and testing.
- **Portability**: Requirements for compatibility with browsers and mobile OS versions (e.g., "Android and iOS operating systems") are verifiable through compatibility testing.
- **Scalability**: Metrics like "50,000 transactions per hour" and "2,500 concurrent users" are verifiable through load testing.
- **Usability**: Metrics like "independent after 2 hours training" and "task completion rates of 90%" are verifiable through user testing.

Appendix

Appendix A: CRUD check

Task / Entity	Customer	Branch	Inventory	Product	Prescription	Order	Payment	Receipt	Staff	Notification
Search for products		R	R	R						
Place order	R		R	R	C, R	C, R				C
Process & validate prescriptions	R				R, U				R	C
Coordinate order fulfillment	R	R	R, U	R	R	R, U, D				C
Handle customer payments	R			R		R	C, U	C, U	R	C
Maintain & track inventory		R	C, R, U, D	R					R	
Generate & analyze operational reports	R	R	R	R	R	R	R	R	R	R
Manage notifications & campaigns	R									C, R, U, D

References

[1] J. Nielsen, “10 usability heuristics for user interface design,” *Nielsen Norman Group*, Apr. 24, 1994. https://www.nngroup.com/articles/ten-usability-heuristics/ (accessed Jun. 09, 2025).