Software Specification

for

<CareLog Project>

Version 1.0 approved

Prepared by:

<Au Yoong Jia Tong (36063908)>

<Kyaw Zin Aung Win (36545759)>

<Nguyen Duy Thien (36337927)>

<Zhao Shaotian (36229814)>

<We Love CareLog - MA-Tue4-6-G8>

Table of Contents

1. Introduction

CareLog is a lightweight hospital tool for recording daily patient notes in one place. It captures clinical details (pain, meds, appetite) and human details (stories, preferences, cultural needs) so the care team can understand what matters for the patient today and over time.

1.1 Purpose

This Software Requirements Specification (SRS) describes what the CareLog system must do and how it should behave. It lists the functional and non-functional requirements so everyone has a shared view of the product. The aim is to improve patient care by making note-taking fast, keeping records consistent, and highlighting key flags (e.g. allergies, consent limits).

This SRS will be the base for design, development, testing and acceptance. It clarifies scopes, roles and quality needs so the team can build the right features and measure success later.

1.2 Document Conventions

Term	Description
SRS	Software Requirements Specification
FR	Functional requirements
NFR	Non-Functional requirements
Care Staff	Staff members who look after the patients (e.g. doctors, nurses etc…)
Scopes	Boundaries to differentiate which will be done or not within a given time period.
IT	Information technology
CRUD	create/read/update/delete
PHI	Protected Health Information
RBAC	Role-based access control
MFA	Multi-factor authentication

2. Problem Statement

Context
 The Modern Health Clinic is a rapidly expanding healthcare provider that delivers medical services to a wide range of patients in the community. With the growing demand for quality healthcare, staff need a reliable way to record patient care notes and preferences. At present, however, many of the processes are managed manually, which leads to inefficiencies and creates barriers to delivering seamless patient care.

AS-IS + Pain Points
 Currently, patient information is stored in physical files and spreadsheets. This makes it hard for staff to quickly retrieve or update records, often causing delays during care and increasing the risk of misplaced or outdated information. Notes are also handwritten, which slows down communication between shifts.

 Moreover, patient information is also recorded and stored in physical files and unsecured spreadsheets (**Landi**, **2019 ; Hcinnovationgroup**, **2025 ; AGENCY**, **2023**). These records are not protected with proper encryption or access controls, meaning that unauthorized individuals could easily hack to view, copy, or even steal sensitive patient data. As a result, there is a significant risk of data breaches where confidential medical histories, contact details, or financial information could fall into the hands of malicious actors.

- **Pain Point 1:** Lack of proper security measures exposes the clinic to the threat of unauthorized access, which may lead to the misuse of sensitive patient data.
- **Pain Point 2:** A breach of patient confidentiality damages the trust between patients and the clinic, and could also result in legal consequences and financial penalties under data protection regulations.
- **Pain Point 3:** Hard to retrieve and update patient information leading to delays during consultations and a higher chance of misplaced or outdated records.
- **Pain Point 4:** Paper records and scattered files can cause important details to be missed between shifts, frustrating both staff and patients.

TO-BE
 To face these challenges, the clinic requires **CareLog,** a system that centralizes patient data and secures patient information through encryption. Such a system would not only reduce administrative errors but also provide real-time access to accurate patient information, improving decision-making and patient outcomes. Furthermore, the system should be easy for care staff to use and support secure reporting. By adopting this solution, the clinic can enhance efficiency, improve patient satisfaction, and ensure that healthcare delivery remains consistent, reliable, and future-ready.

Note: In this version 1 (V1), the focus is on core features like patient note-taking, record searching, scheduling and feedback collection. More advanced features such as automated reminders and cloud synchronization will be considered in future updates (out of scope).

3. Stakeholder Analysis

3.1 Goals and role for each stakeholder

Stakeholder	Role	Goals	Influence	Importance	Linked FR/NFR
Patients	People receiving care. Their health status and preferences are logged.	Want their medical condition, daily feelings and personal preferences (e.g. diet, religious practices, preferred caregiver gender) to be recorded and respected.	Low	High	Patient FR1 (store data), FR3 (update wellbeing), FR7 (view history), General FR2 (keyword search), Patient NFR1 (easy interface)
Care staff (Nurses and Doctors)	Main users of CareLog; enter logs during shifts.	Need a fast and simple way to record observations (e.g. pain level, mood, mobility, appetite) and read yesterday's notes without wasting time.	High	High	Care Staff FR1–FR7 (notes, updates, search, reminders, highlights, schedules), Care Staff NFR1–NFR4 (any device, easy training, fast response, availability)

Admin staff	Manage accounts, assign staff to patients, ensure logs are organized.	Want a clear system to add/remove users, assign patients to the right staff and avoid errors.	High	High	Admin FR1–FR4 (CRUD users, search, workload filter, keyword search), Admin NFR1 (availability), NFR4 (response time)
IT and Privacy staff	Technical staff who run the system and keep the data safe and make it accessible to the right people.	Need to protect patients data, manage access rights and ensure privacy rules are followed.	High	High	Admin NFR3 (secure info), Admin NFR5 (data encryption), General NFR1 (availability 90%), General NFR2 (search speed)
Family	Support patients by sharing important information (if patient allows or emergency)	Want to add cultural needs or special requests when patients cannot.	Low	High	Patient FR2 (feedbacks), Patient FR3 (update wellbeing)
Hospital Executives	Oversees hospital operations and budgets.	Wants CareLog to improve efficiency, reduce mistakes, and show a good satisfaction level from patients	High	Low	Admin FR3 (workload balancing), Care Staff FR1 (fast notes), Care Staff NFR3 (2s response), General NFR4–NFR5 (easy maintenance, usability)

		without being too costly.			
Government	Set regulations for healthcare and data protection.	Want CareLog to respect regulations by keeping data private, recording consent and supporting required reports.	High	Low	Researcher NFR1 (HIPAA/GDPR compliance), Admin NFR3 (secure data), General NFR6 (accurate search result)
Researchers	Use unidentified CareLog data for studies and training improvements.	I want to access safe, reliable and non-identifiable data to find care trends and improve health outcomes.	Low	Low	Researcher FR3 (access anonymized data), Researcher NFR1 (regulation compliance)

3.2 Influence-Importance Matrix
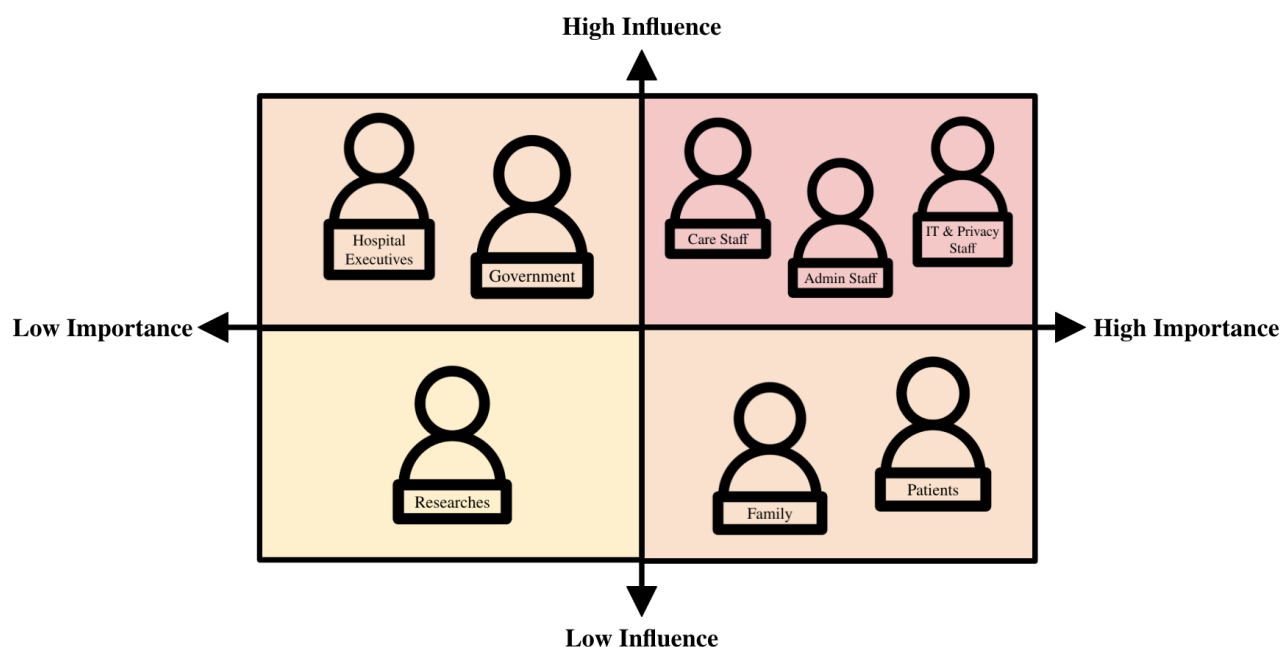
Rationales:

1. Patients and care staff have high importance because they use CareLog daily, but only care staff have a high influence since they affect how the system is used.

2. Admins and IT staff are both of high influence and importance because they manage system data and security.

3. Executives and Government have influence (set rules and budgets) but lower daily importance.

4. Family and researchers are of low influence because they cannot affect the system, but only family is of high importance as they represent the patients when they cannot express their needs themselves.

3.3 Persona

Patient

Name: Abdul Raghid

Occupation: Retired Bodybuilder

Company: Protein Pounder(PP)

Location: Puchong, Selangor, Malaysia

Company

Industry	Fitness
Company size	Small (community gym)

Demographic information

Age	45
Gender	Male
Status	Married for 20 years
Educational attainment	Master's in Kinesiology
Tech Literacy	Medium
Monthly income	4,000-8,000 RM (depends because he owns the business)

Needs and motivations

Core Needs	Frustrations
• Record health updates & preferences • Staff can see past notes (no repeats) • Staff know his background	• Info lost between shifts • Slow to find records • Small details forgotten
Goals	**Personality**
• Be heard and respected • Clear records; no repeating • Cultural/religious needs remembered	• Family-oriented • Religious

Bio

Abdul is a middle-aged man who visits the hospital often for heart and spine check-ups. He prefers to talk about his daily life and feelings with nurses, but sometimes this gets forgotten in the paper notes. He values respect and wants staff to remember his cultural and religious needs.

Care Staff

Name: Sarah Lim

Occupation: Registered Nurse

Company: Sunway Medical Centre Berhad

Location: Bandar Sunway, Selangor, Malaysia

Company

Industry	Healthcare
Company size	L:arge Enterprise

Demographic information

Age	32
Gender	Female
Status	Single
Educational attainment	Bachelor's of Nursing
Tech Literacy	Medium (comfortable with smartphones: WhatsApp, basic hospital systems, but not advanced software)
Monthly income	3,800 RM

Needs and motivations

Core Needs	Frustrations
- Fast note entry during rounds - Quick access to past notes(no repeat questions) - Reminders for meds/tasks - Secure but quick login	- Hunting for paper files wastes time - Shift miscommunication/missing notes - Small but key details get lost (e.g. diet) - Updates scattered across records
Goals	Personality
- Less paperwork, more patient time - Smooth handovers; nothing missed - Remember preferences/risks for better care - Data feels secure and organized	- Efficient, detail-oriented - Compassionate, patient-focused

Bio

Sarah is a registered nurse working in the Modern Health Clinic for the past 7 years. She works rotating shifts and often juggles between patient rounds, medication schedules, and communicating updates to doctors. Paper-based notes frustrate her because she frequently wastes time searching for files or trying to recognize those handwriting from the previous shift. She wants a system that saves her time, reduces errors, and helps her provide consistent, compassionate care without being bogged down by administrative tasks.

(Indeed, 2025)

Admin

Name: John Kim

Occupation: Hospital Admin Staff

Company: Sunway Medical Centre Berhad

Location: Subang Jaya, Kuala Lumpur, Malaysia

Company

Industry	Healthcare
Company size	L:arge Enterprise

Demographic information

Age	35
Gender	Male
Status	Married for 5 years
Educational attainment	Diploma in Healthcare Administration
Tech Literacy	Medium (comfortable with using digital devices like mobile phones and computers, but not specialized.)
Monthly income	3,000 RM

Needs and motivations

Core Needs	Frustrations
- Add/update/remove patients & care staff; manage logs fast - Quick search for patients/logs - Filters to balance workload; assign staff efficiently - Secure system; no data leaks	- Slow to update paper logs - Time wasted searching files - Errors/missing info between shifts - Risk of data loss (e.g., disasters)

Goals	Personality
- Manage patient & staff logs efficiently - Keep info accurate; fix errors immediately - No lost or missing logs (reliable records)	- Organized - Family-centered

Bio

John Kim is an hospital administrator, working in the Modern Health Clinic for 4 years. He ensures that the logs and records of the hospital's patients and care staff are kept appropriately and completely. He finds handling data paper-based logs inefficient as he needs time to find someone's log and he also finds it hard to assign care staffs to patients. He wants a system that could manage patients' and care staffs' logs more efficiently.

(*Administrative Officer Salary in Subang Jaya*, 2025)

Researcher

Name: Dr. Mei Lin

Occupation: Public Health Researcher

Company: IQVIA

Location: Kuala Lumpur, Malaysia

Company

Industry	Public Health Research
Company size	Large

Demographic information

Age	38
Gender	Female
Status	Single
Educational attainment	PhD in Epidemiology
Tech Literacy	High (fluent with SPSS/R/Python, big datasets, viz, secure clouds; quick adopter and trains others)
Monthly income	10,000 RM

Needs and motivations

Core Needs	Frustrations
- Reliable access to anonymized CareLog data - Accurate, up-to-date, comprehensive datasets - Privacy protected without blocking insight	- Privacy limits block needed data - Messy, inconsistent formats - Long approval waits for records

Goals	Personality
- Spot trends to improve outcomes - Publish work that guides policy/training - Link academia to practical solutions	- Analytical, evidence-driven - Curious and innovative - Collaborative but critical

Bio
Dr. Mei Lin is an experienced researcher working at a medical university. She specializes in analyzing healthcare trends and outcomes using hospital data. She often collaborates with hospitals to access anonymized patient records, which she uses for research publications and policy recommendations. She values accuracy, accessibility, and security of data. She also prioritizes ethical practices in handling patient information.

Note: Refer to 'Appendix A & B' for stakeholders interviews. Salary: (ERI Economic Research Institute, 2025)

4. System Features and Requirements

Each specific user has their own requirements for them to use the system.

Functional requirements - FR
Non-functional requirements - NFR

4.1 Admin

In-of-scope
Functional requirements
1. (FR) - The system shall allow admins to create, update and remove patients & care staff to manage logs.
2. (FR) - The system shall allow admins to search for the patient's personal information or health records.
3. (FR) - The system shall allow admins to get the number of patients that a care staff has and filter the care staff that has lesser workload - to assign care staff efficiently and balance the workload of care staff.
4. (FR) - The system shall have searching log of patients and carestaffs by keywords (type of injuries/disease/name)

Non-Functional requirements
1. (NFR) - The system should be available 90% of time except scheduled maintenance time (3am-4am) and physical issues (disaster) (reliability)
2. (NFR) - The system shall be easy to maintain.
3. (NFR) - The system must securely store user information.
4. (NFR) - The system shall respond to a search request for patient information within 2 seconds (performance efficiency).

Out-of-scope
Functional requirements
1. (FR) - The system shall allow users to login the account fast by using QR code or sending verification email.
2. (FR) - The system shall send users notification/reminders of appointments, deadlines.
Non-Functional requirements
1. (NFR) - The system should store data in the cloud to sync with other healthcare facilities and to prevent risk of data loss
2. (NFR) - The system shall automatic backups with disaster recovery options (reliability)
3. (NFR) - The system shall support for multi-language

4.2 Care staff

In-of-scope
Functional requirements
1. (FR) - The system shall allow carestaffs to fast note.
2. (FR) - The system shall allow carestaffs to update patient's disease details at any time.
3. (FR) - The system shall allow carestaffs to search for patients informations/records
4. (FR) - The system shall allow carestaffs to fast access the past notes.
5. (FR) - The system shall allow carestaffs to note/highlight information/key details.
6. (FR) - The system shall allow carestaffs to schedule their tasks/works/appointments.

Non-Functional requirements
1. (NFR) - The system shall be accessed on any device like computer, phone, tablet (usability)
2. (NFR) - The system shall be easy to learn and use by receptionists with basic computer skills, with a maximum of 2 hours of training. (usability)
3. (NFR) - The system shall respond to search request of patient information within 2 seconds (performance efficiency)
4. (NFR) - The system should be available 90% of time except scheduled maintenance time (3am-4am) and physical issues (disaster) (reliability)

Out-of-scope
Functional requirements
1. (FR) - The system shall allow carestaffs to login the account fast by using QR code or sending verification email.
2. (FR) - The system shall send users notification/reminders for medicines, appointments, medical treatments, deadlines.
Non-Functional requirements
1. (NFR) - The system shall automatic backups with disaster recovery options (reliability)
2. (NFR) - The system shall support for multi-language
3. (NFR) - The system should store data in the cloud to sync with other healthcare facilities and to prevent risk of data loss

4.3 Patient

In-of-scope
Functional requirements
1. (FR) - The system shall allow patients to store the data on the system.
2. (FR) - The system shall allow patients to give feedbacks
3. (FR) - The system shall allow patients to sent/update their physical, mental, and social well-being at a given time
4. (FR) - The system shall allow patients to search for doctors/carestaffs by name/medical field
5. (FR) - The system shall allow patients to register profile

6. (FR) - The system shall allow patients to update personal/contact details
7. (FR) - The system shall allow patients to view their medical history and health records

Non-functional requirements

1. (NFR) - The system shall have a simple and easy-to-use interface as different patients have different technology skills.
2. (NFR) - The system should be available 90% of time except scheduled maintenance time (3am-4am) and physical issues (disaster) (reliability)
3. (NFR) - The system shall respond to a search request for patient information within 2 seconds (performance efficiency).

Out-of-scope
Functional requirements

1. (FR) - The system shall allow patients to receive appointment/medical treatment reminders and notifications
2. (FR) - The system shall allow users to login the account fast by using QR code or sending verification email.

Non-functional requirements

1. (NFR) - The system shall read out which part of the system the patient is at, so that they can do what they want to do.
2. (NFR) - The system shall automatic backups with disaster recovery options (reliability)
3. (NFR) - The system shall support for multi-language
4. (NFR) - The system should store data in the cloud to sync with other healthcare facilities and to prevent risk of data loss

4.4 Researcher

In-of-scope
Functional requirements

1. (FR) - The system shall allow researchers to create and manage research projects
2. (FR) - The system shall allow researchers to upload, store and organize the documents/lab results
3. (FR) - The system shall allow researchers to access patient or study participant data (with proper consent and anonymization).

Non-Functional Requirements

1. (NFR) - The system must comply with research regulations and data protection laws (HIPAA, GDPR, FDA 21 CFR Part 11)
2. (NFR) - The system shall respond to a search request for patient information within 2 seconds (performance efficiency).
3. (NFR) - The system should be available 90% of time except scheduled maintenance time (3am-4am) and physical issues (disaster) (reliability)

Out-of-scope
Functional requirements
1. (FR) - The system shall allow researchers to share data and documents securely with other researchers or institutions.
2. (FR) - The system shall provide notifications for data updates, approvals, or deadlines.
3. (FR) - The system shall allow users to login the account fast by using QR code or sending verification email.
4. (FR) - The system shall send researchers notification/reminders for deadlines, grant submissions, or approvals.

Non-Functional Requirements
1. (NFR) - The system shall automatic backups with disaster recovery options (reliability)
2. (NFR) - The system shall support for multi-language
3. (NFR) - The system should store data in the cloud to sync with other healthcare facilities and to prevent risk of data loss

4.5 General requirements

In-of-scope
Functional requirements
1. (FR) - The system shall allow users to register their profile
2. (FR) - The system shall allow users to search for data/name with keywords

Non-Functional Requirements
1. (NFR) - The system should be available 90% of time except scheduled maintenance time (3am-4am) and physical issues (disaster) (reliability)
2. (NFR) - The system shall respond to a search request for patient information within 2 seconds (performance efficiency).
3. (NFR) - The system shall be accessed on any device like computer, phone, tablet (usability)
4. (NFR) - The system shall be easy to maintain.
5. (NFR) - The system should be easy to use for everyone
6. (NFR) - The searching result must be accurate, complete, and relevant information.
7. (NFR) - The system shall store user passwords using a modern password-hash algorithm (e.g. Bcrypt or Argon2) with salt.
8. (NFR) - The system shall enforce role-based access control (RBAC) for admin, care staff, patient, and researcher roles so each role can only see what they are allowed to.
9. (NFR) - The system shall auto-logout idle sessions after 15 minutes of inactivity to protect data from unauthorized access.
10. (NFR) - The system shall maintain an audit log of who viewed or changed patient records, including timestamp, user and action.
11. (NFR) - The system shall apply rate-limiting and temporary account lockout after repeated failed login attempts to prevent brute-force attacks.

12. (NFR) - The system shall require multi-factor authentication (MFA) for staff accounts to increase login security.

Out-of-scope
Functional requirements

1. (FR) - The system shall allow users to login the account fast by using QR code or sending verification email.
2. (FR) - The system shall send users notification/reminders for medicines, appointments, medical treatments, deadlines.
3. (FR) - The system shall check for scheduling conflicts based on (patient_id, carestaff_id, time_window).

Non-Functional Requirements

1. (NFR) - The system shall encrypt all patients and hospital care staff's data (security)
2. (NFR) - The system shall automatic backups with disaster recovery options (reliability)
3. (NFR) - The system shall support for multi-language
4. (NFR) - The system shall store data in the cloud to sync with other healthcare facilities and to prevent risk of data loss
5. (NFR) - The system shall comply with basic web content analysis guidelines basics including:
   - Full keyboard navigation support
   - Use suitable color contrast for text and interface elements
   - Clear labels for all input fields and buttons

4.6 System Features

1. Medication & Food Recommendation (Based on Patient Records)
   - This system feature recommends food and medication for the patient based on the patient records.
   - Data sources: recommendations are derived from verified clinical databases, nutrition guidelines, and the patient's health records.
   - Validation: All generated recommendations are validated against medical rules and checked for potential conflicts (e.g., allergy or drug interaction alerts).
   - Before implementation, each recommendation must be reviewed and confirmed by a licensed clinician or care staff to ensure safety and accuracy.
   - It detects keywords from patient records and allocates food and medication according to it.
   - Purpose of the feature: to decrease the workload for the care staff as they would not need to think about food and medication for the patient.
2. Patient record search (with filters)
   - This system feature shows patient records searched by admins or care staff.
   - This system feature allows care staff and admins to input any keywords about the patient and it would show all the patients that fits the keyword.
   - Purpose of the feature: to look for a patient record efficiently.

3. Schedule - who, where and when
   - This system feature allows care staff to create any schedule for the patient (e.g. check-ups, treatments etc).
   - The schedule contains information of the care staff that are involved in, where the schedule is held (e.g. CT room, doctor room etc), and what date and time the schedule is held on.
   - The schedule information can be updated (e.g. delay the schedule time, change the venue of schedule etc) and can be cancelled (delete) too.
   - Purpose of the feature: to remind care staff and patients about the schedule.
4. Food to deliver - what, where and when (daily basis)
   - This system feature allows care staff (mainly nurses) to create a "food to deliver", similarly to order, but created on a daily basis where it sets the food to deliver everyday.
   - The food to deliver information consists of the food to deliver, which patient room to deliver and when to deliver the food.
   - The food to deliver information can be updated (e.g. change the food to deliver, change the time to deliver the food etc) and can be cancelled (delete) too.
   - Purpose of the feature: to remind care staff (mainly nurses) about the food that they need to deliver.
5. Create, update and delete patient record (for care staff and admin)
   - This system feature allows admin to create patient record when new patient is admitted to the hospital
   - Furthermore, it allows care staff to update any patient log (medical conditions etc) and delete the patient record after the patient is discharged from the hospital.
   - Purpose of the feature: to store all the patient records of the hospital.
6. Record feedbacks after the consultations in freetext form (for patients)
   - This system feature allows patients to give their feedback after every consultations, which would be given to the care staff and admin
   - Purpose of the feature: allow care staff and admin to improve themselves.
7. Flag patients as high-risk when uploaded logs contain keywords such as the seriousness of the injury, type of disease, mood
   - This system feature flags patients that are high-risk.
   - It detects keywords seriousness of the injury, type of disease and mood from the patient's record and determines whether they are high-risk.
   - Purpose of the feature: to let care staff pay special attention to the patients that are high-risk.

5. Acceptance Criteria

User Management and creating profiles
1. When the user submits all required fields, the system creates an account and displays a success message within 2 seconds.
2. Admins can create, update, and remove patient and care staff accounts.

3. When a patient updates their profile, changes are stored and visible on refresh within 5 seconds, regardless of time of day.
4. When care staff submit updated disease details, the record reflects changes immediately and logs the staff ID.
5. Researchers can create, edit, and delete projects; changes are saved persistently and viewable by authorized users only.

Data entry and storage
1. When users enter valid data, it's stored and retrievable without corruption (e.g., patient logs, research documents, health details).
2. The system ensures all stored data is encrypted using the specified method.
3. When patients access records, data loads fully with zero missing fields or database errors.
4. Researchers can upload and organize research-related documents/lab results.
5. Data integrity is maintained, with no unauthorized modifications or losses.

Searching system
1. When users enter a keyword, matching records display in under 2 seconds (name, type of illness, field, etc.).
2. Search results return accurate, complete, and relevant information.
3. The system responds to search requests within 2 seconds.
4. Past notes load within 2 seconds after a search query.
5. Patients can search for doctors or care staff by name or specialty.

Schedule management
1. Admins can view the number of patients per care staff.
2. The system provides filtering to balance workload by assigning staff with fewer patients.
3. When carestaff create or edit a schedule, changes are visible to others within 2 minutes.
4. The system shall provide reminders for appointments, medication and important tasks 10 minutes before the scheduled event.
5. Task updates are visible instantly and sync between devices.

System usability and accessibility
1. The system shall be accessible on multiple devices (desktop, mobile, tablet).
2. The system shall be simple and friendly for 80% users with basic tech skills to complete simple task like (login, search, update) without assistance during testing..
3. After 2 hours of training, care staff can complete 5 key actions (login, update patient, view schedule, search, feedback) without error.
4. The system shall provide note/highlight features for easy referencing.
5. 90% of test users of varying skill levels can complete registration and view history without any help.

Performance and reliability
1. The system is available 90% of the time, excluding scheduled downtime (3–4 AM) and physical issues (disasters).

2. The system shall support concurrent access by up to 100 users while maintaining the performance target:
    - Data entry: response time within 2 seconds
    - Search operations: average latency within 3 seconds for datasets up to 10000 records
3. Routine system maintenance does not affect stored data.
4. All actions (data entry, search, updates) complete without crashing or freezing.
5. Automatic system recovery occurs in the event of unexpected downtime.

Security and compliance
1. All patient and staff data are encrypted during storage and transfer.
2. User information is securely stored and protected
3. Access to research data is only possible with proper consent
4. The system must comply with healthcare regulation (HIPAA, GDPR, FDA 21 CFR Part 11).
5. Users must log in before accessing sensitive data.

Medication & Food Recommendation (Based on Patient Records)
1. The system shall recommend safe medications and food for patients according to their disease history and allergy records.
2. The system shall prevent recommending any medication or food that may conflict with a patient's allergies.
3. The system shall provide reasoning or justification for each recommendation (e.g., "Recommended due to diabetes diagnosis").
4. The system shall update recommendations immediately when a patient's record is updated.
5. The system shall allow care staff to view and confirm the recommendations before applying them to the patient's care plan.

Patient record search (with filters)

1. The system shall allow care staff to search for patient records by applying filters such as Department, Mood Level, or Seriousness Level.
2. The system shall allow carestaff to combine multiple filters to refine search results.
3. The system shall return results quickly and efficiently, even when large numbers of records exist.
4. The system shall display results in an organized list, with the option to sort by Patient Name, Patient ID, or Date of Last Update.
5. The system shall display a clear message if no patient records match the selected filters.

Schedule - who, where and when
1. The system shall let care staff view schedules for patient activities.
2. Each schedule must show **who** is responsible, **where** it will happen, and **when** it is planned.
3. The system shall prevent time clashes based on (patient_id, carestaff_id, time_window) (e.g., two activities at the same time for the same patient).
4. The system shall show the schedules happening soon first inside - care staff can know what is happening next.
5. The system shall notify the person that is responsible for the schedule 10 minutes before the scheduled time.

Food to deliver - what, where and when (daily basis)
1. The system shall accept new food delivery entries 24/7 and save records immediately upon submission.
2. The system shall keep all the food to deliver records everyday - records can be used for the next day too where care staff would not need to input details again.
3. The system shall allow care staff to change the food of a patient, change the location to be delivered and the time to be delivered.
4. The system shall allow the care staff to indicate that the food was delivered - to prevent care staff sending it twice or overlook.
5. The system shall remind the carestaffs to deliver the food - to prevent carestaffs forgetting it.

Create, update and delete patient record (for care staff and admin)
1. The system shall allow admin to create more than one user at the same time.
2. The system shall show all the lists of patients with the same name if there are patients with the same name, and allow care staff to choose which patient record to update when care staff wants to update patient records.
3. The system shall only allow admin or care staff to delete patient records, proving that patients are approved to be discharged from the hospital.
4. The system shall only allow care staff to update any observation records on patients' records, to ensure that their observation records are true.
5. The system shall update any information on the patient record immediately after changes requests are entered.
6. The system shall keep the deleted patient record (patients that are discharged from the hospital) in case the patient wants the record for some purposes.

Record feedbacks after the consultations in freetext form (for patients)
1. The system shall allow patients to enter their feedback with no word limit.
2. The system shall only allow care staff and admins to view patient feedback in the patient's record.
3. The system shall allow feedback to be edited by the patient, and will notify care staff once the feedback is edited.
4. The system shall keep all the feedback by patients - can monitor the progress through feedback.
5. The system shall send a notification to care staff and admins after the patient has submitted their feedback - to remind them to read it.

Flag patients as high-risk when uploaded logs contain keywords such as the seriousness of the injury, type of disease, mood
1. The system shall automatically flag the patient as "High Risk" once any keyword (e.g., "severe pain", "high fever", "fall risk", "depressed") is detected.
2. A flagged patient shall appear on a **high-risk list** visible to care staff.
3. The system shall notify the care staff on duty when a patient is flagged - ensuring that they closely monitor the patient.
4. Once the patient is not in high-risk (after care staff updated their observations), the patient shall be un-flagged and removed from the high-risk list.
5. The system shall check their logs every time immediately after care staff update it.

6. Use Case Diagram

Ensure Seecurity & Access Control

IT staff protect sensitive patient data by setting permissions, encrypting records, and monitoring system access for compliance with regulations.

Provide Feedback

Patients share comments on their care experience in free text. Feedback is stored, editable by patients, and visible to staff/admins for improving service.

Record/Update Patient Notes

Care staff and patients (or family) enter new observations or personal details into the system. Notes can include medical info (pain, appetite, meds) or personal needs (diet, cultural practices).

Flag High-Risk Patients

The system automatically identifies "high-risk" patients by detecting keywords in logs (e.g., "severe pain"). Alerts care staff immediately so they can respond.

Schedule Tasks/Appointments

Care staff plan activities such as check-ups, treatments, or tasks. Prevents time clashes and sends reminders for upcoming responsibilities.

Plan & Track Food Delivery

Care staff manage daily food schedules (what, where, when). Includes reminders, record-keeping, and updates so meals are not missed or duplicated.

Search & Retrieve Records

Admins and care staff search for patient records quickly, using filters like department, seriousness, or mood level. Ensures fast access during consultations or shift handovers.

Manage Accounts & Roles

Admins create, update, or remove users (patients, staff). They also assign patients to specific care staff, balancing workloads and ensuring correct access levels.

7. Comprehensive System Context Analysis

7.1 Operational

The operational context explains the physical settings of use, in details:
1) What environmental conditions might the product encounter.
2) What sorts of resources will likely be available to keep the product functioning.

1) Environmental condition
1. Physical environment
   - Operating environment of the system: hospital in general - nurse stations for nurses, doctor rooms for doctors, offices for admin, patient room for patients and family.
   - Possible conditions that may encounter:
      1. No power supply - if devices have no battery it cannot be charged and the system cannot be accessed.
2. Technical environment
   - (Security reason) - Use intranet, a private network limited within the hospital which is isolated from the public internet; only insiders (care staff, admin and patients) can access the system and outsiders cannot access the system without going through VPN.
   - Possible conditions that may encounter:
      1. Slow speed - if there is a high demand on using the system it will cause lag and it takes care staff more time to implement information in the system.
      2. Network outages - if a switch or router or server fails, may lose access to the system.
      3. Cannot access specific places in hospital - there is a possibility that the network coverage does not cover some places, where the system cannot be accessed at some places.
3. Organizational and Human environment
   - Possible conditions that may encounter:
      1. Different stakeholders have different technical requirements - patients have higher technical requirements than care staff, where they need a system that is easy to use, especially for the ones with disabilities (for example, blind patients).
      2. The system may not be always accessible - hospitals run 24 hours and never stop working, stakeholders need to have access to the system at any time; however, IT staff would have a maintenance time everyday to maintain the system.
4. Regulatory & security environment
   - Possible conditions that may encounter:
      1. Leakage of data - intranet might not always be safe and there would definitely be a chance for outsiders to hack into the system, where outsiders could get patient information.

2. Misuse of patients' personal information for care staff and admin - care staff and admin have access to patients' personal information where there is a chance that they use it for something illegal, violating the laws.

2) Resources

1. Human resources
   - IT staff: monitors the system condition and makes necessary changes if needed, it is the main resource to maintain the system to keep functioning.
   - Care staff, admin and patients: the main stakeholders that use the system, which could provide feedback and ensure that the system functionality is correct.
   - Training team that trains care staff and admin to use the system: teaches the main stakeholders of the system to use the system, ensures that they know how to use the system.
2. Technical resources
   - Hospital IT infrastructure: provides the main hardware and software to use the system.
   - Security tools and monitoring system: to monitor the internet movements, to keep the system secured and ensure that no outsiders hack to destroy the system.
3. Financial resources
   - Hospital budget: to hire an IT company to create and maintain the system.
4. Organizational resources
   - Government policies: clear hospital IT policies for system use, incident handling and data access.

7.2 Behavioral

The behavioral context of CareLog explains how the system behaves when users interact with it in daily hospital situations. It looks at the actions, responses, and routines that happen around the system.

1. Care Staff (Nurses, Doctors)
   - During patient rounds, staff log both medical details (pain level, food intake, medication response) and personal notes (patient mood, stories, cultural needs).
   - The system should allow quick entry so staff don't waste time typing long forms.
   - Staff will often use the system in short breaks, so it needs to be fast and not overloaded with steps.
   - Logs entered are used later to share updates with other staff, so accuracy and clarity matter.
2. Patients
   - Patients share their stories, preferences, or cultural needs (e.g. prefer female doctor, specific diet).
   - They behave more openly when they feel respected, so the system must be easy for staff to record sensitive details in a respectful way.

- Patient notes are not just one-time entries. They build up over time to reflect how the patient's overall experience changes.
3. Admin Staff
    - Admins monitor if staff are filling logs correctly and completely.
    - They check system usage (who entered what and when) for compliance and audits.
    - They also assign patients to certain staff, so the system must support managing roles and access levels.
4. System Behavior in General
    - The system reacts to each input immediately: saving notes, updating logs, or alerting if something is missing.
    - It behaves as a central record, meaning all updates are stored safely and can be seen by the right people only.
    - Privacy and access control are built into the system's behavior, so patient's personal stories are not misused.
    - Behavior also includes remainders (like if a log hasn't been completed for the day).

7.3 Ecological

The ecological context explains the networks of organizational, legal, and economic relationships, in detailed:
1) What actors and stakeholders are involved in creating and maintaining the system.
2) What do those actors and stakeholders need to participate and cooperate.

Actors and stakeholders
1. Care staff (nurses and doctors)
   - Care staff use the system to check out patients' condition and update it.
   - They are the main users of the system where they need to consistently use the system and provide feedback on the usability of the system.
2. Admins
   - Admin handles patients and care staff; by adding new patients' information and removing discharged patients, and assigning care staff to patients.
   - They need to ensure that all the data and information of the patient and care staff entered into the system is accurate.
3. Patients
   - Patients give feedback to the care staff and input how they feel everyday into the system.
   - Their job is to use the system appropriately and responsibly.
4. IT and Privacy staff
   - IT and privacy staff maintain the entire CareLog system, and make necessary changes to the system if needed.
   - They ensure that the system is kept up to date, secured, and available except for maintenance time.
5. Family
   - Family members of patients rely on the system to obtain the latest information of their patient.

- Their job is also to use the system appropriately and responsibly.

6. Government
   - The government oversees the responsible use of patient data.
   - Their job is to ensure legal compliance and conduct audits.

7. Hospital executives
   - Hospital executives set the usage policies, approve system adoption and funds for the system.
   - They participate by setting policies and allocating resources.

8. Researches
   - Researchers use the data in CareLog to analyse and help improve the system.
   - They need to cooperate with not leaking information and data inside the system.

7.4 Sociocultural

1. **Different cultures & beliefs**
   Patients and staff come from many backgrounds. CareLog should help record and follow preferences like diet rules, prayer times, or preferred caregiver gender so care feels respectful.

2. **Language & Clarity**
   Notes must be easy to read (plain words, standard terms). Where needed, store key phrases or preferences so care stays consistent across shifts.

3. **Family roles & decision-making**
   Some patients want family involved. Record who to contact, who can decide, and what they consent to.

4. **Privacy, consent and trust**
   Personal stories are sensitive. Only the right roles should see them. Show consent status clearly and keep an audit trail of who viewed/edited.

5. **Fair access**
   Design should not disadvantage older adults, people with disabilities or those with low tech literacy. Use simple forms, readable text and as few steps as possible.

6. **Professional tone & power balance**
   Nurses/doctors write most notes and patients may feel shy to disagree. CareLog should encourage respectful, neutral wording and show what actions were taken.

7. **When expectations are broken**
   If privacy is breached or cultural needs are ignored, there should be a clear way to report it (through admins/IT) and the system should show who accessed what to support follow-up.

8. **What "good" looks like**

   Patients feel heard and respected; fewer cultural mistakes; smoother handovers; fewer privacy issues; notes are clear and consistent. This aligns with the brief's push for human-centred, ethical, privacy-aware design.

7.5 System Context Diagram

CareLog -- System Context Diagram
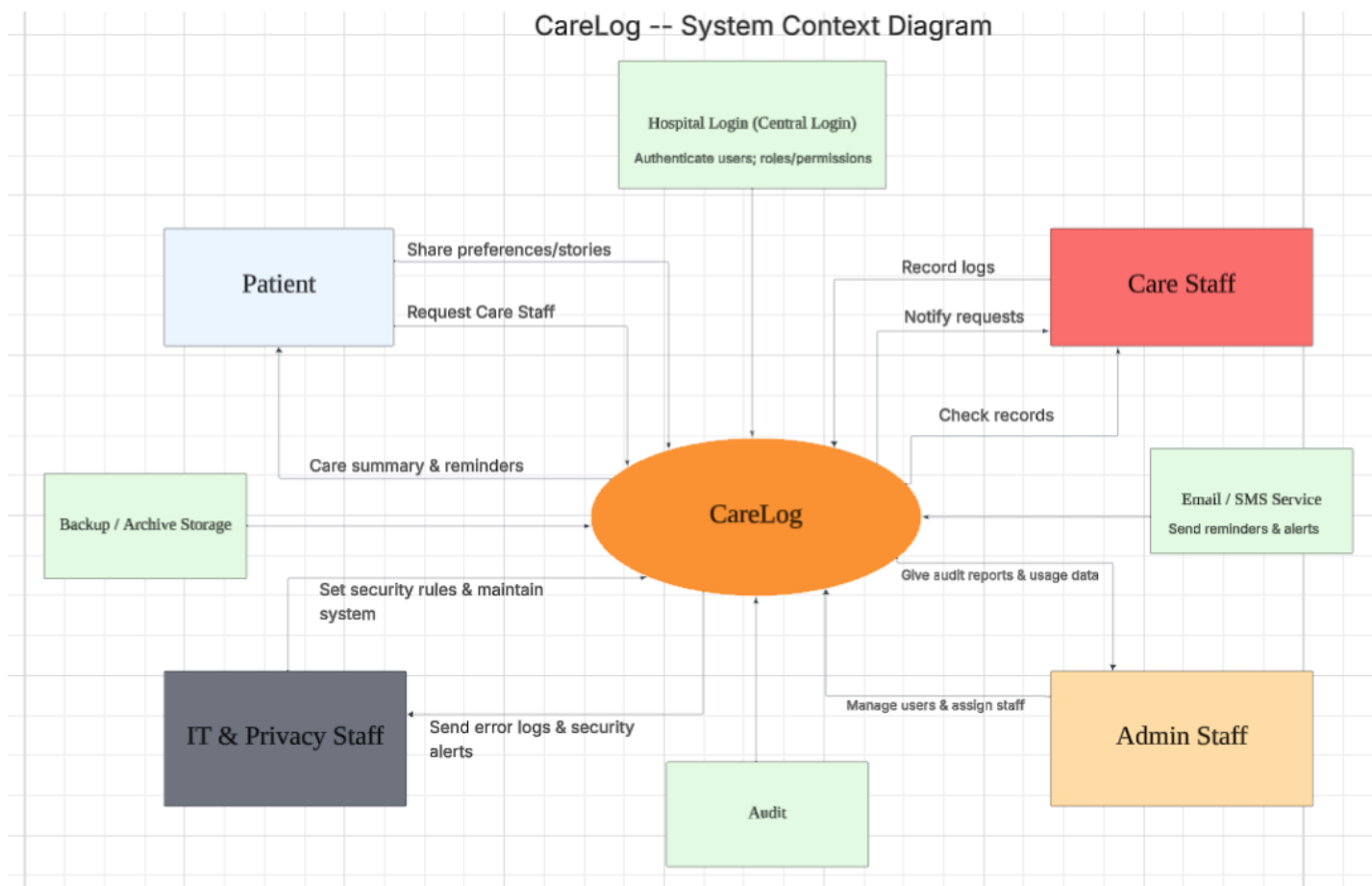
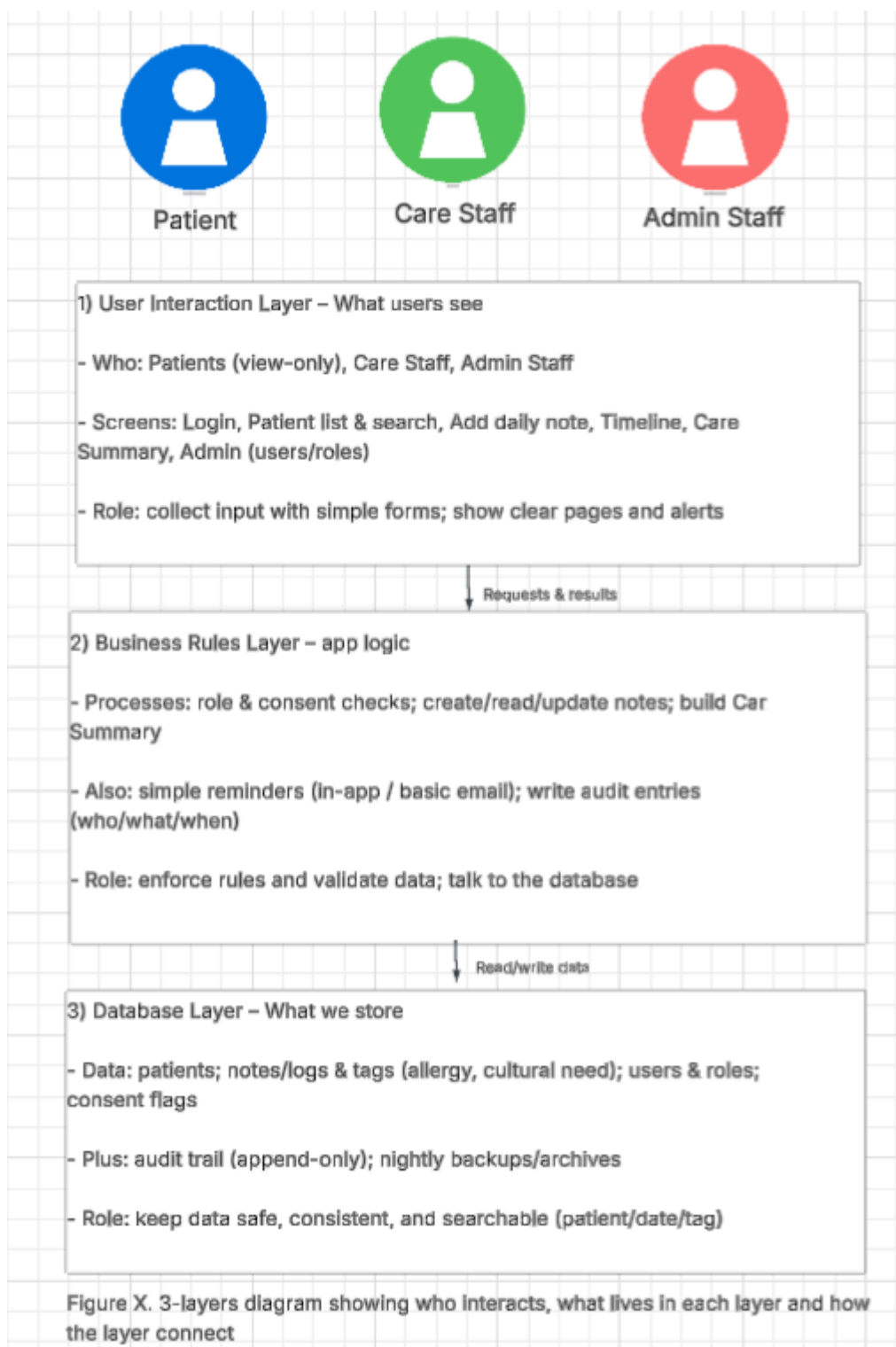# 8. System Architecture Diagram

1) User Interaction Layer – What users see

- Who: Patients (view-only), Care Staff, Admin Staff

- Screens: Login, Patient list & search, Add daily note, Timeline, Care Summary, Admin (users/roles)

- Role: collect input with simple forms; show clear pages and alerts

Requests & results

2) Business Rules Layer – app logic

- Processes: role & consent checks; create/read/update notes; build Car Summary

- Also: simple reminders (in-app / basic email); write audit entries (who/what/when)

- Role: enforce rules and validate data; talk to the database

Read/write data

3) Database Layer – What we store

- Data: patients; notes/logs & tags (allergy, cultural need); users & roles; consent flags

- Plus: audit trail (append-only); nightly backups/archives

- Role: keep data safe, consistent, and searchable (patient/date/tag)

Figure X. 3-layers diagram showing who interacts, what lives in each layer and how the layer connect

Why this style ?

We use a 3-layer architecture because it keeps the screens simple, puts all rules in one place, and stores data safely. This makes it easier to meet our functional work (notes, search, schedules) and our non-functional goals (security, speed, availability, usability). And we can scale it later without changing the whole app. (refer back to Figure X)

How each layer satisfies our FRs/NFRs ?

1. **UI layer (what people see)**
- **Care Staff screens:** quick note, update details, search, view past notes, highlight key info, schedules, reminders → Care-Staff FR1-FR7.
- **Admin screens:** patient/user search and keyword search lists → Admin FR2, FR4
- **Patient screens:** register, update profile, submit wellbeing, search staff, view history → Patient FR5, FR6, FR3, FR4, FR7
- **NFRs primarily addressed here:** works on any device & easy to learn (Care Staff NFR1-NFR2); fast page responses (Care staff NFR3, General NFR2, Patient NFR3); availability shown to users (General NFR1, Patient NFR2)

2. **Business Rules Layer (app logic)**
- Authentication & Roles guard every action (admin, care staff, patient) → Admin FR1
- Notes/Stories service (create/update/read notes, highlight important info) → Care staff FR1, FR2, FR4, FR6
- Scheduling & reminders (who/where/when; avoid clashes) → Care staff FR7, FR5
- **NFRs primarily addressed here:** keep responses fast with pagination (Care staff NFR3, General NFR2, Patient NFR3); cleaner code & easier changes (Admin NFR2, General NFR4-NFR5)

3. **Data Layer (where info lives, safely)**
- **What's inside:**
  - Main database with tables for patients, users/roles, notes/logs, schedules.
  - File storage for attachments (e.g. lab files).
  - This storage supports all the CRUD work in → Admin FR1; Care staff FR1-FR7; Patient FR3-FR7; General FR1-FR2
- **Safety & recovery:**
  - **Audit trail:** the system records who viewed/changed what and when.
  - **Backups:** data is saved regularly so we can restore if something goes wrong.
  - **Maintenance window:** a planned short downtime (e.g. late night) for updates and fixes.
- **NFRs primarily addressed here:**
  - **Security:** data is locked when stored (encryption at rest using Caesar Cipher) and when sent between layers → Admin NFR3 & NFR5
  - **Availability:** system aims to be up almost all the time (90%), helped by backups and restore steps. → General NFR1-NFR2, Patient NFR2

- ○ **Performance (speed):** the database is organised with quick-find keys (indexes) so searches return faster. → Care staff NFR3-NFR4

NFR decisions & trade-offs

- **Security & privacy**
  - ○ **Decisions:** role-based access, hashed passwords, DB encryption, audit log.
  - ○ **Trade-off:** small write overhead + operational effort (but necessary for safety/compliance)
- **Performance**
  - ○ **Decisions:** server-side filtering, pagination, DB indexing (name/ID/date), lightweight JSON
  - ○ **Trade-off:** extra engineering/config work, but keeps UI fast and stable.

- **Availability**
  - ○ **Decisions:** nightly backups, restore drills, planned maintenance
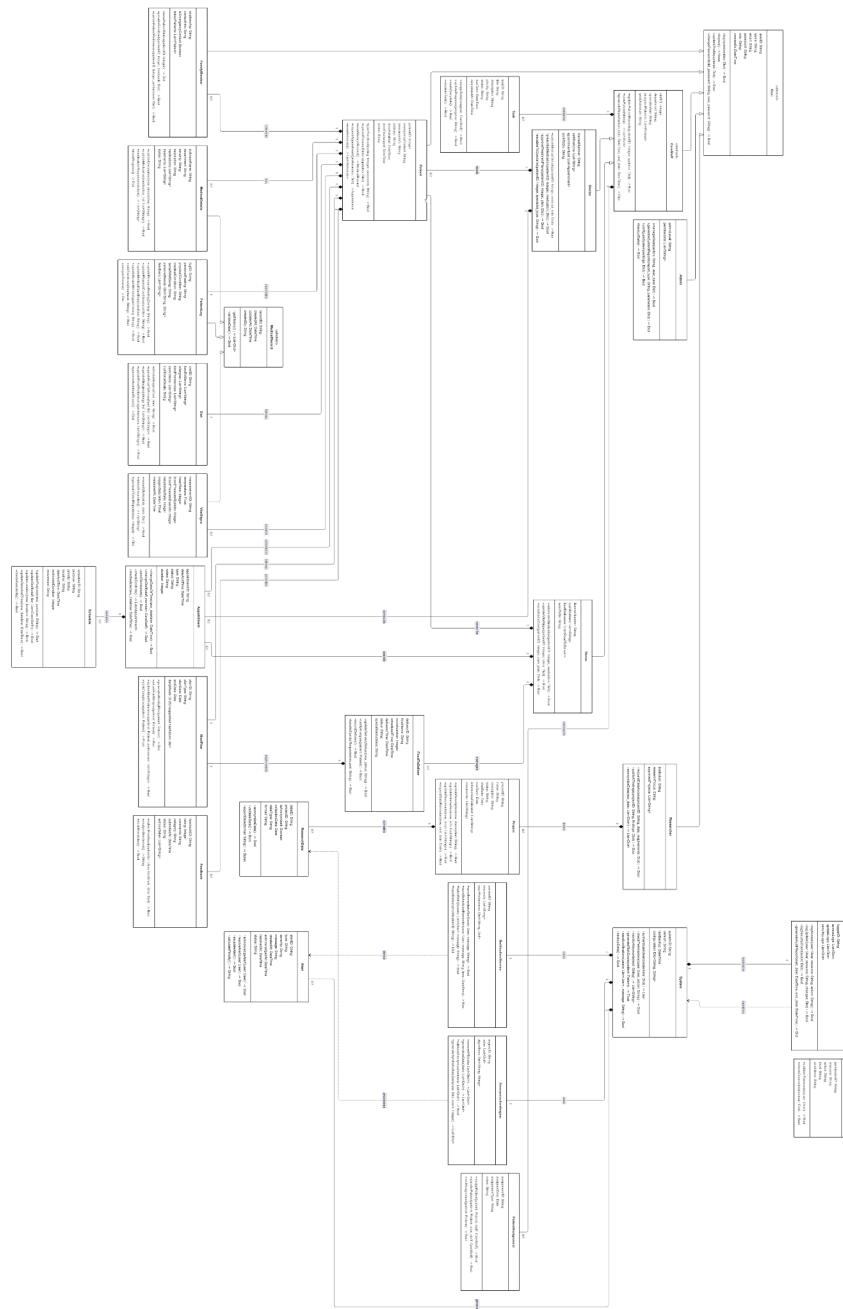 - ○ **Trade-off:** storage cost + brief planned downtime, but clear recovery path.

- **Usability**
  - ○ **Decisions:** responsive web pages, simple forms, clear flags/ alerts.
  - ○ **Trade-off:** fewer fancy UI effects to keep things easy and consistent.

- **Maintainability**
  - ○ **Decisions:** thin UI, all business rules in Logica layer, validations/logging as cross-cutting.
  - ○ **Trade-off:** an extra hop (UI → Logic → Data) adds tiny latency, but changes are safer/faster.
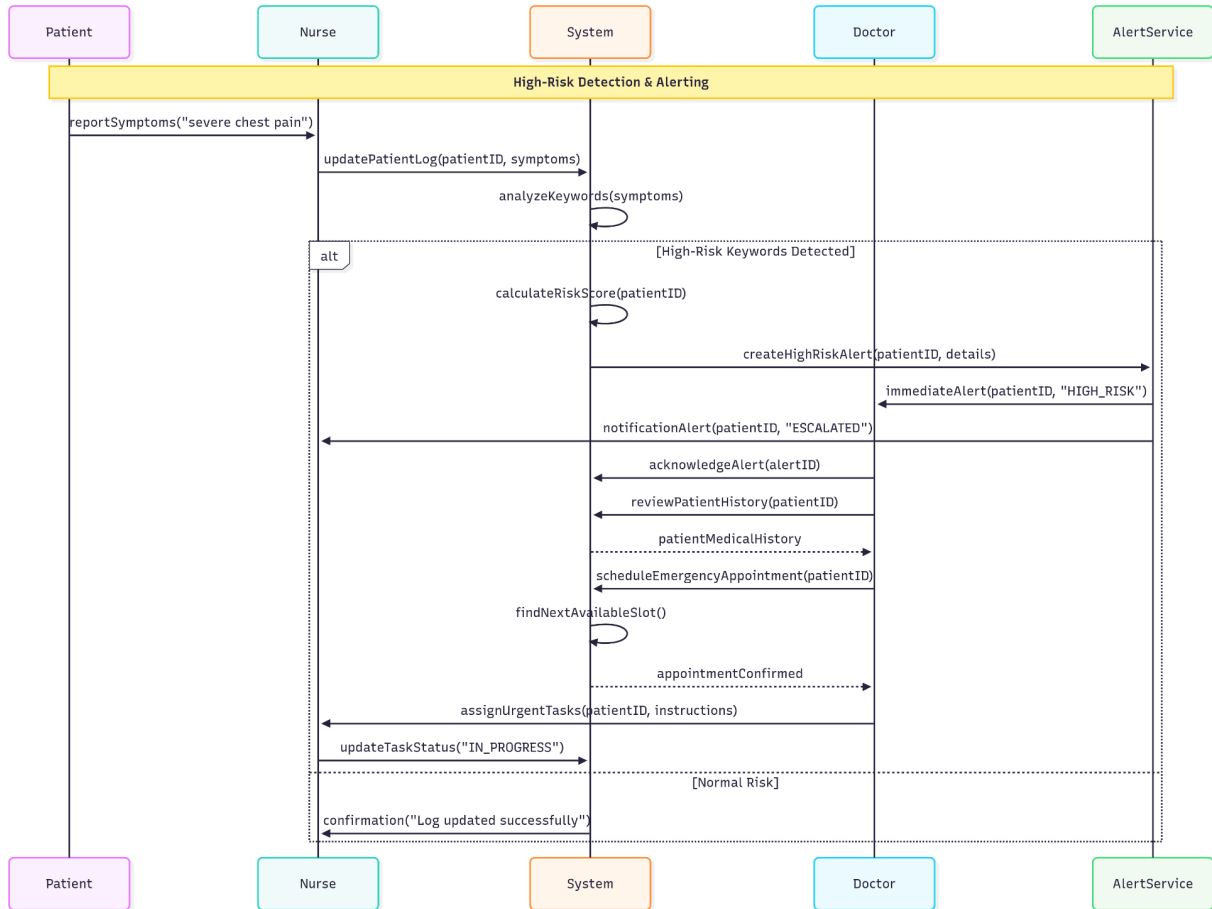
9. Class Diagram
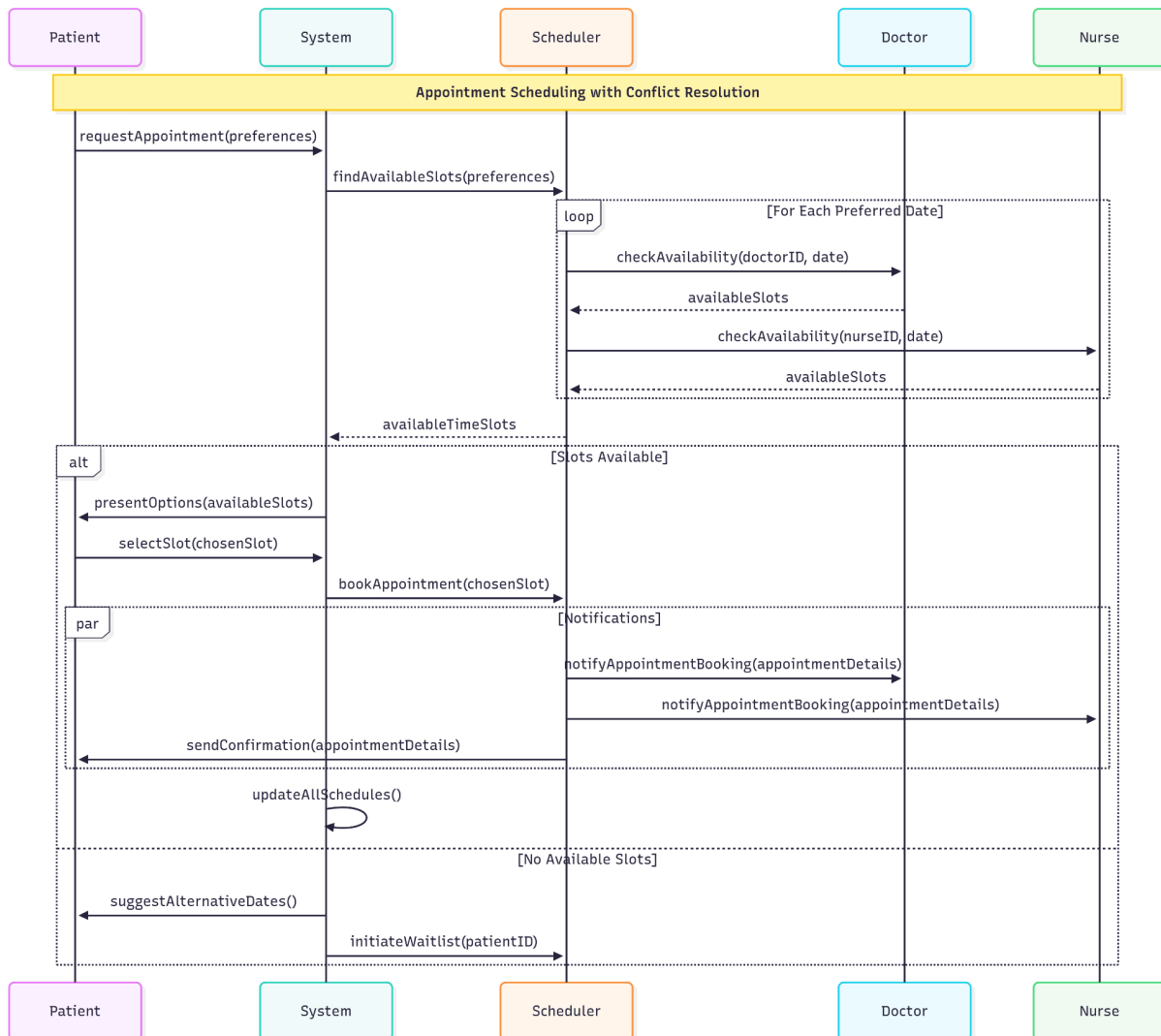

Link to a clearer class diagram:
https://drive.google.com/file/d/1tKWzQ1VCBRB7sRmDdS9PoZz-9PFAuPNW/view?usp=sharing
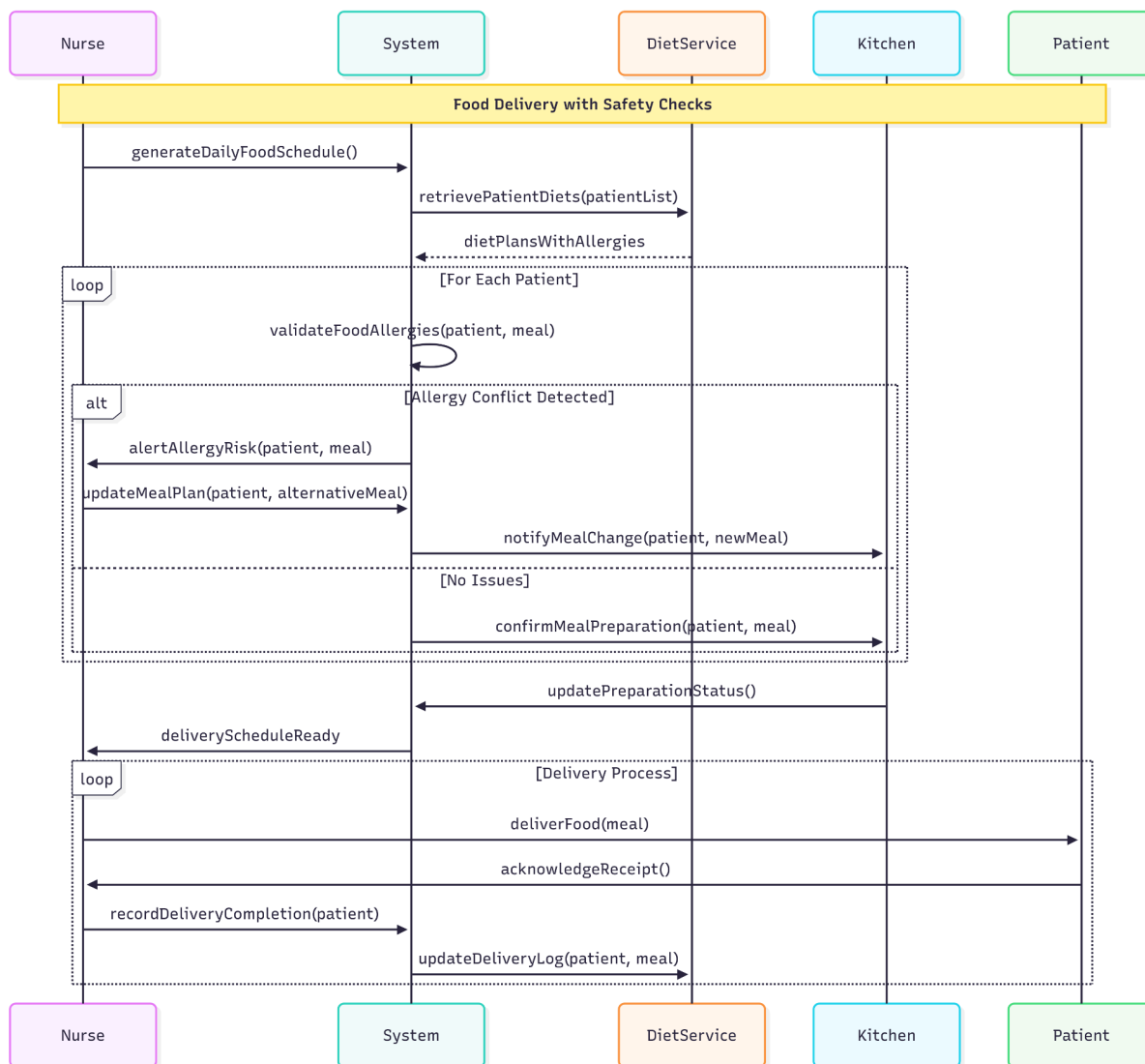
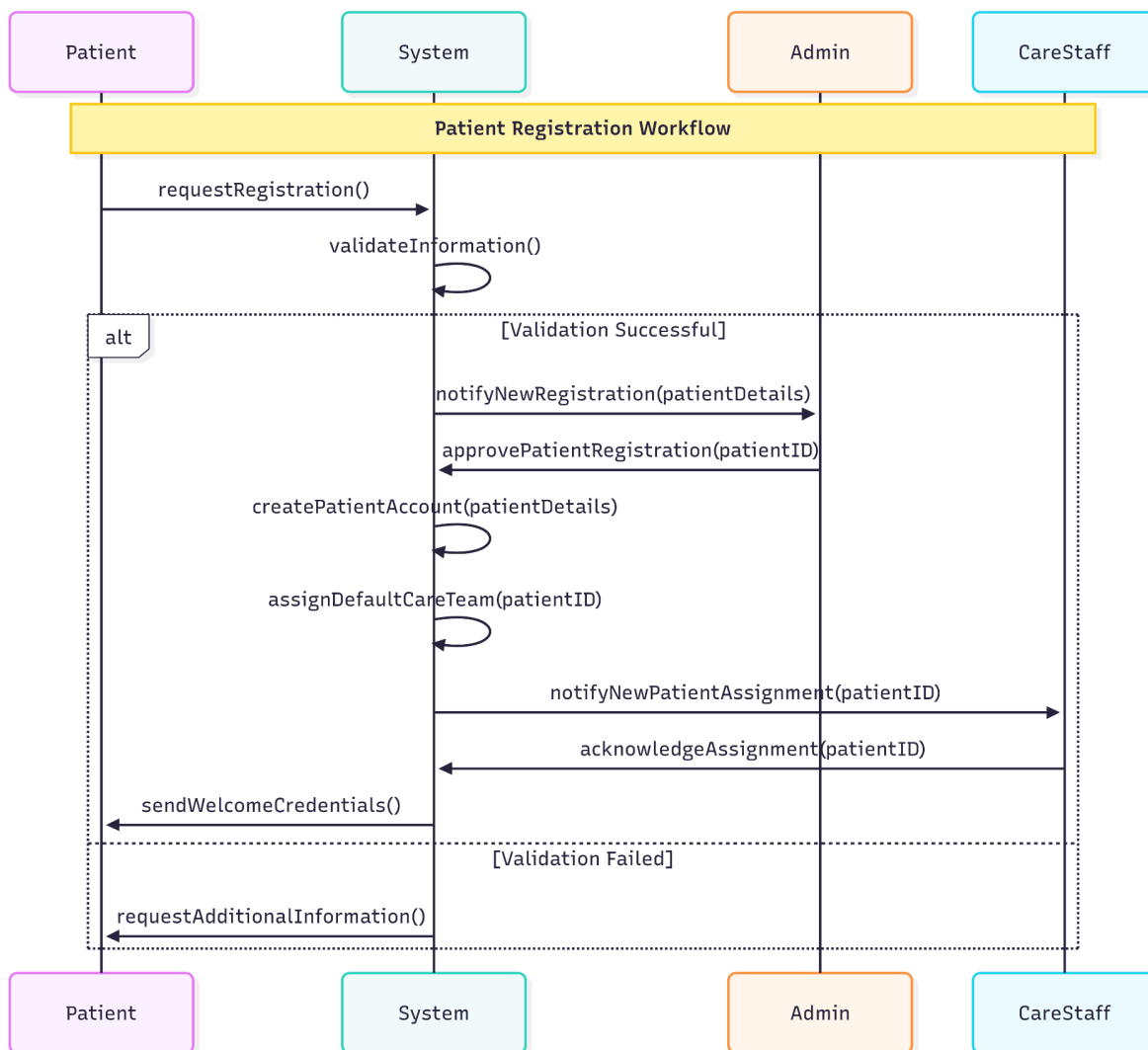# 10. Sequence Diagrams

Patient Registration & Initial Setup

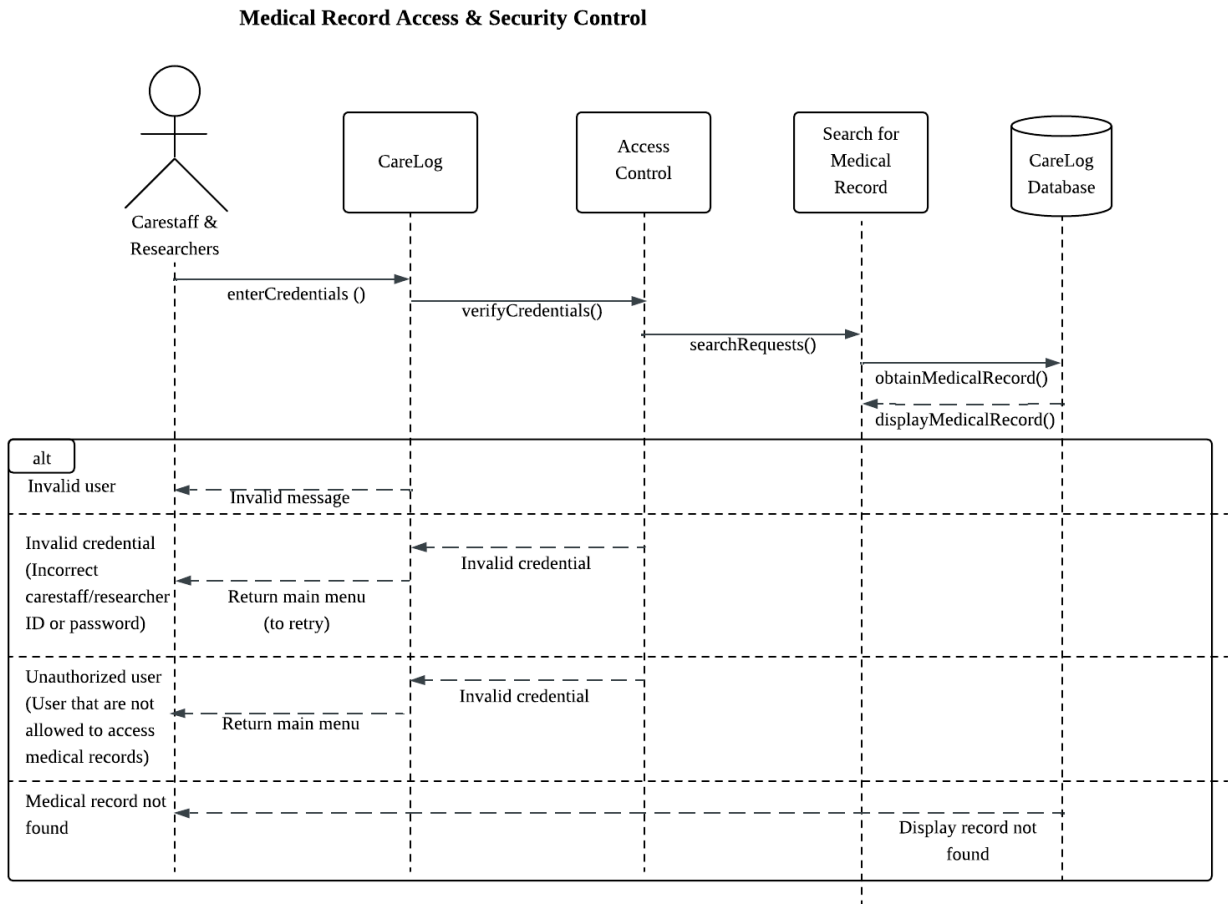# High-Risk Patient Detection & Alert Escalation

Comprehensive Appointment Scheduling

Nurse	System	DietService	Kitchen	Patient

Food Delivery with Safety Checks

Nurse → System: generateDailyFoodSchedule()

System → DietService: retrievePatientDiets(patientList)

DietService ⇠ System: dietPlansWithAllergies

loop [For Each Patient]

System → System: validateFoodAllergies(patient, meal)

alt [Allergy Conflict Detected]

System → Nurse: alertAllergyRisk(patient, meal)

Nurse → System: updateMealPlan(patient, alternativeMeal)

System → Kitchen: notifyMealChange(patient, newMeal)

[No Issues]

System → Kitchen: confirmMealPreparation(patient, meal)

Kitchen → System: updatePreparationStatus()

System → Nurse: deliveryScheduleReady

loop [Delivery Process]

Nurse → Patient: deliverFood(meal)

Patient → Nurse: acknowledgeReceipt()

Nurse → System: recordDeliveryCompletion(patient)

System → DietService: updateDeliveryLog(patient, meal)

Nurse	System	DietService	Kitchen	Patient

Food Delivery Management with Allergy Checks

Patient | System | Admin | CareStaff

Patient Registration Workflow

Patient → System: requestRegistration()

System → System: validateInformation()

alt [Validation Successful]

System → Admin: notifyNewRegistration(patientDetails)

Admin → System: approvePatientRegistration(patientID)

System → System: createPatientAccount(patientDetails)

System → System: assignDefaultCareTeam(patientID)

System → CareStaff: notifyNewPatientAssignment(patientID)

CareStaff → System: acknowledgeAssignment(patientID)

System → Patient: sendWelcomeCredentials()

[Validation Failed]

System → Patient: requestAdditionalInformation()

Medical Record Access & Security Control

Medical Record Access & Security Control

Search & Retrieve Records

Admin/Care Staff searching & retrieving patient records through CareLog
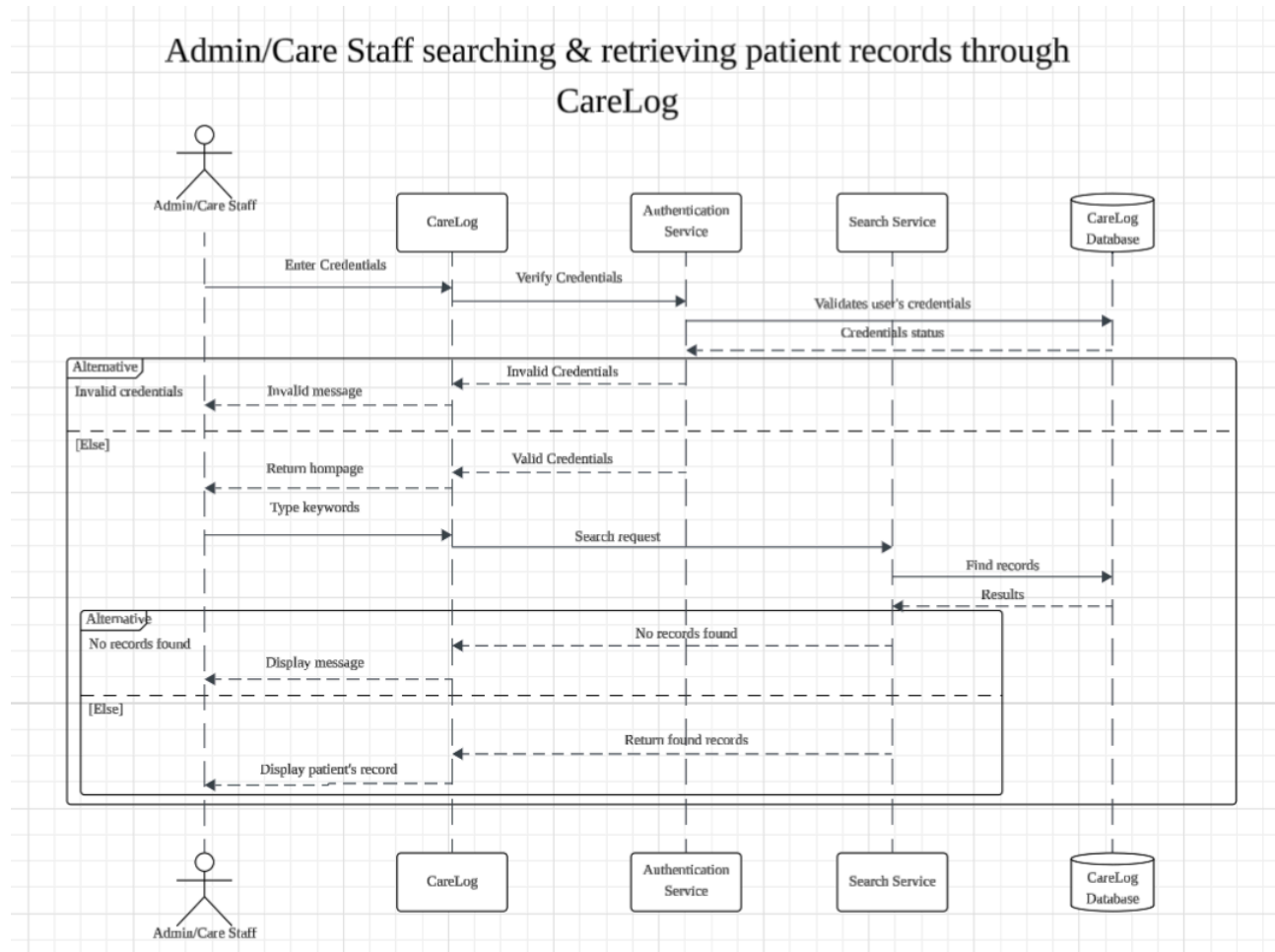
Feedback collection & service improvement
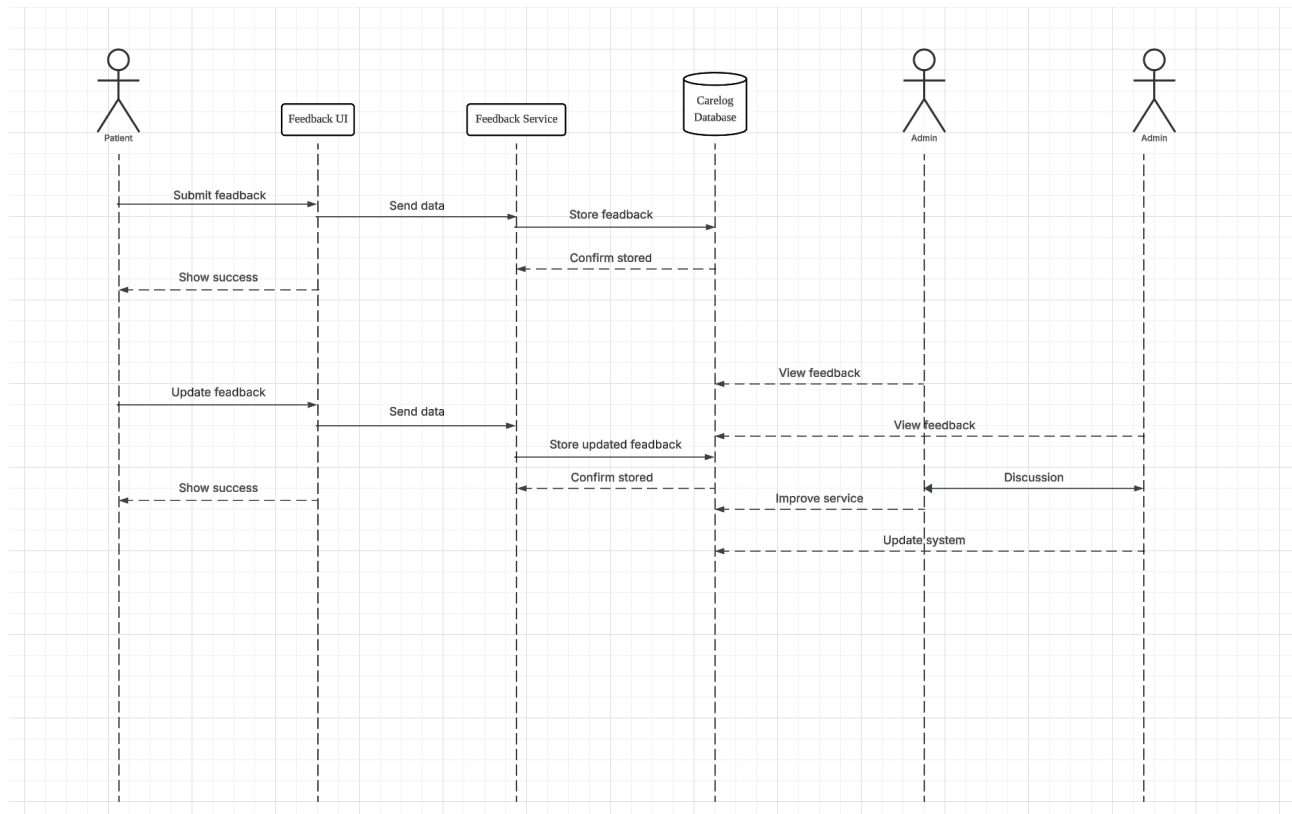
11. Usability evaluation

11.1 Purpose

The goal of this usability evaluation is to check how easy and comfortable it is for users to use CareLog. We used Nielsen's usability heuristics (Nielsen, 1994) and a think-aloud test where participants used the system while explaining what they were thinking. This helps identify what works well and what can be improved.

11.2 Method

We invited three test users based on our main personas:
- Sarah (Nurse/Care Staff)
- John (Admin Staff)
- Abdul (Patient User)

Each user was given realistic tasks based on their role:
- Care Staff: Record a new patient note and set a reminder.
- Admin Staff: Search for a patient record and assign a new care staff.
- Patient: Log in and read care summary notes.

While performing each task, they were asked to "think aloud" and explain what they saw, understood, or found confusing. We observed their actions, comments, and reactions.

11.3 Heuristics Covered

We used Nielsen's 10 Usability Heuristics (Nielsen, 1994) to evaluate the system:
1. Visibility of system status
2. Match between system and real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition rather than recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose, and recover from errors
10. Help and Documentation

Each task was reviewed based on these rules to find strengths and weaknesses.

11.4 Findings

Heuristic	Strengths	Improvements
Visibility of system status	The system shows clear feedback when data is saved or updated.	Add loading or success icons for better visual confirmation.
Match between system and real world	Labels and wording are simple and familiar (e.g. "Add Note", "Search Patient").	Some terms like "Summary" could be clearer (e.g. "Patient Summary").
User control & freedom	Users can go back or cancel actions easily.	Add a "Confirm Delete" step to avoid mistakes.
Consistency & standards	All pages use similar colors and button styles.	Keep icon positions consistent across all pages.
Error prevention	Input validation works correctly.	Add clearer messages when required fields are empty.
Recognition rather than recall	Drop-down lists help users select options instead of remembering.	Consider showing a short tutorial for first-time users.
Aesthetic design	Clean layout with simple icons.	Add a bit more spacing between form fields.
Help & Documentation	Tooltips and button labels are clear.	Add a short help section or pop-up guide that explains each page and how to use the main buttons.

11.5 Summary of Results

Overall, the users found CareLog easy to use, clear, and beginner-friendly. They liked the simple navigation and consistent layout. However, some areas could be improved, such as adding cleared feedback messages and better help features.

12. Quality Assurance Plan

Deliverable 1 Update:
We implemented all the functional requirements and non-functional requirements for Admin, Carestaff and Patient. We did not implement anything code for the Researcher.

13. Appendix

Appendix A

Interview Questions (Patient):

Q1. Introduction
  - Let the patient explain who they are and their situation.

Q2. How do you feel about that system (recording manually)?
  - State their opinion of the current AS-IS system.

Q3. What kind of problems does that cause for you?
  - Captures pain points.

Q4. If we had a system like CareLog, what would you want from it?
  - Elicits requirements.

Q5. How would that make your experience better?
  - Shows goals and expected improvements.

Q6. Can you give a quick example (the scenario of a patient interacting with the system)?.
  - Directly provides the required scenario.

Interview Outcome (Patient):

We interviewed a peer acting as a patient. They said they often have to repeat the same details every visit because information is not always shared between shifts. Small but important details such as diets or prayer times can be forgotten. They want CareLog to store all their information in one place, keep it safe, and make it easy for nurses to access so they feel listened to.

Note: This interview confirmed the issues we identified earlier in our problem statement, especially the difficulty of sharing patient information between shifts. The patient also emphasized personal needs (diet, prayer times) which shows the importance of CareLog in supporting cultural and individual care.

Scenario:

One day, the patient tells the nurse about back pain and a special diet. The nurse records it in CareLog. The next day, another nurse checks CareLog and already knows these details, so the patient does not need to repeat themselves and feels respected.

Interview recording:
🎞 Interview.mp4

Appendix B

Interview Questions (Nurse):

Q1. Introduction
- Nurse explain their role

Q2. How do you record patient notes right now?
- Identify AS-IS method.

Q3. What problems do you face with this?
- Capture pain points.

Q4. If we had a CareLog system, what would you want it to do?
- Elicit requirements.

Q5. How would that improve your work?
- Show expected benefits.

Q6. Can you give me a quick example (scenario) ?
- Provide a required scenario.

Interview Outcome (Patient):

We interviewed a peer acting as a nurse. They said using paper and slow shared computers wastes time, and during busy shifts they sometimes skip details. They also mentioned it's hard to show what's urgent, so the next shift may miss it. They want CareLog to be fast, easy to use, and able to highlight important notes.

Scenario:

The nurse records a patient's chest pain in CareLog and marks it urgent. The evening nurse logs in and sees it right away, so the patient gets quick care.

Interview recording:
📄 New Recording.m4a

Appendix C

References:

Registered Nurse. (2025). Indeed.com.
https://malaysia.indeed.com/career/registered-nurse/salaries/Bandar-Sunway

Administrative officer salary in Subang Jaya. (2025). Indeed.com.
https://malaysia.indeed.com/career/administrative-officer/salaries/Subang-Jaya

ERI Economic Research Institute. (2025). *Epidemiologist Salary in Malaysia (2025)*. Salary Expert.
https://www.salaryexpert.com/salary/job/epidemiologist/malaysia

Landi, H. (2019, September 30). *Many organizations are careless with sensitive paper documents. It's increasing the risk of data breaches*. Fierce Healthcare.
https://www.fiercehealthcare.com/tech/many-healthcare-professionals-are-careless-sensitive-paper-documents-it-s-putting

Most Patient Records are Still Paper-Based. (2025). Hcinnovationgroup.com.
https://www.hcinnovationgroup.com/home/news/13015668/most-patient-records-are-still-paper-based

AGENCY. (2023, September 18). *Many UK hospitals still using paper, despite electronic system target*. The Star.
https://www.thestar.com.my/lifestyle/health/2023/09/18/many-uk-hospitals-still-using-paper-despite-electronic-system-target

Patients record stored on physical and unsecured file

https://www.hcinnovationgroup.com/home/news/13015668/most-patient-records-are-still-paper-based

https://www.thestar.com.my/lifestyle/health/2023/09/18/many-uk-hospitals-still-using-paper-despite-electronic-system-target

(HIPAA, GDPR, FDA 21 CFR Part 11):
HIPAA (Health Insurance Portability and Accountability Act – USA)
Protects personal health information (PHI).
Requires that medical data be encrypted, anonymized, and accessed only by authorized users.
GDPR (General Data Protection Regulation – European Union)
Protects personal data of all EU citizens.
Defines rights such as: right to know, right to delete, right to withdraw consent when data is collected.
Applies even to organizations outside the EU if they handle data of EU residents.
FDA 21 CFR Part 11 (USA, Food and Drug Administration)
- Governs electronic records and electronic signatures in clinical research and pharmaceutical manufacturing.
    - Requires research data systems to: Keep a full audit trail (who accessed/modified data and when).
    - Ensure records cannot be altered without authorization.

Nielsen, J. (1994, April 24). *10 Heuristics for User Interface Design: Article by Jakob Nielsen*. Nielsen Norman Group. https://www.nngroup.com/articles/ten-usability-heuristics