ELDER CARE SERVER DOCUMENTATION

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Overview

This project is a *medical records and appointment management system* designed to help healthcare providers manage patient information, track medical records, and streamline scheduling.

Core Features

1. Patient Management
2. Appointment Scheduling and Tracking
3. Medical Records
4. Medication and Prescription Tracking
5. Progress Reports
6. User Access and Roles

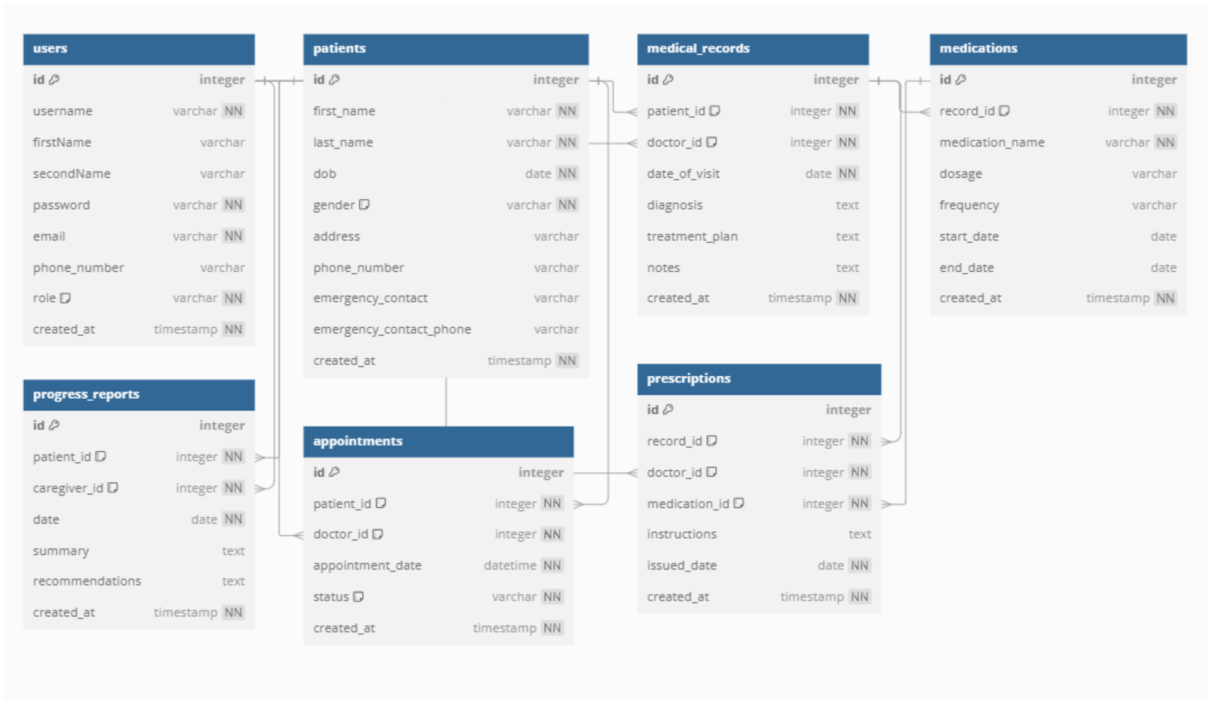
Technical Stack and Structure

The system uses Java with Spring Boot as the backend framework, employing JPA (Java Persistence API) repositories for data access. The backend is structured with various JPA repositories that allow complex queries maintaining a scalable and maintainable codebase. Spring Services and Controllers drive all of this to allow access to the backend.

API Layer	spring Spring Web REST controllers
Service Layer	Spring Services. Manages the Business Logic
Data Access Layer	+ Spring Data JPA, built on Jakarta Hibernate. Manages CRUD operations by directly interfacing with the Database
Database Layer	SQLite

Entities

An overview of the schema:



All entities are defined under the *"entity"* directory in the main source files.

Appointment Entity

The Appointment entity represents a scheduled meeting between a patient and a doctor.

Fields:

- ***id (Long):*** Primary key.
- ***patient (Patient):*** Foreign key reference to the Patient entity.
- ***doctor (User):*** Foreign key reference to the User entity representing the doctor.
- ***appointmentDate (LocalDateTime):*** Date and time of the appointment.
- ***location (String):*** Location of the appointment.
- ***status (String):*** Status of the appointment (e.g., scheduled, completed).
- ***createdAt (LocalDateTime):*** Timestamp for when the record was created.

MedicalRecord Entity

The MedicalRecord entity stores a patient’s medical history related to a specific doctor visit.

Fields:

- ***id (Long):*** Primary key.
- ***patient (Patient):*** Foreign key reference to the Patient entity.
- ***doctor (User):*** Foreign key reference to the User entity representing the doctor.
- ***dateOfVisit (LocalDateTime):*** Date of the medical visit.
- ***location (String):*** Location where the visit occurred.
- ***diagnosis (String):*** Diagnosis given by the doctor.
- ***treatmentPlan (String):*** Outline of the proposed treatment.
- ***notes (String):*** Additional notes related to the visit.
- ***createdAt (LocalDateTime):*** Timestamp for when the record was created.

Medication Entity

The Medication entity tracks individual medications prescribed as part of a medical record.

Fields:

- ***id (Long):*** Primary key.
- ***medicalRecord (MedicalRecord):*** Foreign key reference to the MedicalRecord entity.
- ***medication Name (String):*** Name of the medication.
- ***dosage (String):*** Dosage information.
- ***frequency (String):*** Frequency of dosage.
- ***startDate (LocalDateTime):*** Start date for the medication.
- ***endDate (LocalDateTime):*** End date for the medication.
- ***createdAt (LocalDateTime):*** Timestamp for when the record was created.

Patient Entity

The Patient entity represents an individual receiving medical care.

Fields:

- ***id (Long):*** Primary key.
- ***firstName (String):*** Patient's first name.
- ***lastName (String):*** Patient's last name.
- ***dob (LocalDate):*** Date of birth.
- ***gender (String):*** Gender of the patient.
- ***address (String):*** Address of the patient.
- ***phoneNumber (String):*** Contact number.
- ***emergencyContact (String):*** Emergency contact's name.
- ***emergencyContactPhone (String):*** Emergency contact's phone number.
- ***createdAt (LocalDateTime):*** Timestamp for when the record was created.

Prescription Entity

The Prescription entity contains information about medication prescribed to a patient.

Fields:

- ***id (Long):*** Primary key.
- ***medicalRecord (MedicalRecord):*** Foreign key reference to the MedicalRecord entity.
- ***medication (Medication):*** Foreign key reference to the Medication entity.
- ***doctor (User):*** Foreign key reference to the prescribing doctor.
- ***instructions (String):*** Instructions for taking the medication.
- ***issuedDate (LocalDateTime):*** Date the prescription was issued.
- ***createdAt (LocalDateTime):*** Timestamp for when the record was created.

ProgressReport Entity

The ProgressReport entity provides updates on a patient's health over time.

Fields:

- ***id (Long):*** Primary key.
- ***patient (Patient):*** Foreign key reference to the Patient entity.
- ***caregiver (User):*** Foreign key reference to the User entity representing the caregiver.
- ***date (LocalDateTime):*** Date of the report.
- ***summary (String):*** Summary of the patient's condition and progress.

- ***recommendations (String):*** Recommendations for future care.
- ***createdAt (LocalDateTime):*** Timestamp for when the record was created.

User Entity

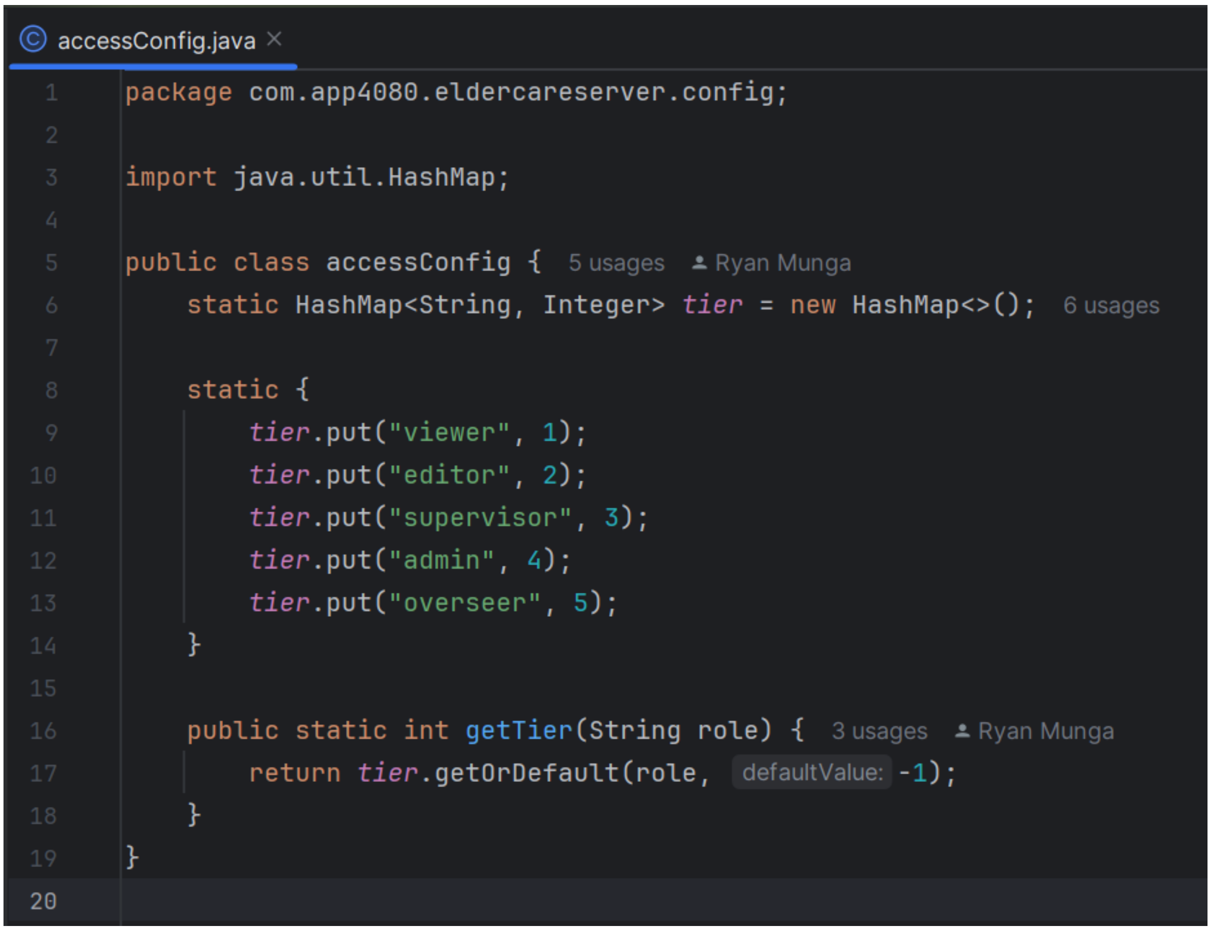
The User entity represents medical personnel, such as doctors and caregivers.

Fields:

- ***id (Long):*** Primary key.
- ***username (String):*** Unique username.
- ***firstName (String)***
- ***secondName (String)***
- ***password (String):*** User's password.
- ***email (String):*** Email address.
- ***primaryLocation (String):*** Primary work location.
- ***secondaryLocation (String):*** Secondary work location (optional).
- ***phoneNumber (String):*** Contact number.
- ***role (String):*** Defines the user's role, which can be **"doctor," "nurse," or "patient."**
- ***privileges (String):*** Specifies the user's access level within the system. Options include **"overseer," "admin," "supervisor," "editor," or "viewer."**
- ***createdAt (LocalDateTime):*** Timestamp for when the user account was created.

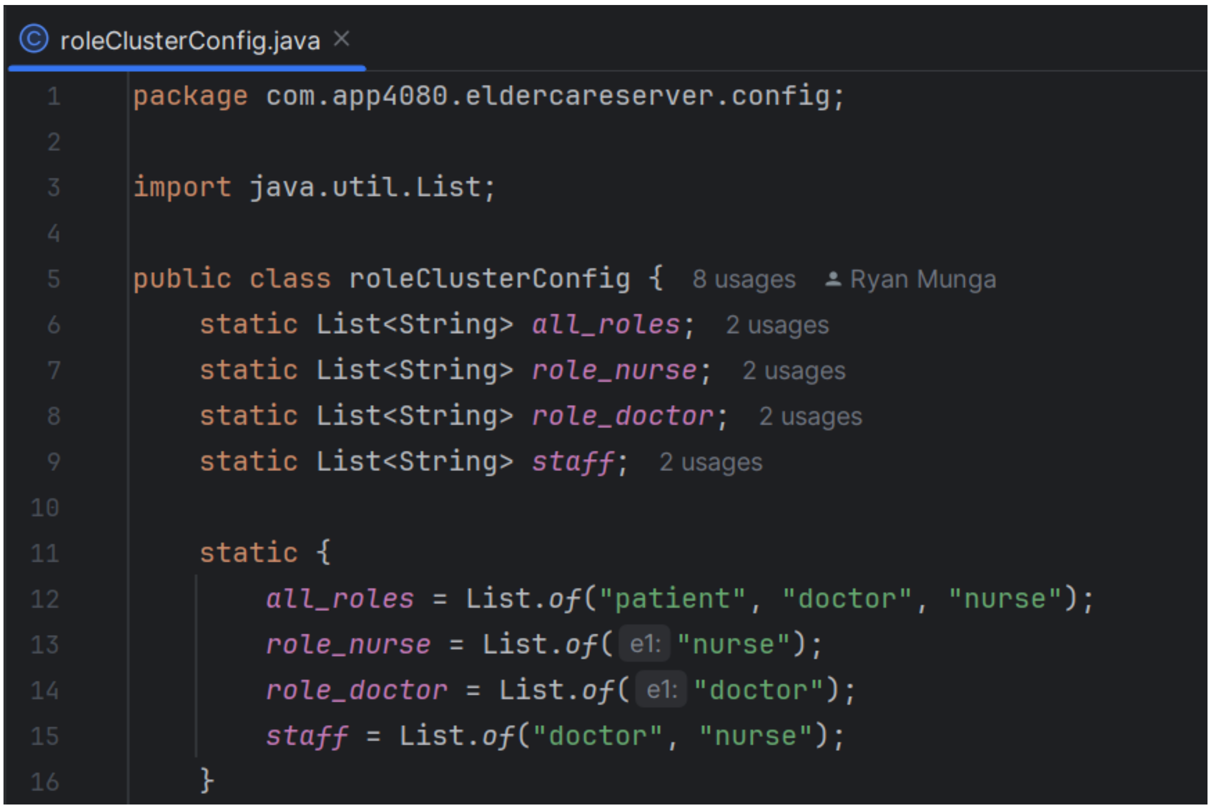
Note on User Constraints:

Configuration for a User's role & privileges can be found under the "*config*" directory in the main source files



accessConfig.java ×

```java
package com.app4080.eldercareserver.config;

import java.util.HashMap;

public class accessConfig {  5 usages  Ryan Munga
    static HashMap<String, Integer> tier = new HashMap<>();  6 usages

    static {
        tier.put("viewer", 1);
        tier.put("editor", 2);
        tier.put("supervisor", 3);
        tier.put("admin", 4);
        tier.put("overseer", 5);
    }

    public static int getTier(String role) {  3 usages  Ryan Munga
        return tier.getOrDefault(role,  defaultValue: -1);
    }
}

```



roleClusterConfig.java ×

```java
package com.app4080.eldercareserver.config;

import java.util.List;

public class roleClusterConfig {  8 usages  Ryan Munga
    static List<String> all_roles;  2 usages
    static List<String> role_nurse;  2 usages
    static List<String> role_doctor;  2 usages
    static List<String> staff;  2 usages

    static {
        all_roles = List.of("patient", "doctor", "nurse");
        role_nurse = List.of( e1: "nurse");
        role_doctor = List.of( e1: "doctor");
        staff = List.of("doctor", "nurse");
    }
```

Data Access (JPA Repositories)

The application uses repositories from Spring Data JPA to manage Data Access. This notably includes CRUD (Create, Read, Update, Delete) functionality, as well as bespoke Queries.

AppointmentRepository

Manages CRUD operations for Appointment entities and provides custom queries:

- ***findByPatientId(Long patientId):*** Retrieves all appointments for a specific patient.
- ***findByDoctorId(Long doctorId):*** Retrieves all appointments for a specific doctor.
- ***findByStatus(String status):*** Finds appointments by their status **(active, cancelled, or completed).**
- ***findByPatientIdAndDoctorId(Long patientId, Long doctorId):*** Retrieves appointments for a specific patient-doctor pair.
- ***findByLocationAndDoctorId(String location, Long doctorId):*** Finds appointments at a specific location for a doctor.
- ***findByLocation(String location):*** Finds appointments by location.
- ***findByPatientIdAndStatus(Long patientId, String status): Retrieves*** appointments for a patient with a specific status.
- ***findByDoctorIdAndStatus(Long doctorId, String status):*** Retrieves appointments for a doctor with a specific status.
- ***findByAppointmentDateBetween(LocalDateTime startDate, LocalDateTime endDate):*** Finds appointments within a specified date range.
- ***findUpcomingAppointments():*** Finds upcoming scheduled appointments.
- ***findOverlappingAppointments(Long doctorId, LocalDateTime startTime, LocalDateTime endTime):*** Checks for overlapping appointments for a doctor within a time range.

MedicalRecordRepository

Manages CRUD operations for MedicalRecord entities and custom queries:

- ***findByPatientId(Long patientId):*** Retrieves all medical records for a specific patient.
- ***findByDoctorId(Long doctorId):*** Retrieves all medical records created by a specific doctor.

- ***findByPatientIdAndDoctorId(Long patientId, Long doctorId):*** Finds records for a patient-doctor pair.
- ***findByDoctorIdAndDateOfVisit(Long doctorId, LocalDateTime dateOfVisit):*** Finds records for a doctor on a specific visit date.
- ***findAll():*** Retrieves all records.
- ***findByLocation(String location):*** Finds records based on location.
- ***findByDateOfVisitBetween(LocalDateTime startDate, LocalDateTime endDate):*** Finds records within a date range.
- ***searchRecords(String searchTerm):*** Searches records by diagnosis or treatment.

MedicationRepository

Manages CRUD operations for Medication entities and provides:

- ***findByMedicalRecord(MedicalRecord mr):*** Finds medications related to a specific medical record.
- ***findActiveMedications():*** Retrieves medications still active based on endDate.
- ***findByMedicationNameContainingIgnoreCase(String name):*** Finds medications by name (case-insensitive).
- ***findMedicationsExpiringSoon(LocalDateTime date):*** Retrieves medications expiring soon within a specified date.

PatientRepository

Manages CRUD operations for Patient entities and includes:

- ***findByLastName(String lastName):*** Finds patients by last name.
- ***findByFirstNameAndLastName(String firstName, String lastName):*** Finds patients by first and last name.
- ***searchPatients(String searchTerm):*** Searches patients by name, phone number, or emergency contact.
- ***findByAgeRange(int minAge, int maxAge):*** Retrieves patients within a specified age range.

PrescriptionRepository

Manages Prescription entities with the following:

- ***findByMedicalRecord(MedicalRecord mr):*** Finds prescriptions for a medical record.
- ***findByDoctorId(Long doctorId):*** Finds prescriptions issued by a doctor.
- ***findByMedicationId(Long medicationId):*** Finds prescriptions for a specific medication.
- ***findActivePrescriptions():*** Retrieves active prescriptions based on medication end date.
- ***findByIssuedDateBetween(LocalDateTime startDate, LocalDateTime endDate):*** Finds prescriptions within a date range.
- ***findByPatientId(Long patientId):*** Finds prescriptions for a specific patient.

ProgressReportRepository

Manages ProgressReport entities and provides:

- ***findByPatientId(Long patientId):*** Finds progress reports for a patient.
- ***findByCaregiverId(Long caregiverId):*** Finds reports created by a caregiver.
- ***findByDateBetween(LocalDateTime startDate, LocalDateTime endDate):*** Finds reports within a date range.
- ***findLatestReportsForAllPatients():*** Retrieves the latest report for each patient.
- ***searchReports(String searchTerm):*** Searches reports by summary or recommendations.

UserRepository

Manages User entities and includes:

- ***findByUsername(String username):*** Finds a user by username.
- ***findByRole(String role):*** Finds users by role (e.g., doctor, caregiver).
- ***findByPrivileges(String privileges):*** Finds users by specific privileges.
- ***findByEmail(String email):*** Finds users by email.
- ***findByPrimaryLocation(String primaryLocation):*** Finds users by primary location.
- ***findBySecondaryLocation(String secondaryLocation):*** Finds users by secondary location.
- ***existsByUsername(String username):*** Checks if a username exists.

- ***existsByEmail(String email):*** Checks if an email exists.
- ***searchUsers(String searchTerm):*** Searches users by username, email, or phone number.

Business Logic (Service Layer)

This is the core of the application. An intermediary between the API and Data Access layer, the Service layer manages the day to day operations of the system. It is built using Services defined by Spring Boot. These Services can be found under the "*service*" directory in the source files.

User Service

The User Service manages user-related operations in the Elder Care Server system, including user registration, authentication, access control, and user information management. It implements the business logic layer for user-related functionality and integrates with the UserRepository for data persistence.

Dependencies

- UserRepository: Data access layer for user operations
- @Transactional: Ensures database operation atomicity
- Access control configuration for privilege management

Core Functionality

Access Control

validatePrivileges(String username, String requiredPrivilege)

- Validates whether a user has sufficient privileges for an operation.
- Parameters:
  - username: The username to check
  - requiredPrivilege: The privilege level required
- Throws: AccessDeniedException if privileges are insufficient

validateRole(String username, List<String> requiredRole)

- Validates whether a user has the required role.
- Parameters:
  - username: The username to check
  - requiredRole: List of acceptable roles

- Throws: AccessDeniedException if role requirements aren't met

User Management Operations

<u>Registration</u>

registerUser(UserRegistrationRequest registrationRequest)

- Creates new user accounts
- Validates unique constraints (username, email)
- Returns: UserResponse with created user details
- Throws: IllegalArgumentException for duplicate username/email

<u>Authentication</u>

login(LoginRequest loginRequest)

- Authenticates user credentials
- Throws:
    - IllegalArgumentException for non-existent username
    - AccessDeniedException for invalid password

<u>Update Operations</u>

updateUser(Long id, UserUpdateRequest updateRequest)

- Updates existing user information
- Returns: UserResponse with updated user details
- Throws: IllegalArgumentException if user not found

<u>Deletion</u>

deleteUser(LoginRequest lr)

- Removes user accounts
- Throws: IllegalArgumentException if user not found

Query Operations

All query operations return data in the UserResponse format to ensure data security.

Single User Queries

- findUserByUsername(String username): Retrieves user by username
- fetchUserByUsername(String username): Internal method for user retrieval

Multi-User Queries

- findUsersByRole(String role): Finds users by role
- findUsersByPrivileges(String privileges): Finds users by privilege level
- findUsersByEmail(String email): Finds users by email
- findUsersByPrimaryLocation(String primaryLocation): Finds users by primary work location
- findUsersBySecondaryLocation(String secondaryLocation): Finds users by secondary work location
- findUsersByRoleAndPrivileges(String role, String privileges): Finds users by both role and privileges
- searchUsers(String searchTerm): Searches users by username, email, or phone number

Data Transformation

convertToResponse(User user)

- Internal method
- Converts User entity to UserResponse DTO
- Ensures sensitive data (like passwords) isn't exposed in responses

Transaction Management

All write operations are transactional

Read operations use @Transactional(readOnly = true) for optimization

Transaction boundaries are managed at the service level

Patient Service

The Patient Service manages patient-related operations in the Elder Care Server system. It handles patient registration, information management, and search functionality, with strict access control based on user roles (doctors, nurses, and patients).

Dependencies

- PatientRepository: Data access layer for patient operations
- @Transactional: Ensures database operation atomicity
- Access control configuration for role-based access control (RBAC)

Access Control Model

The service implements a role-based access control system with three primary roles:

1. **Doctors**
    - Full access to all patient records
    - Can create, read, update, and delete patient records
    - Can search across all patients

2. **Nurses**

    Read access to all patient records
    - Can create and update patient records
    - Limited deletion rights
    - Can search across all patients

3. **Patients**
    - Access restricted to their own record only
    - Read-only access
    - Cannot perform search operations across other patients
    - Cannot modify or delete records

Core Functionality

Patient Management Operations

<u>Creation</u>

createPatient(PatientRequest requestDto)

- Creates new patient records
- Requires staff role (doctor or nurse)
- Validates against duplicate entries
- Returns: PatientResponse with created patient details
- **Throws:**

    - IllegalArgumentException for duplicate patients
    - AccessDeniedException for insufficient privileges

Retrieval

getAllPatients():

- Returns list of all patients for staff
- Returns single patient record for patient users
- Access filtered based on user role

findPatientById(Long patientId)

- Retrieves specific patient by ID
- For patients: only allows access to own record
- For staff: allows access to any patient record

Deletion

deletePatient(Long patientId, User user)

- Removes patient records
- Requires elevated privileges (tier 3 or higher)
- Only available to doctor role
- **Throws:**
    - IllegalArgumentException if patient not found
    - AccessDeniedException if user lacks sufficient privileges

Search Operations

All search operations implement role-based access control:

Basic Search

keywordSearch(String keyword)

- Staff: Can search across all patients
- Patients: Operation not available
- Returns: List of PatientSearch DTOs
- **Throws:** AccessDeniedException for patient role

Advanced Search

findPatientsByAgeRange(int minAge, int maxAge)

- Staff only operation
- Returns: List of PatientSearch DTOs
- **Throws:** AccessDeniedException for patient role

Data Validation

checkExists(Patient patient)

- Internal method to verify patient uniqueness
- Checks for duplicate entries based on first and last name
- Used during patient creation process

Data Transformation Methods

Internal conversion methods with role-based data filtering:

- convertToResponseDto(Patient): Creates full response with data filtered by role
- convertToEntity(PatientRequest): Converts request to entity
- convertToSummaryDto(Patient): Creates minimal summary with role-appropriate data
- convertToSearchDto(Patient): Creates search-optimized DTO for staff use

Transaction Management

- Write operations (create, update, delete) use full transaction support
- Read operations use @Transactional(readOnly = true) for optimization
- Transaction boundaries are managed at the service level

Error Handling

- Duplicate patient creation is prevented
- Non-existent patient access is handled
- Access control violations are caught and reported
- Role-based access violations are explicitly handled