Software Requirements Specification

for

<CoFaktory>

Version 1.0 approved

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<date created>

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Revision History

Name	Date	Reason For Changes	Version
Whole Team	5/5/2025	1st Draft	1.0
Lujain Hesham	5/8/2025	2nd Draft	1.1

1. Introduction

1.1 Purpose

This document specifies the software requirements for the **Carbon Footprint Tracking System for Coffee Operations**. This system will support the monitoring, calculation, and reporting of carbon emissions across multiple stages of coffee production, packaging, and distribution for 16 branches spread across 4 cities. It includes role-based access control, emission tracking modules, reduction strategy management, and reporting functionality. This SRS defines the complete scope for the first full release of the system and does not cover future integrations with external climate APIs or carbon offset platforms.

1.2 Document Conventions

This Software Requirements Specification (SRS) follows specific formatting and typographical standards to maintain consistency and clarity throughout the document:

- **Font and Spacing**: The document uses *Times New Roman* font with a line spacing of **1.5** for improved readability.
- **Heading Styles**: Section headings are formatted using *numbered heading styles* (e.g., 1, 1.1, 1.2) to clearly organize content and reflect the document structure.
- **Emphasis**:
    - **Bold** text is used to highlight important information, technical terms, or **keywords** that require the reader's attention.
    - *Italic* text is used for formulas or expressions to distinguish them from regular text.
- **Requirement Priority Inheritance**: Priorities assigned to higher-level requirements are **not** automatically inherited by their detailed sub-requirements. Each requirement is assigned its own priority level individually to ensure clarity and proper traceability.

1.3 Intended Audience and Reading Suggestions

This document is intended for the following stakeholders:

- **Developers:** for implementing frontend/backend features, database structures, and APIs.
- **Project Managers:** to monitor scope, track development phases, and validate deliverables.
- **Testers:** to develop test plans based on functional and non-functional requirements.
- **Operations and Executives:** to ensure the system aligns with organizational goals and reporting needs.
- **Documentation Writers:** to prepare user manuals and training content.

Recommended reading flow:

- Sections 1–2 for all readers to understand system context.
- Section 3 for developers and testers.
- Section 4 for database implementers.

- Section 5 for QA and security planners.

1.4 Project Scope

The Carbon Footprint Tracking System is designed to monitor and reduce emissions related to coffee production in multiple branches. It automates emissions calculations, provides visual reporting, and helps managers implement reduction strategies. The system supports real-time data entry, centralized monitoring, and decision-making tools aligned with corporate sustainability objectives. It is a core part of the organization's digital transformation and environmental responsibility initiatives.

1.5 References

- **Database Preparation Document** (Internal Reference: Database_Preparation.docx)
- **Back and Frontend Functional Specification** (Internal Reference: Back+FrontendFunctions.docx)
- **Queries and Forms Guide** (Internal Reference: Queries+Forms.docx)
- **ISO/IEC 27001** – Information Security Standard
- **Apache PDFBox / iText** – Libraries for PDF generation

2. Overall Description

2.1 Product Perspective

This system is a new product developed specifically for a coffee company's sustainability program. It is self-contained but integrates with internal data collection tools and supports export functionality. It replaces legacy spreadsheets and manual tracking methods. The system is designed for scalability, supporting growth from 16 to 50+ branches.
A simplified system overview includes:

- **Frontend GUI** for data entry and visualization (JavaFX)
- **Backend Controller** managing logic and access control (Java)
- **SQL Database** storing production, packaging, and distribution records
- **Reporting Module** generating visuals and PDFs

2.2 Product Features

- Carbon emission calculations based on formulas for production, packaging, and distribution.
- Role-based access control with four distinct roles (Branch User, OP Manager, CIO, CEO).
- Data tracking for all branch operations and vehicle usage.
- Reduction plan creation, status tracking, and profitability estimation.
- Audit logging of all system changes.
- Pop-up notifications for emissions threshold breaches.
- Visual and PDF reporting tools.
- CSV import capability for external data integration.

2.3 User Classes and Characteristics

User class distinctions are enforced via strict access control policies.

- **Branch Users**: Local staff responsible for entering production, packaging, and distribution data. Basic system usage.
- **Operational (OP) Managers**: Regional heads overseeing multiple branches. Require access to all operational data, logs, and plan management.
- **Chief Information Officer (CIO)**: Read-only access to environmental metrics and strategy tracking.
- **Chief Executive Officer (CEO)**: View aggregated summaries only. High-level strategic decision-making.

2.4 Operating Environment

- **Frontend**: JavaFX-based desktop application.
- **Backend**: Java application.
- **Database**: MySQL.
- **Operating System**: Windows 10+ recommended.
- **Other Dependencies**: Java 17+, JDBC, Apache PDFBox/iText for PDF generation.

2.5 Design and Implementation Constraints

2.5.1 Software Constraints

- The backend must be developed using **Java**, and front end using **JavaFX**.
- Database must use **MySQL**, with **JDBC** for connectivity.
- All passwords must be **hashed (SHA-256)**, and sensitive data must use **AES-256 encryption**.
- Only **Apache PDFBox** or **iText** is allowed for PDF generation.
- All emissions and reduction formulas are **predefined and stored in a config file**.

2.5.2 Hardware Constraints

- System must run on standard desktops/laptops with:

  -8 GB RAM, Intel i5 processor, 1366x768 resolution.

- Optional: **USB for CSV import** and **printer** for report output**.**

2.5.3 Deadline Constraints

- Project must be completed and demonstrated by **Week 11** of the semester.
- Major development milestones must be locked by **Week 6** to avoid feature creep.
- No changes to tools or tech stack are allowed after Week 6.

2.5.4 Budget Constraints

- Must use **free or open-source tools and libraries** only.
- System must run **locally or over LAN** — no paid cloud services.
- No paid APIs or external integrations are allowed in this version.

2.6 User Documentation

- **User Manual** – Includes step-by-step guides for all modules.
- **Quick Start Guide** – For branch-level users.
- **System Admin Manual** – For OP Managers.

2.7 Assumptions and Dependencies

- All branches will have access to computers with Java runtime and internet connection.
- Emission factors used in formulas are standardized and agreed upon by stakeholders.
- System performance tested under max expected loads (1,000 concurrent users).
- Reduction strategies and profitability estimates are static formulas (subject to update post-deployment).
- Notification delivery is limited to in-app alerts only; no external email/SMS integration is planned yet.
- Future integration with ESG platforms or national climate portals is considered out-of-scope for this release.

3. System Features

3.1 Carbon Emission Calculation

Calculates CO_2 emissions across production, packaging, and distribution activities for each branch.

3.1.1 (High) The system shall calculate production emissions of each branch based on coffee quantities using this formula:

(Production Emissions (kg CO_2) = Production Quantities (kg) × 6.4 (kg CO_2/kg) Emission Factor).

3.1.2 (High) The system shall calculate the packaging emissions of each branch based on waste quantities using this formula:

(Packaging Emissions (kg CO_2) = Packaging Waste (kg) × 6 (kg CO_2/kg) Emission Factor).

3.1.3 (High) The system shall calculate the distribution emissions of each branch based on vehicle type, distance, and fuel efficiency; *(Minivan: 10 km/L eflciency, Pickup Truck: 15 km/L eflciency)* using this formula

(Distribution Emissions (kg CO_2) = (Total Distance (km)/Fuel Eflciency (km/L))×2.68 (kg CO_2/l) Emission Factor)).

3.2 Notifications and Alerts

Triggers real-time alerts for emission breaches or plan changes.

3.2.1 (High) The system shall generate notifications as pop-up alerts when

- Emission target branches.
- Reduction plan status changes.

3.3 Role-Based Access Control

Restricts system access based on user roles to ensure data security.

- **Branch Users:**

3.3.1 (High) The branch user shall only access their assigned branch.

3.3.2 (High) The system shall enable branch users to enter production, packaging, and distribution data.

3.3.3 (High) The system shall enable branch users to view production, packaging, and distribution data.

- **OP Managers:**

3.3.4 (High) The operational manager shall have full access to all branches.

3.3.5 (High) The system shall enable the operational manager to manage all users.

3.3.6 (High) The system shall enable operational manager to view all operational data (Production data, Packaging data, Distribution data, Branch performance metrics (employees, locations) Reduction plans, Audit logs and User activities).

- **CIO:**

3.3.7 (High) The CIO shall have Read-only access to carbon footprints and reduction plans.

- **CEO:**

3.3.8 (High) The CEO shall have access to aggregated reports.

3.4 Audit Logging

3.4.1 (High) The system shall record all database changes:

- The User who made the change.
- The Action type (INSERT, UPDATE, DELETE).
- The Affected table and record.
- The Timestamp of change.

3.4.2 (High) The system shall enable the operational manager to delete audit logs before a chosen date.

3.5 Data Tracking Modules

3.5.1 (High) The system shall track Branch data(16 branches (4 per city: Cairo, Alexandria, Aswan, Suez)):

- Location details.
- Number of employees.
- Associated users.

3.5.2 (High) The system shall track Coffee Production data:

- Supplier information.
- Coffee type (Arabica, Robusta, Organic).
- Product type (Ground, Whole Bean, Instant)
- Production quantities.

3.5.3 (High) The system shall track Coffee Packaging data:

- Packaging waste amounts.

3.5.4 (High) The system shall Coffee Distribution data

- Vehicle type (Minivan/Pickup Truck).
- Number of vehicles.
- Distance travelled.

3.6 Reduction Strategy Management

3.6.1 (High) The system shall record implementation strategies.

3.6.2 (High) The system shall track status (Draft, In Progress, Complete).

3.6.3 (High) The system shall calculate projected annual profits (20% of implementation costs).

3.6.4 (High) The system shall allow filtering by city and branch.

3.7 Reporting and Analytics

3.7.1 (High) The system shall provide Visual data representation using: (**Line, Bar, Pie Charts**).

3.7.2 (High) The system shall be able to generate PDF reports (**using Apache PDFBox or iText**).

3.7.3 (High) The system shall enable the operational manager to import **CSV** files.

4. External Interface Requirements

4.1 User Interfaces

The system will employ a **JavaFX-based Graphical User Interface (GUI)**. All user interfaces are designed for ease of use by non-technical users while adhering to standard usability principles. The UI will follow the following conventions:

- **Standard Layout**: Each screen contains a header (with role-based user info), a sidebar (for navigation), and a main content pane.
- **Consistent Navigation**: The left-hand side vertical navigation bar allows quick access to modules such as Dashboard, Branch Data Entry, Audit Logs, Reports, and Reduction Strategies.
- **Input Forms**: Clearly labeled with inline validation and tooltips.
- **Buttons**: Common buttons include Save, Cancel, Edit, Delete, Export, and Calculate. Standard icons are used across the platform.
- **Color Scheme**: Shades of green and earth tones, aligning with the environmental theme. Warnings use yellow, and errors are in red.
- **Error Messages**: Displayed at the top of forms with context-aware messages (e.g., "Invalid CO_2 value. Must be a positive number.").
- **Help Button**: Available on each screen with role-specific guidance.
- **Keyboard Shortcuts**:
  - Ctrl + S: Save form
  - Esc: Cancel/Close window
  - F1: Open help panel
- **Responsiveness**: The GUI will be sized for 1366x768 resolution and above.

User Interface Components:

- Login Screen
- Role-based Dashboards (CEO, CIO, OP Manager, Branch User)
- Data Entry Forms (Production, Packaging, Vehicles)
- Carbon Emission Calculators
- Strategy Management Screens
- Report Generators with Charts and Export Options
- Audit Log Viewer
- Notifications Pane

4.2 Hardware Interfaces

This is a desktop software solution with no direct interaction with external hardware beyond the user's standard computing setup.

Hardware Requirements:

Standard desktop or laptop with:

- 8 GB RAM minimum
- Intel i5 processor or equivalent
- Display resolution: 1366x768 or higher

Interface Characteristics:

- **Data I/O**: CSV files can be read from USB drives or local folders.
- **Printing**: Standard print interface for PDF reports; supports all system-configured printers.

4.3 Software Interfaces

4.3.1 **Database System:** MySQL

- Tables for branches, emissions, packaging, vehicles, plans, and users.
- Queries implemented using JDBC.
- All SQL statements prepared using parameterized queries to prevent SQL injection.

4.3.2 Operating System:

- Windows 10 or above.
- Compatible with macOS and Linux (pending future testing and adjustment).

4.3.3 Libraries and Tools:

- **Java 17+** runtime environment.
- **JavaFX** for GUI development.
- **JDBC** for database connectivity.
- **Apache PDFBox / iText** for PDF generation.
- **Apache Commons CSV** for import/export functionality.

4.3.4 Shared Data:

- Logged-in user session (global context for access control).
- Emission formulas (shared between calculator and strategy module).
- Notification flags (shared between database and pop-up system).

4.3.5 Implementation Constraints:

- Shared user state managed via singleton session handler.
- Database must be initialized before GUI launch.
- Emission thresholds and reduction formulas in the config file, editable only by OP Managers.

4.4 Communications Interfaces

Although the system does not rely on external online communication, it supports local communication and may optionally support LAN-based deployments in the future.

4.4.1 Internal Communication:

- Data exchanges occur via JDBC between the application and the database.
- Inter-module communication (e.g., from emission tracker to notification handler) uses internal Java method calls and service classes.

4.4.2 Message Formatting:

- Notifications stored and transmitted as simple text with metadata (timestamp, type, viewed-status).
- CSV files must follow the company format:
- Comma-separated.
- First row contains headers.
- UTF-8 encoding.

4.4.3 Security:

Role-based access is enforced on all database operations.

- AES-256 encryption for locally saved configuration files.
- SHA-256 hashing for user passwords.
- TLS recommended for any future networked deployment.

4.4.4 Standards:

- In-app messaging follows Java serialization standards.
- Communication via HTTPS or WebSocket will be considered for Version 2.0 if cloud-based integration is added.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

5.1.1 The system shall handle large volumes of data (up to 10 million records) for emissions calculations across coffee production, packaging, and transportation.

5.1.2 The system shall respond to key operations (report generation, data entry) within 2 seconds to ensure a smooth user experience.

5.1.3 The system shall scale to support up to 50 additional branches or 5 new cities without performance degradation beyond a 10% latency increase.

5.1.4 The system shall maintain performance standards for 1000 concurrent users (e.g., different branches accessing data simultaneously) without any notable performance lag.

5.1.5 The system shall complete emissions calculations for all stages (production, packaging, distribution) in under 5 seconds per branch.

5.2 Safety Requirements

5.2.1 The system shall implement built-in validation checks for all carbon emission calculations to prevent data integrity issues.

5.2.2 The system shall perform automated daily backups with 99.9% reliability to ensure business continuity and environmental reporting accuracy.

5.2.3 In the event of a failure, the system shall support a recovery plan that restores the most recent backup within 30 minutes, minimizing disruption.

5.2.4 The system shall trigger alerts within 1 minute of detecting errors that impact environmental reporting accuracy.

5.2.5 The system shall comply with relevant safety and data protection standards, such as

5.2.6 ISO/IEC 27001 for information security management.

5.3 Security Requirements

5.3.1 The system shall enforce multi-factor authentication (MFA) for all administrative and branch-level users.

5.3.2 The system shall support secure login via registered email and password credentials, with passwords hashed (e.g., bcrypt/scrypt) and securely stored.

5.3.3 The system shall enforce strong password rules: minimum 8 characters, including uppercase, lowercase, and numeric characters.

5.3.4 The system shall provide a "Forgot Password" feature, allowing users to reset their password securely through email verification or security questions.

5.3.5 The system shall implement role-based access control (RBAC) and redirect users (Branch User, Operational Manager, CIO, CEO) to role-specific dashboards post-login.

5.3.6 The system shall terminate inactive sessions after 20 minutes of inactivity.

5.4 Software Quality Attributes

Usability Requirements

5.4.1 The system shall support English and Arabic language interface options

5.4.2 The system should achieve a 90% user satisfaction rating for interface intuitiveness within 3 months of deployment. The goal is to minimize the learning curve for new users.

Maintainability Requirements

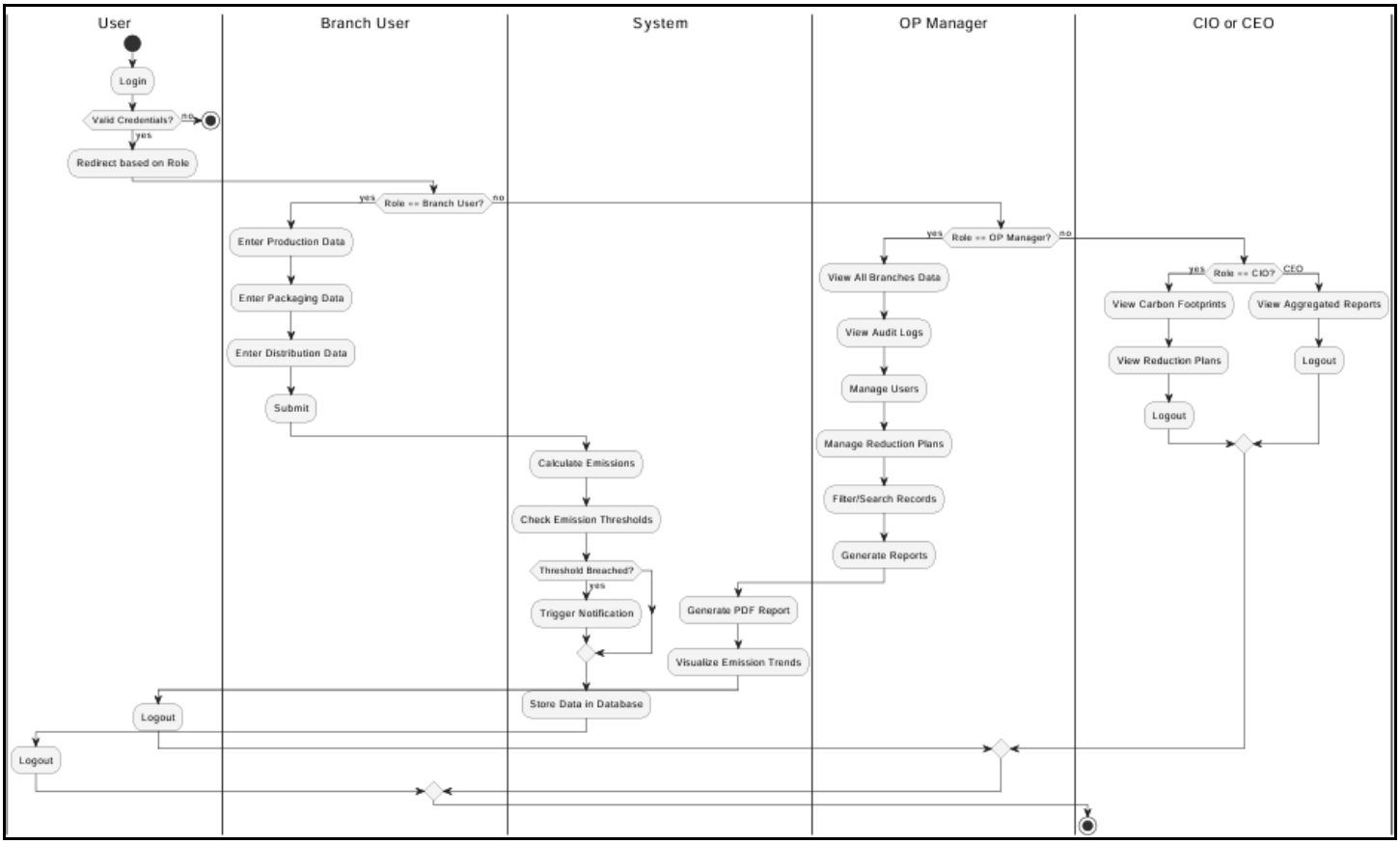
5.4.3 The system should be adaptable to future changes, such as integrating new sustainability strategies or reporting features.

5.4.4 The system should include comprehensive testing (unit, integration, and acceptance tests) to ensure software quality and avoid potential issues during deployment.

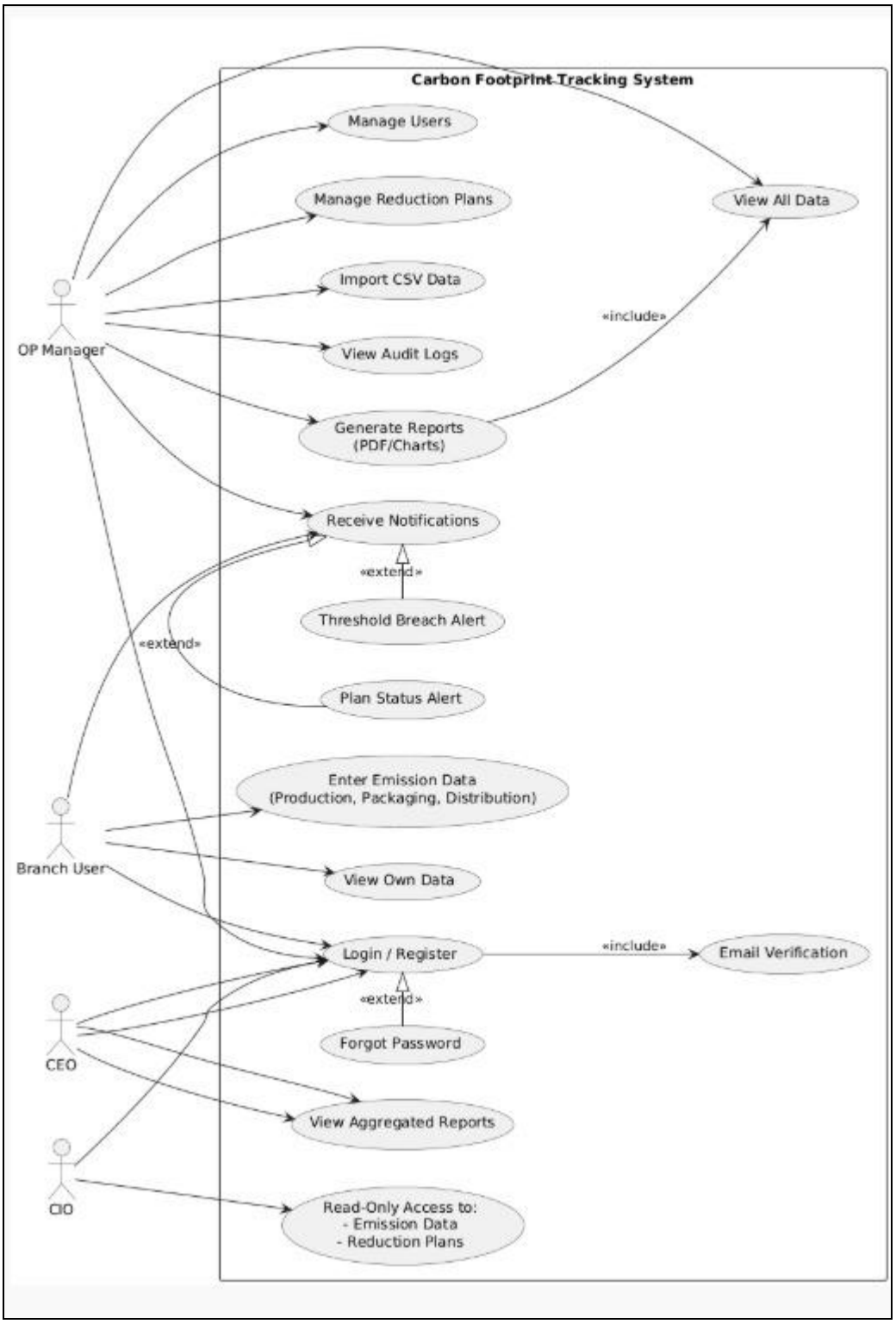
6. UML Diagrams

6.1 **Activity diagram :**

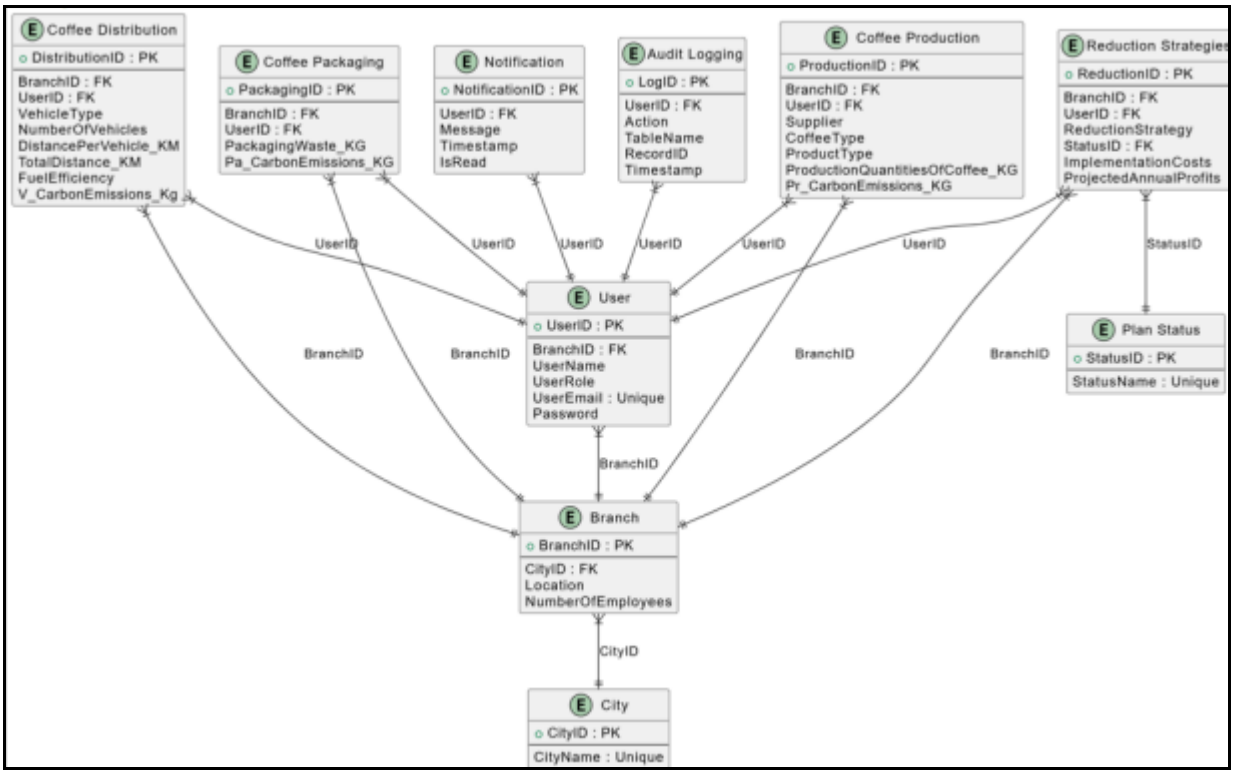
The activity diagram shows the step-by-step workflow of how emissions are recorded, calculated, and monitored across the coffee production, packaging, and distribution processes in CoFaktory.



6.2 Use Case diagram : The use case diagram illustrates how different users—such as admins, branch managers, and auditors—interact with CoFaktory's main features, including emission logging, reduction strategy management, and performance reporting.



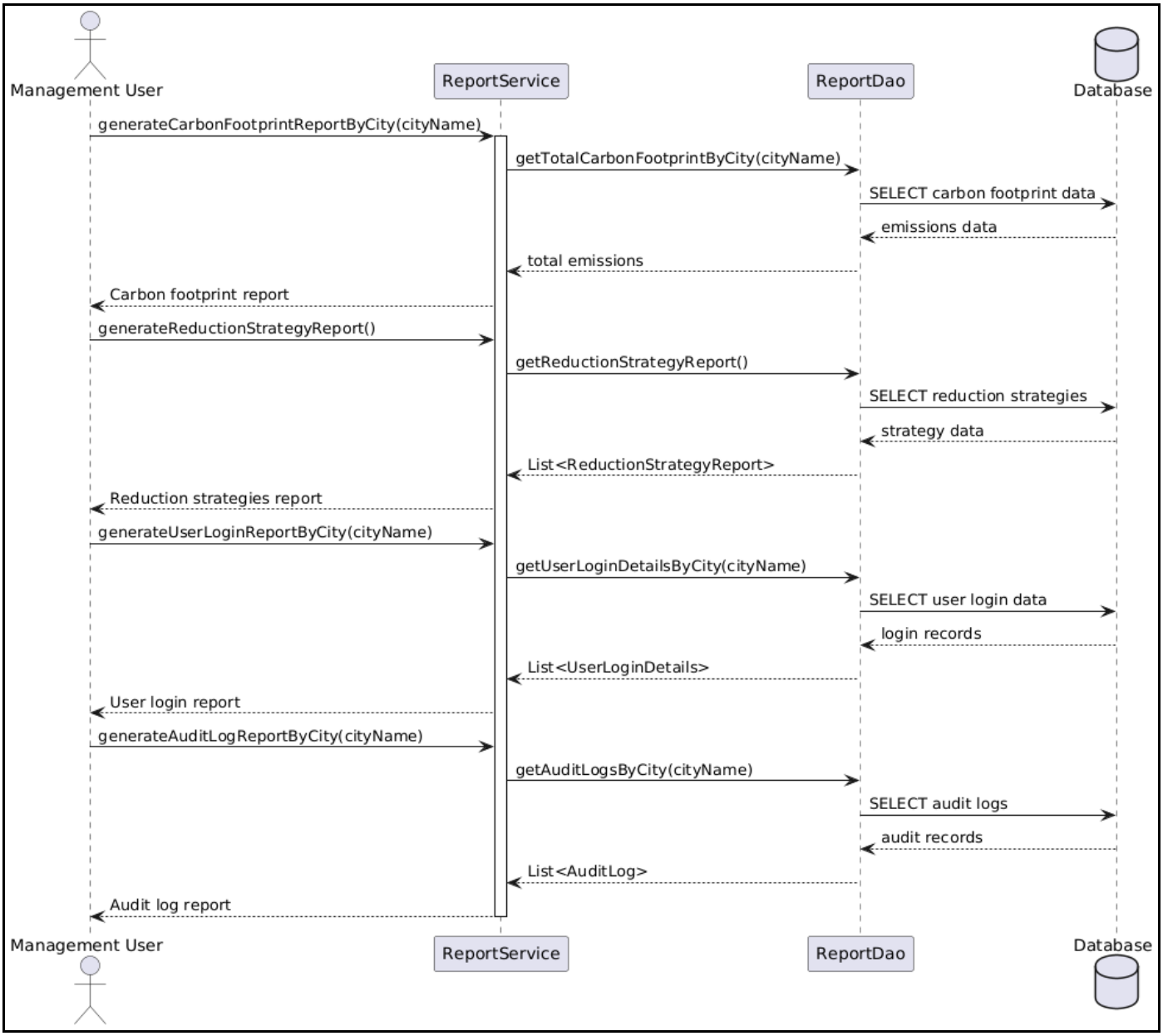
6.3 Class diagram : The class diagram defines the structure of CoFaktory's core components, including classes like User, Branch, CoffeeProduction, and ReductionStrategy, showing their attributes, methods, and relationships.



6.4 Sequence Diagram: The sequence diagram depicts the interaction between MySQL database as they process user requests like adding emissions data or retrieving branch-specific reduction plans

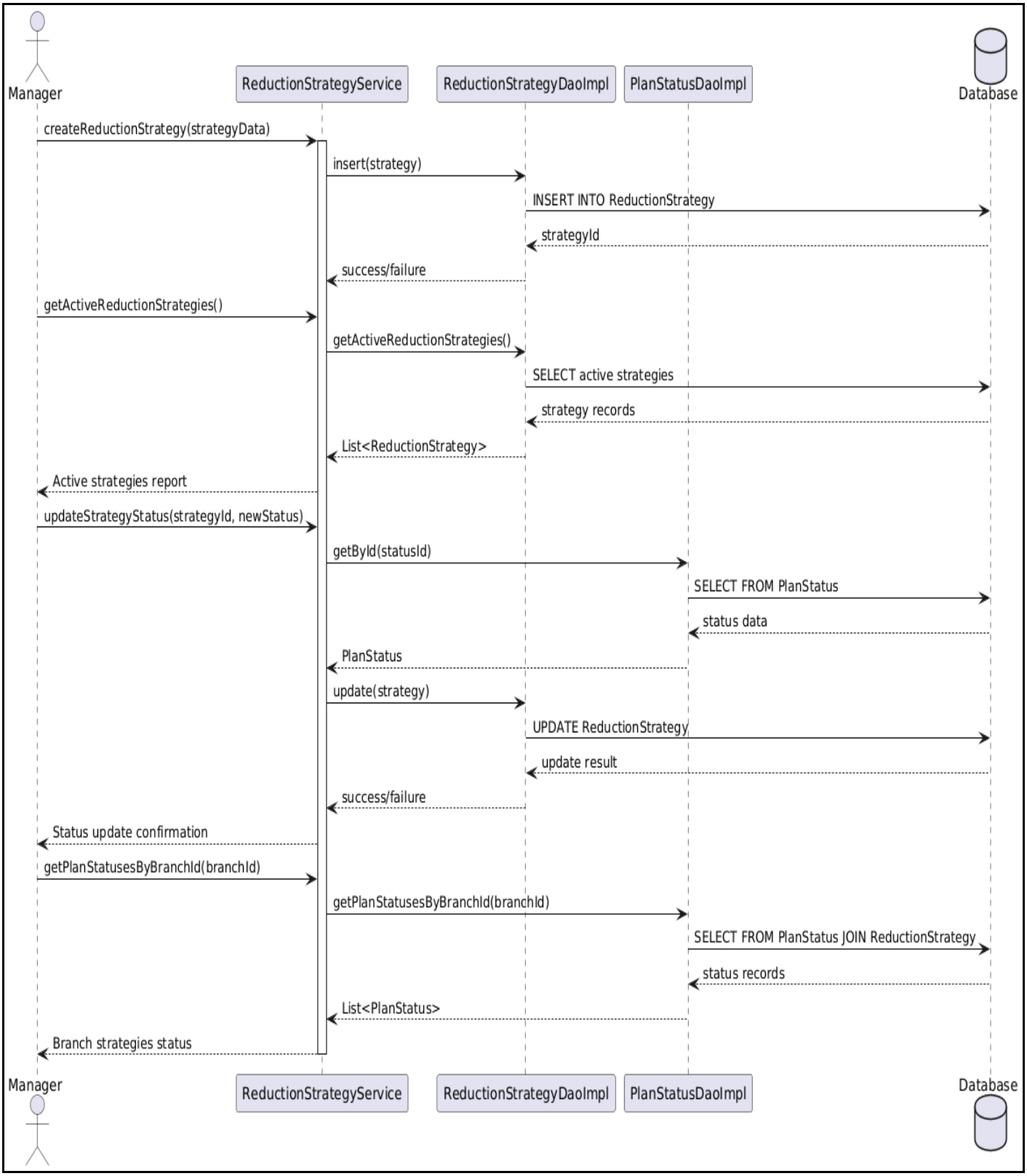
6.4.1 Reporting Sequence

Visualizes the process of generating and retrieving reports.



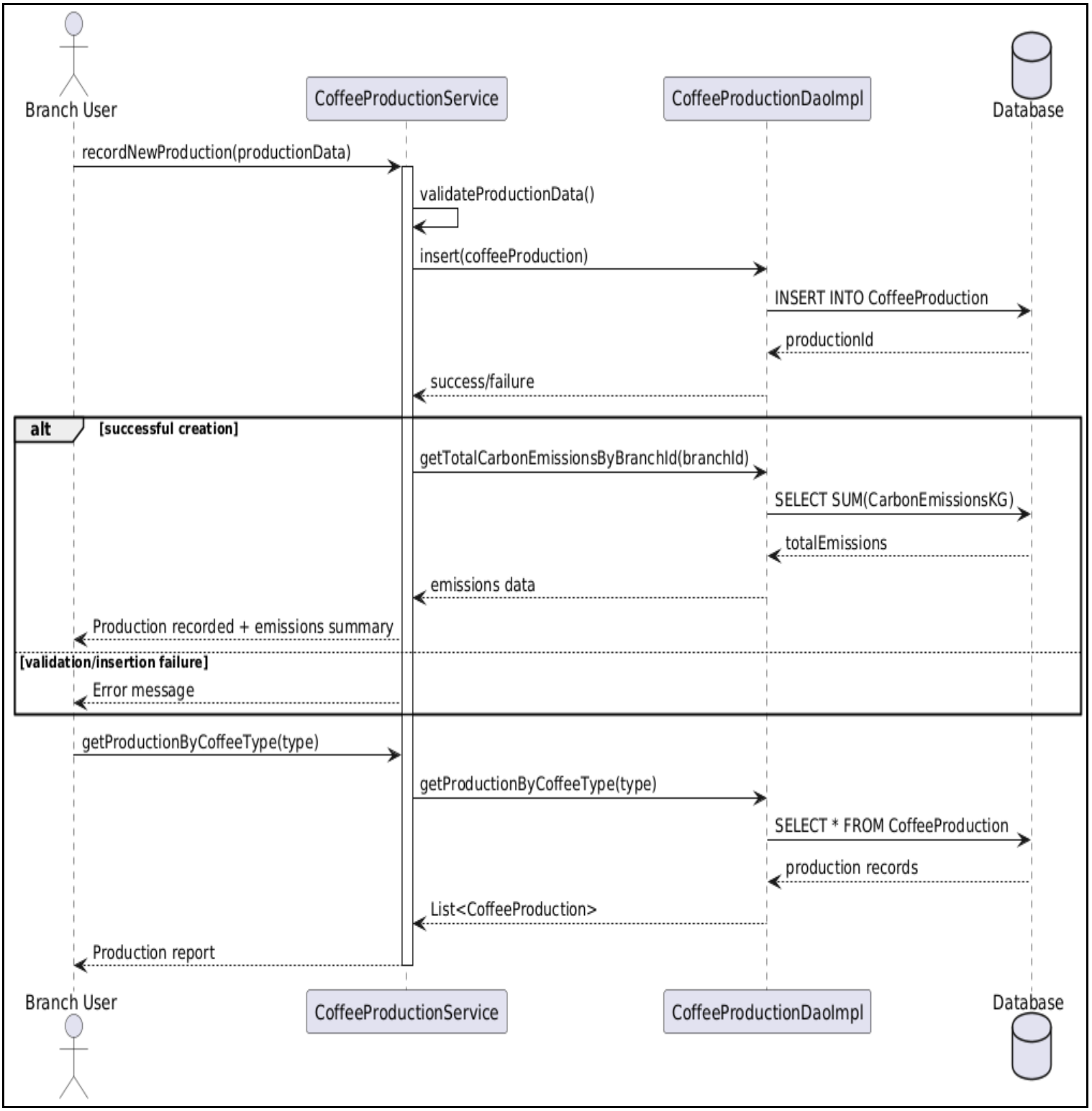
6.4.2 Reduction Strategy Sequence

Details how reduction strategies are added, updated, or retrieved.



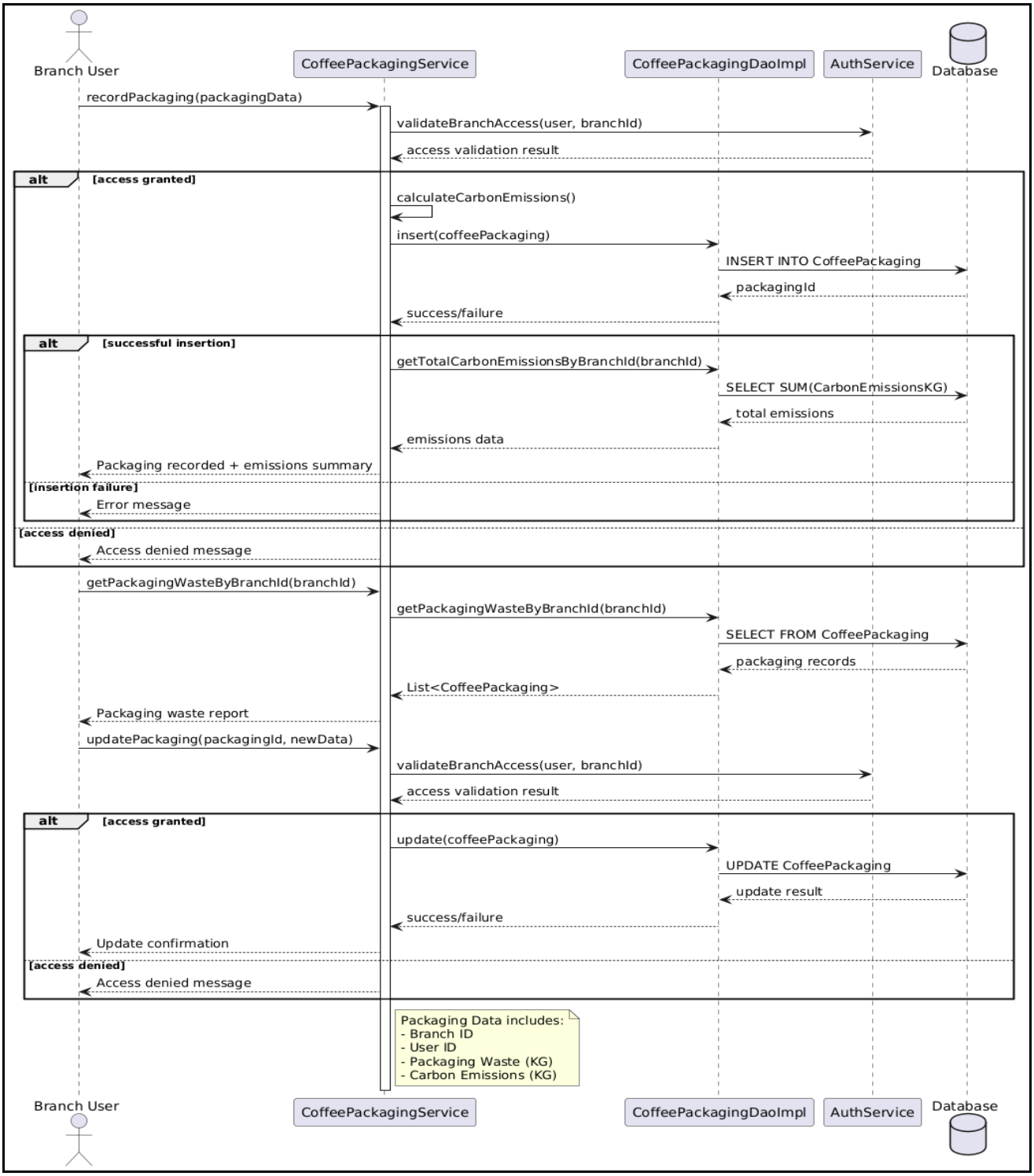
6.4.3 Coffee Production Sequence

Describes the process of recording coffee production data and emissions.



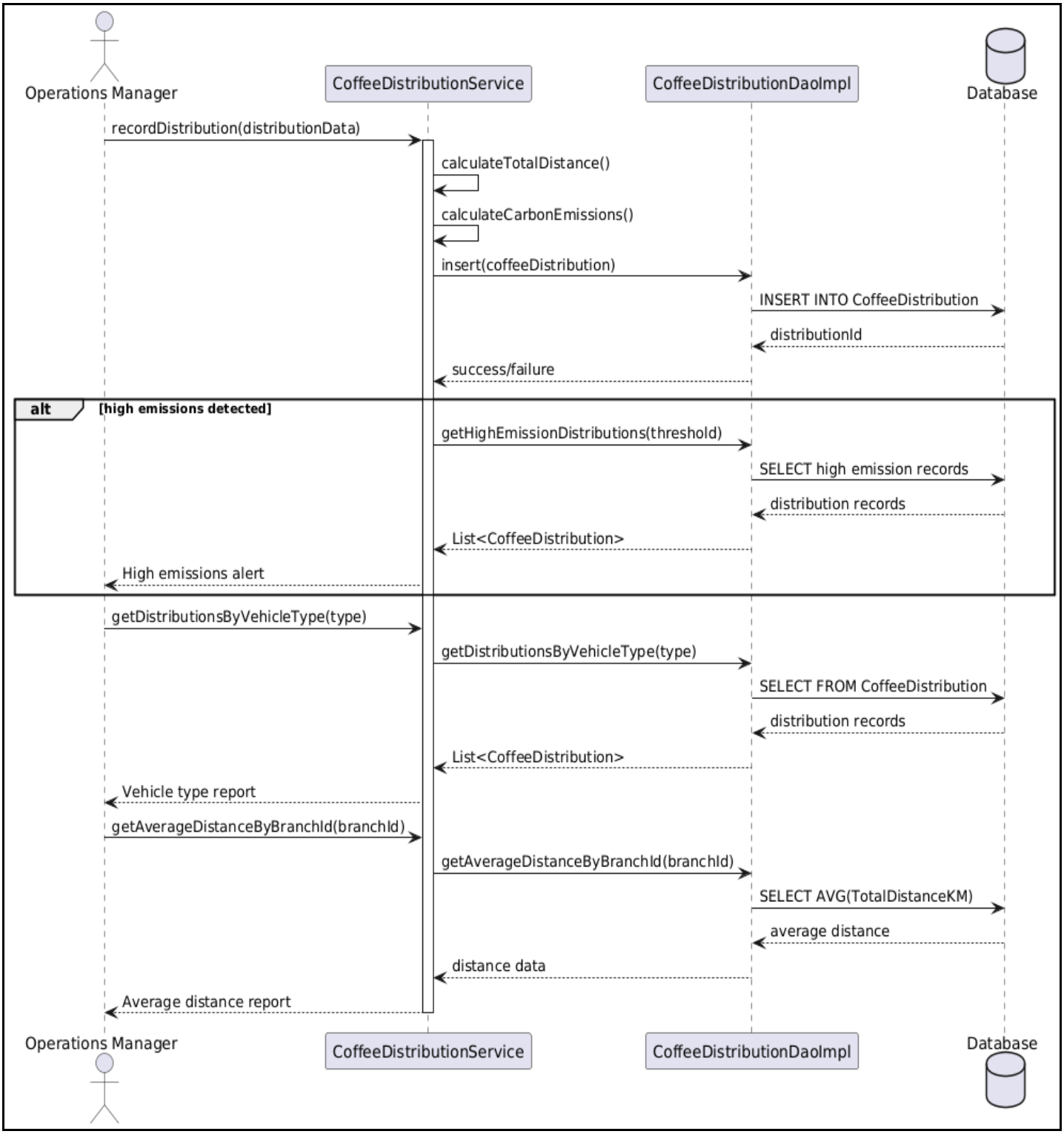
6.4.4 Coffee Packing Sequence

Shows interactions for tracking packaging material usage and calculating carbon impact.



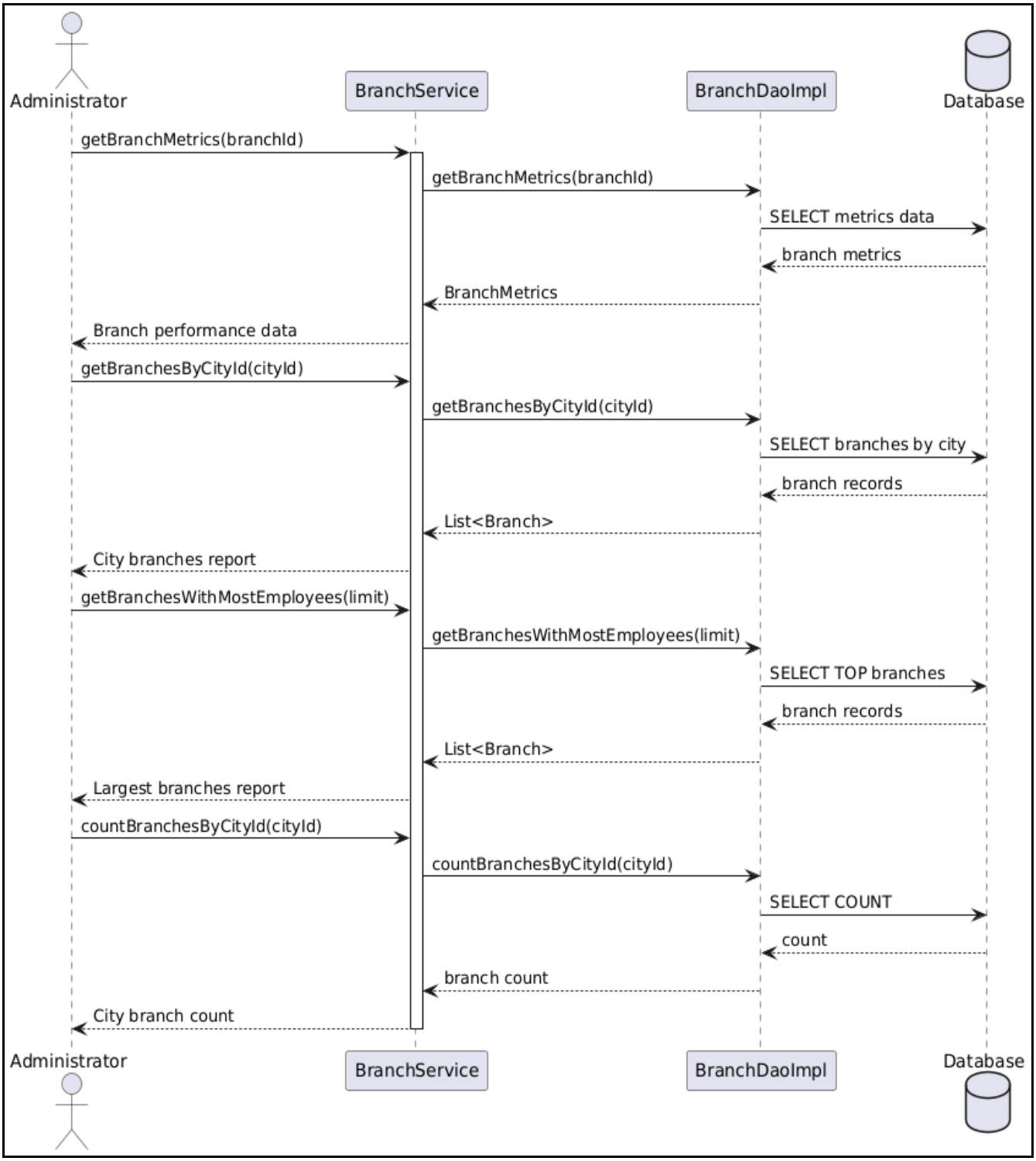
6.4.5 Coffee Distribution Sequence

Outlines the flow of adding or updating distribution data and calculating related emissions.



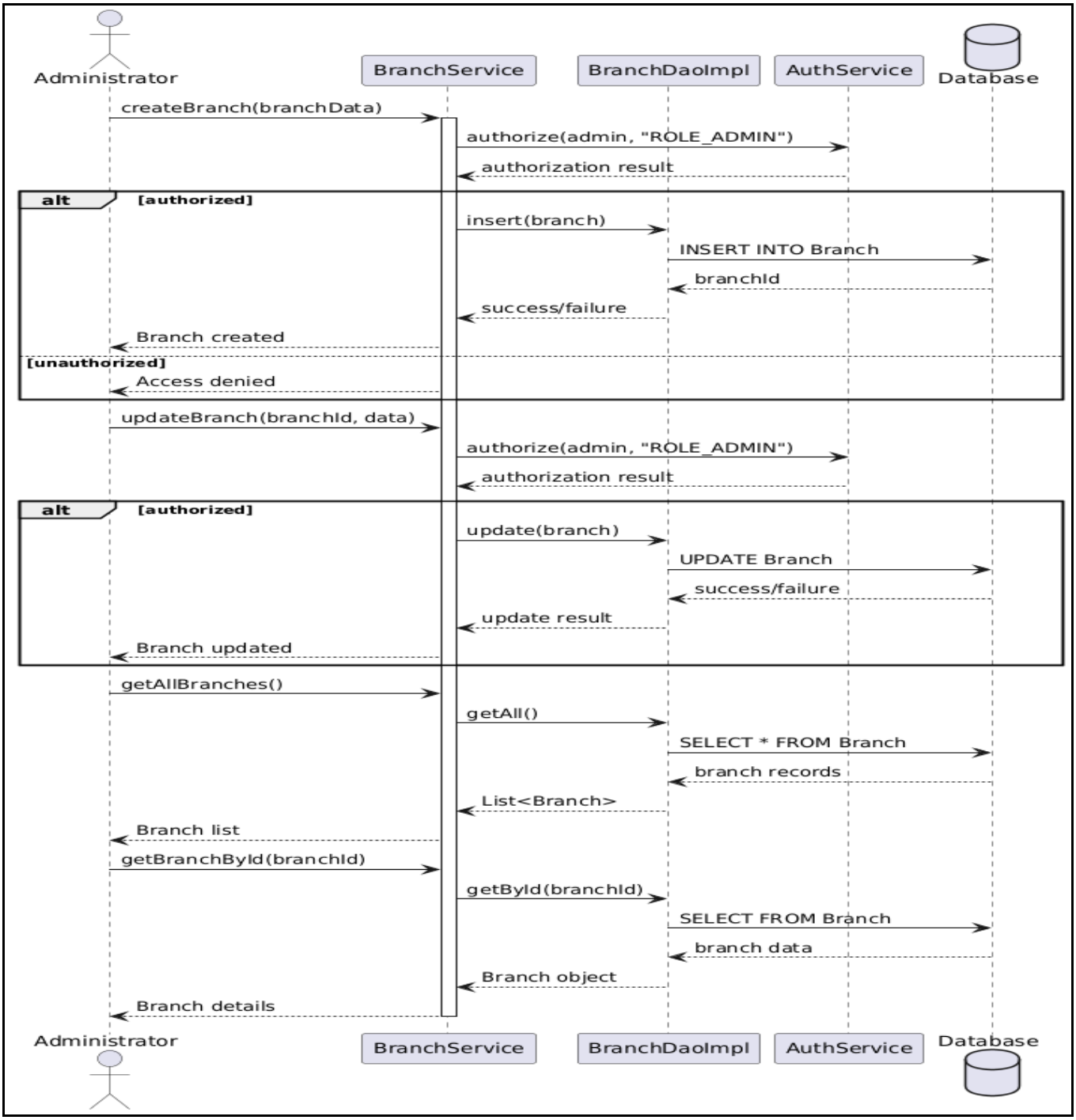
6.4.6 Branch Metrics Sequence

Displays how metrics for a specific branch (emissions, costs) are fetched and displayed.



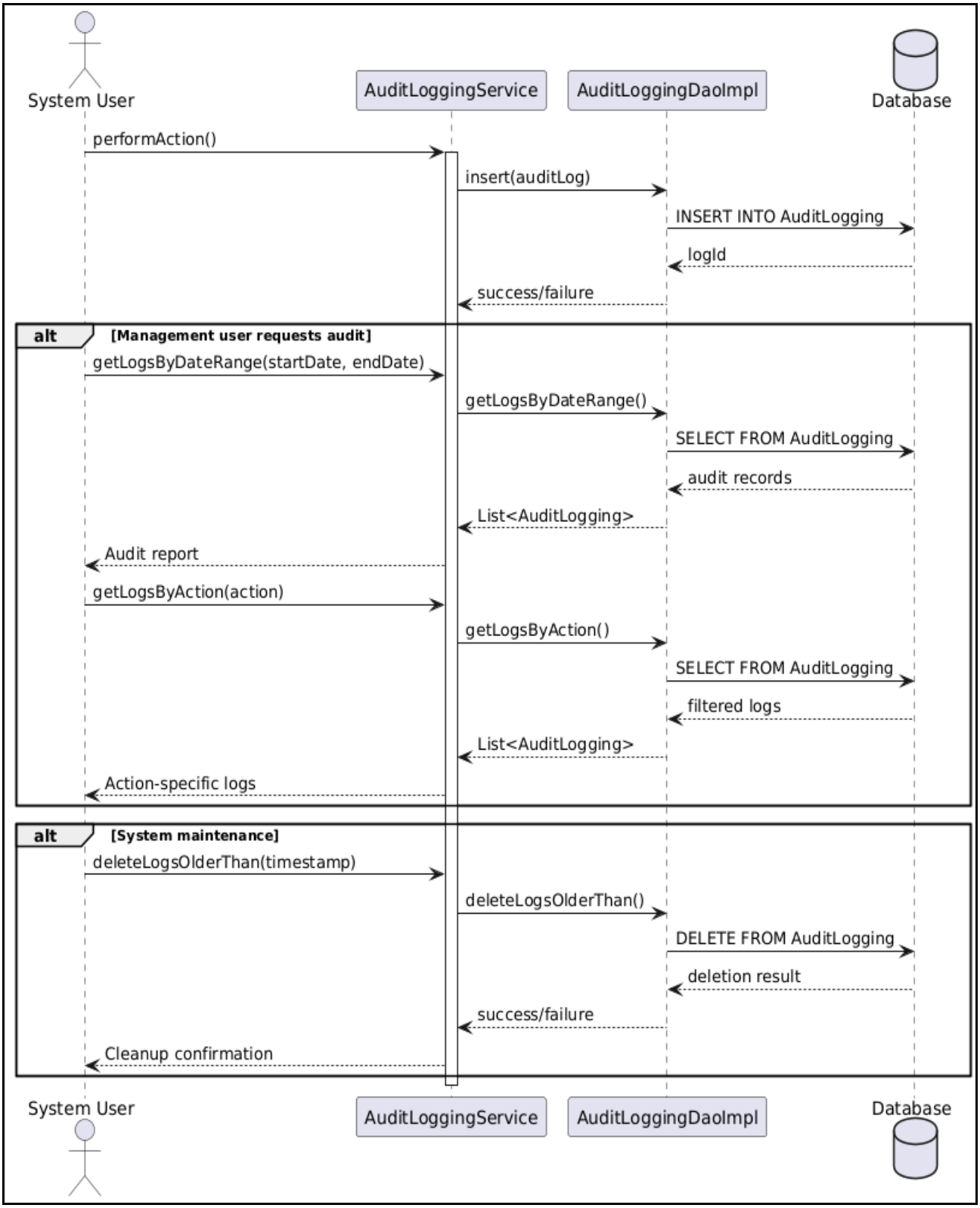
6.4.7 Branch Management Sequence

Illustrates the process of managing branches (create, update, delete).



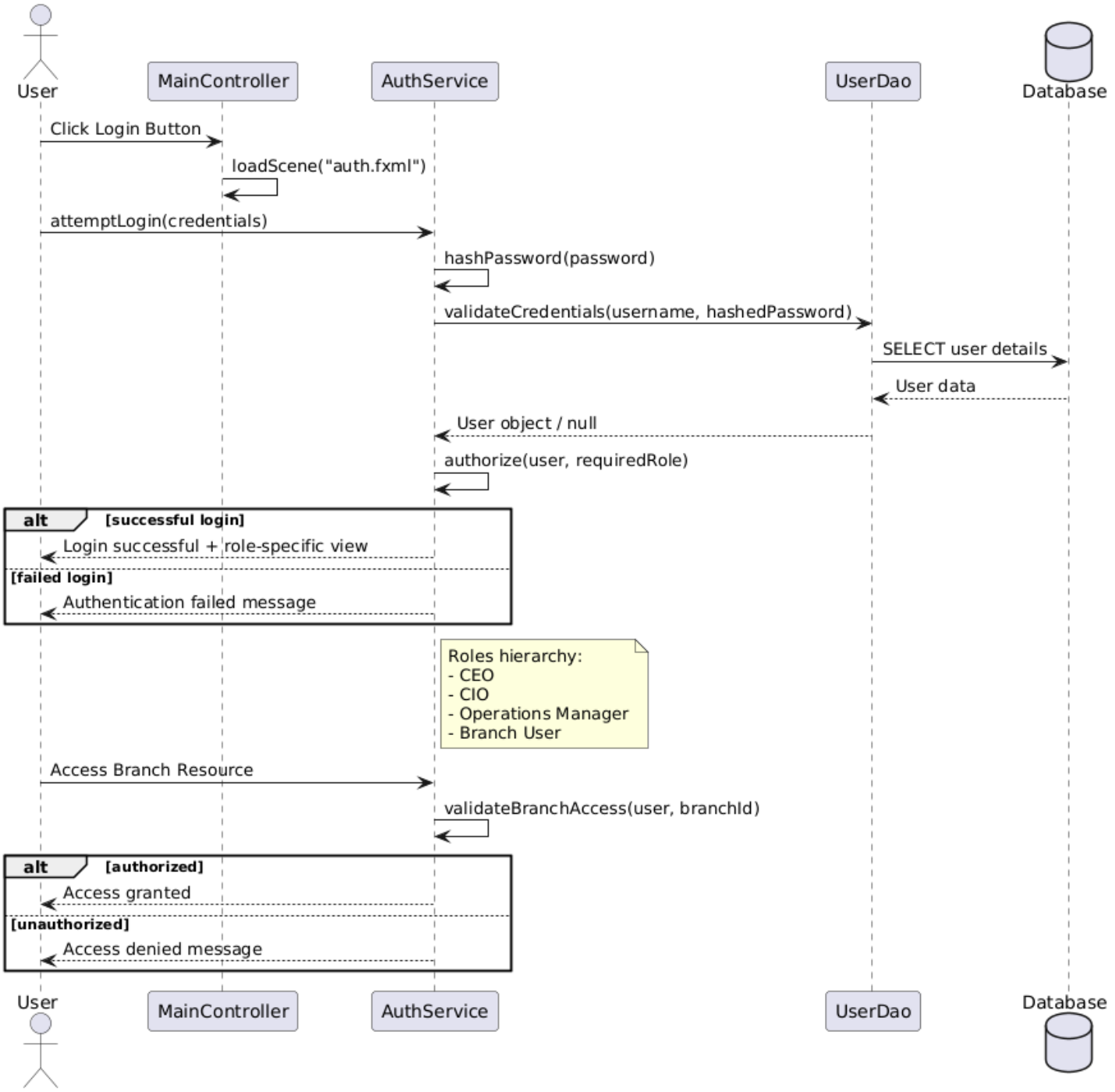
6.4.8 Audit logging Sequence

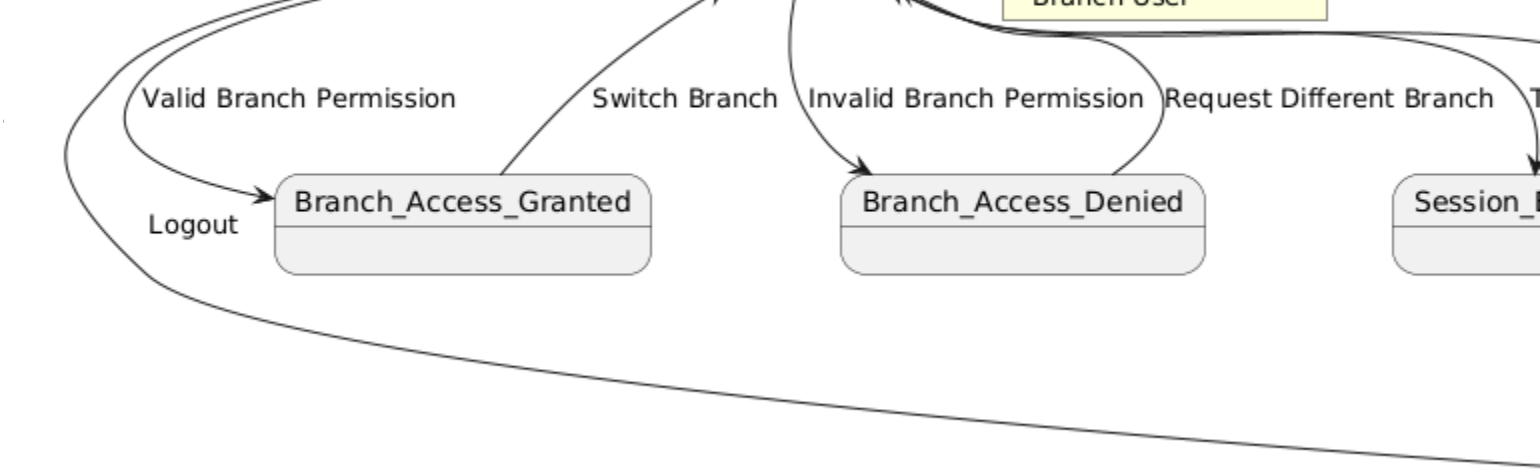
Demonstrates how user activities are logged for tracking and accountability.

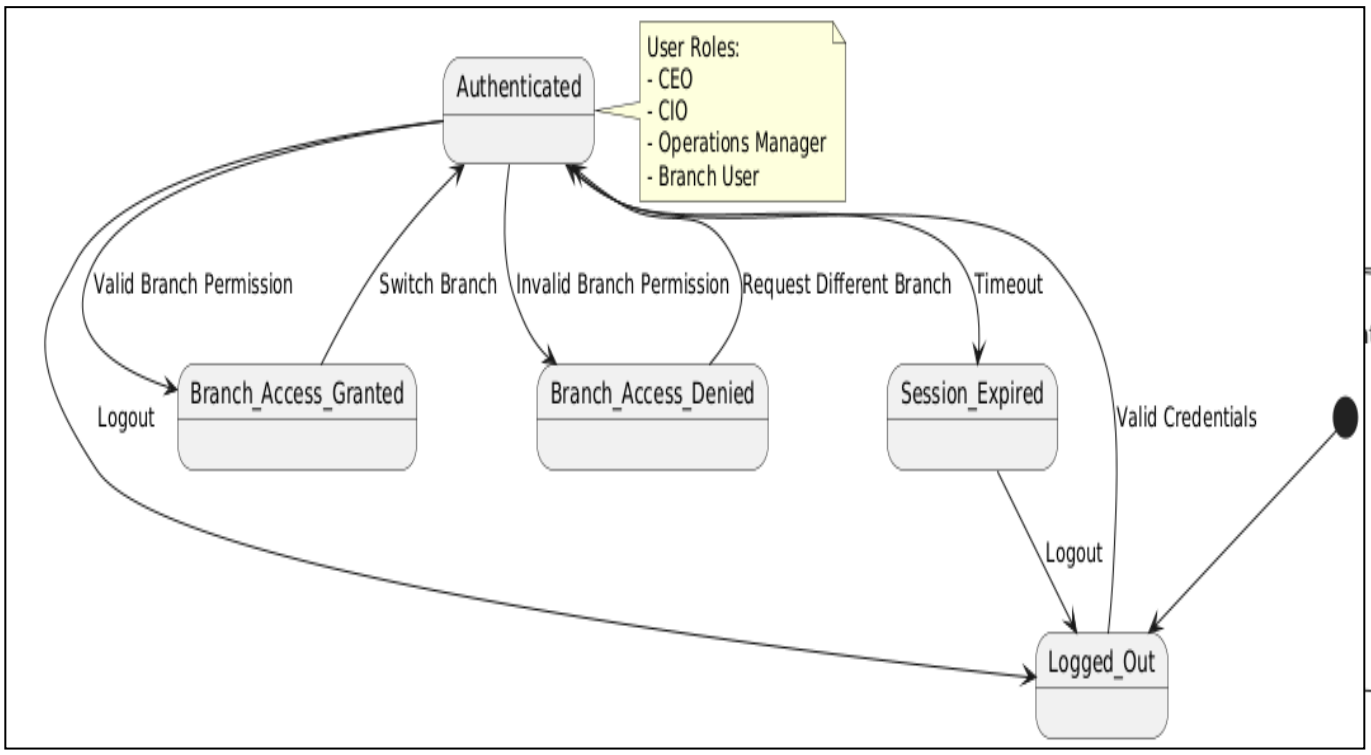


6.4.9 Authentication Sequence

Shows how a user logs in, gets authenticated, and gains access to the system.

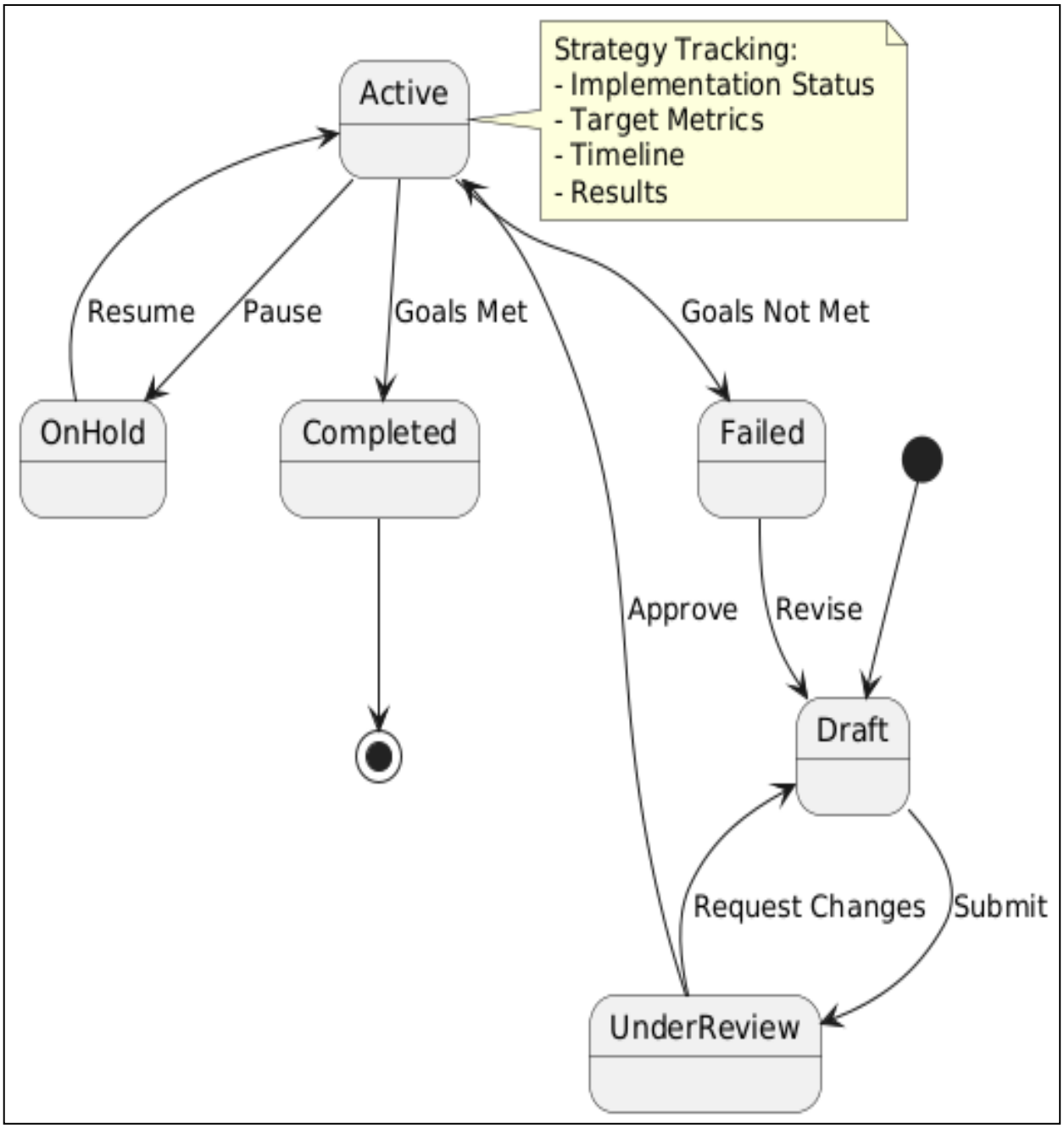



Valid Branch Permission
Switch Branch
Invalid Branch Permission
Request Different Branch
Logout
Branch_Access_Granted
Branch_Access_Denied


Authenticated
User Roles:
- CEO
- CIO
- Operations Manager
- Branch User
Valid Branch Permission
Switch Branch
Invalid Branch Permission
Request Different Branch
Timeout
Logout
Branch_Access_Granted
Branch_Access_Denied
Session_Expired
Valid Credentials
Logout
Logged_Out

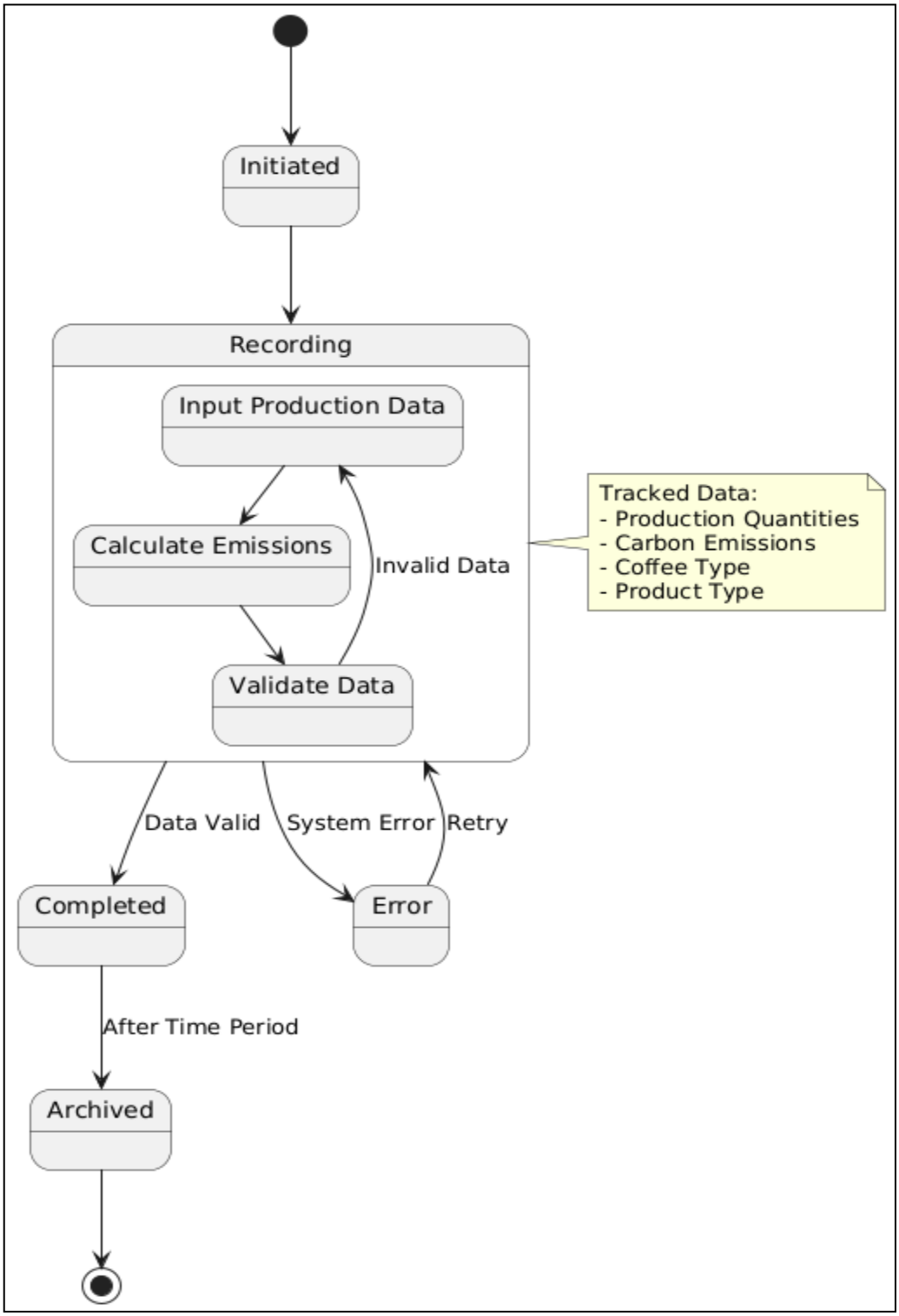
6.5.2 Reduction Strategy

Possibly a class or activity diagram defining how strategies are modeled or implemented.



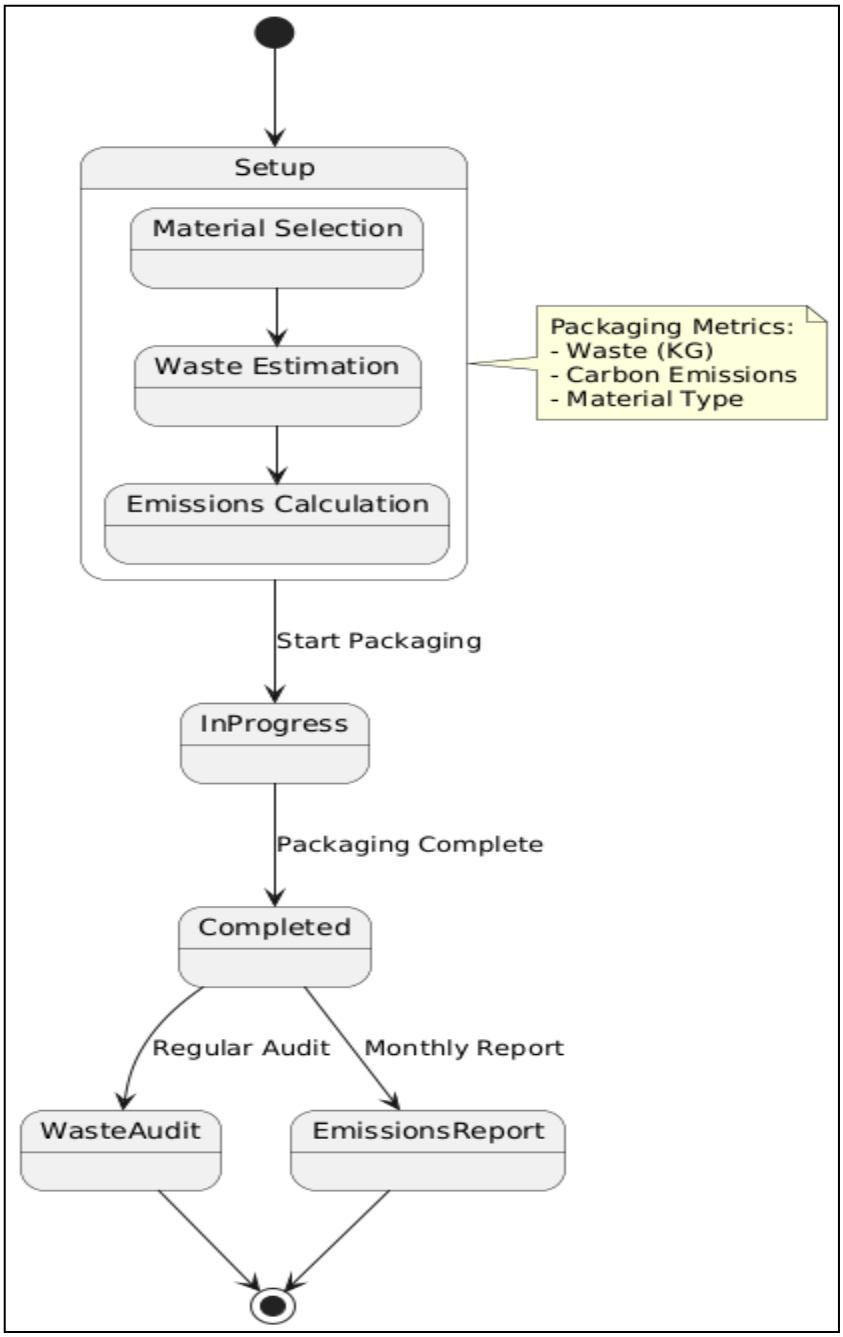
6.5.3 Coffee Production

State diagram that shows the lifecycle of a coffee production record.



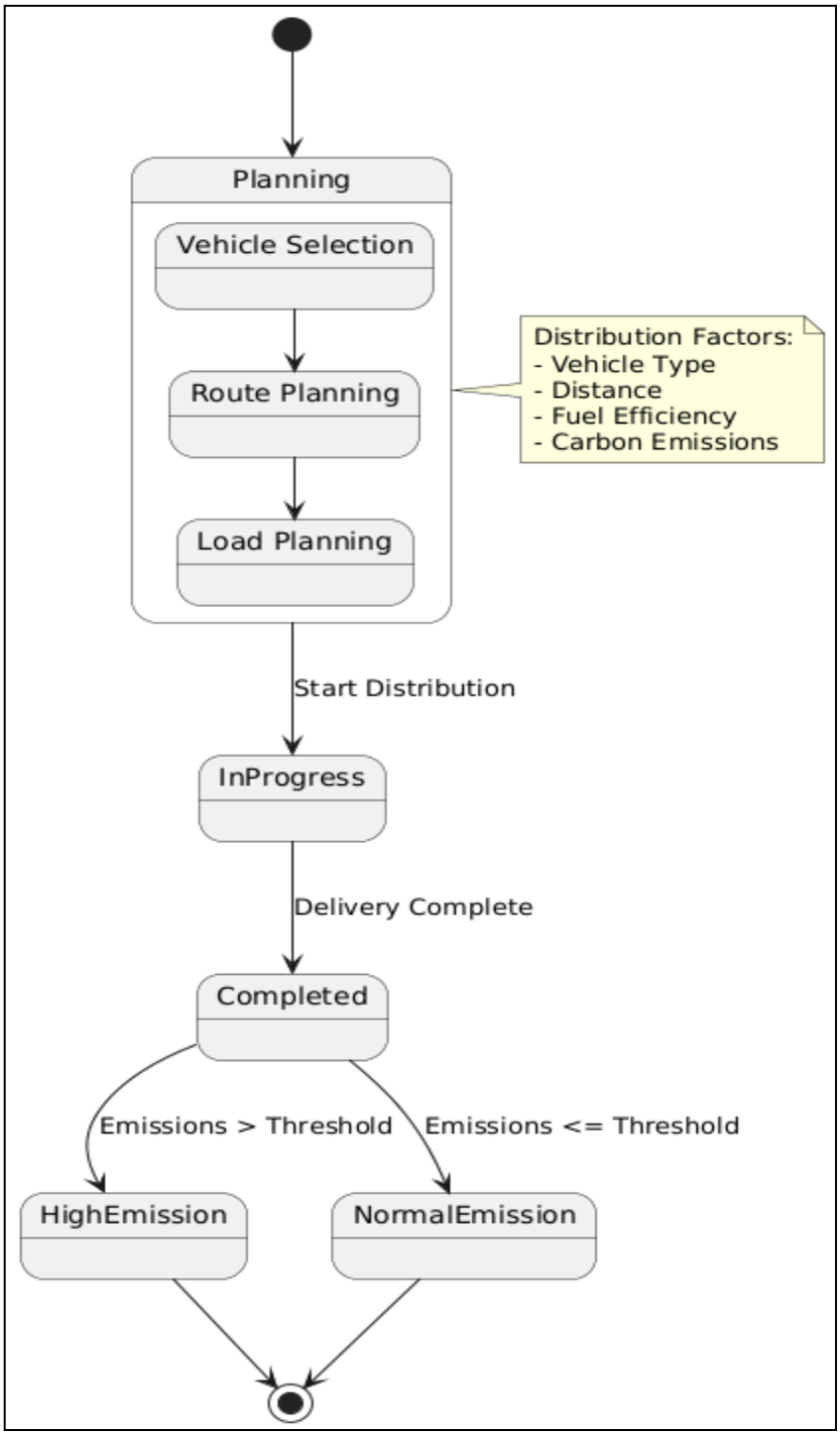
6.5.4 Coffee Packing

Could be a class or use case diagram illustrating entities and functions involved in packaging.



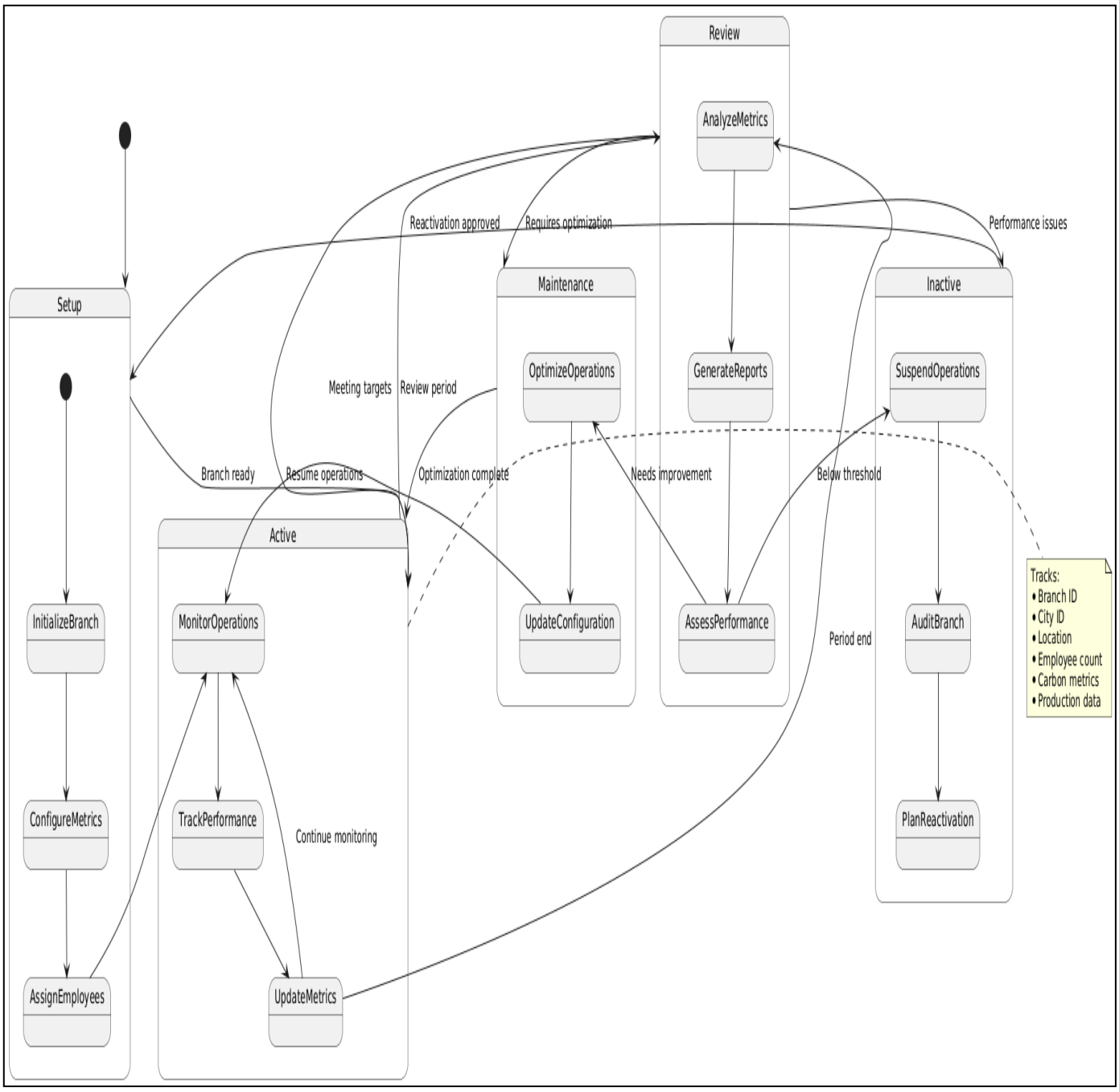
6.5.5 Coffee Distribution

Represents the data model or flow related to transporting coffee to branches.



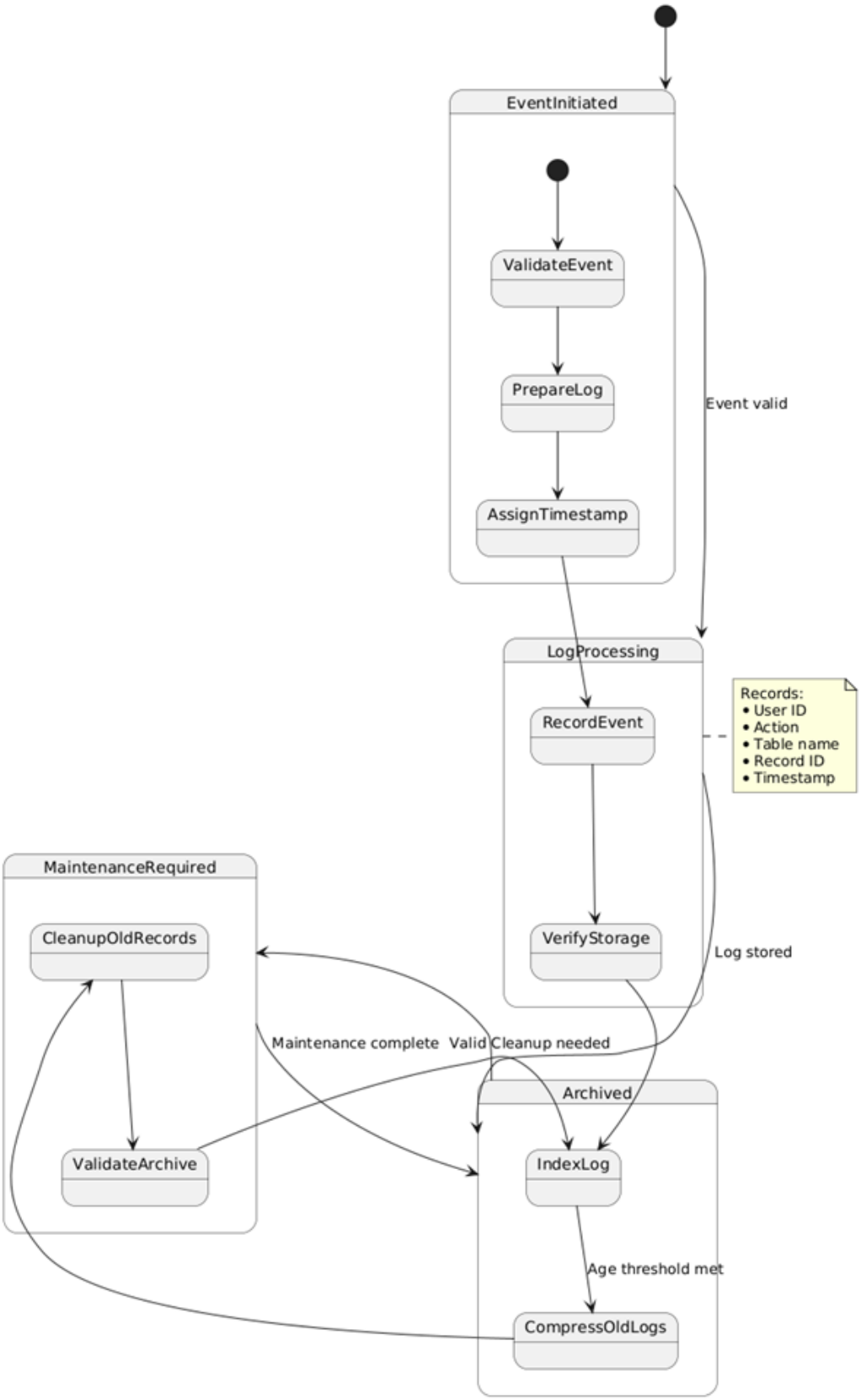
6.5.6 Branch Management

Likely showing structure or flow for managing branches.



6.5.7 Audit logging

Likely showing logging behavior or logging structure.


EventInitiated
ValidateEvent
PrepareLog
AssignTimestamp
Event valid
LogProcessing
RecordEvent
Records:
• User ID
• Action
• Table name
• Record ID
• Timestamp
VerifyStorage
Log stored
MaintenanceRequired
CleanupOldRecords
Maintenance complete
Valid Cleanup needed
Archived
ValidateArchive
IndexLog
Age threshold met
CompressOldLogs