



Case Study

Smart Bus Operations

System Development

 Visit our website:
www.luvina.net

PROJECT OVERVIEW

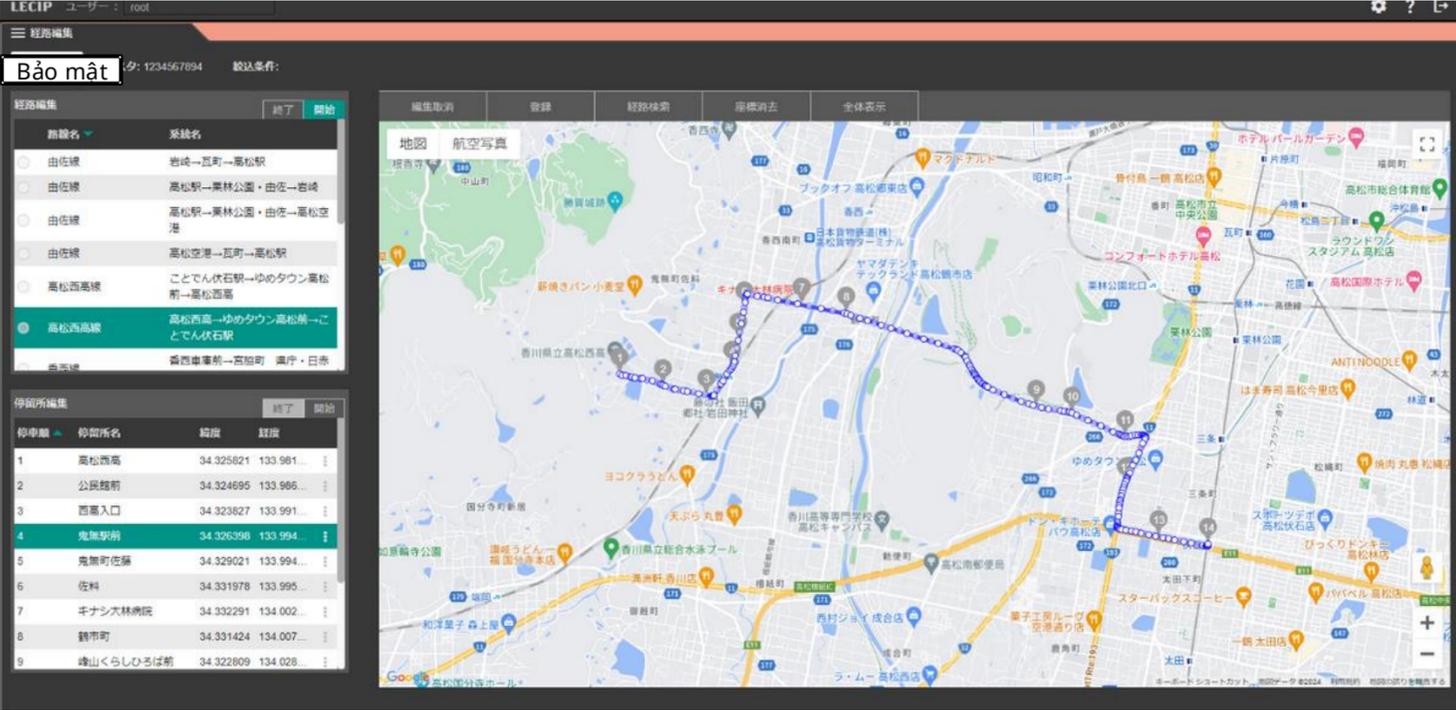


PROJECT OVERVIEW

Luvina Software partnered with a Japanese client to design and develop a **smart bus monitoring and operations system** for small-scale transportation companies. The solution includes both a **PC-based management portal** and a **mobile web application** for end users. Alongside development, Luvina also provided expert consulting on **system architecture and infrastructure**, proposing a **cost-effective, scalable serverless and microservices-based model**.

This helped the client significantly reduce operational costs and remove reliance on expensive, off-the-shelf products, improving profitability while maintaining system reliability.

- **Region:** Japan
- **Industry:** Transportation
- **Focus Area:** Bus Operations
- **Duration:** 08/2023 ~ 11/2023
- **Size:** 30.9 MM
- **Service Offered:** End-to-end web app and mobile app development



PROJECT OVERVIEW

Client & Objectives

Our client is a local bus operator in Japan, managing fewer than 15 vehicles per month. They sought to build a **dedicated operations management system** tailored to their needs, as existing off-the-shelf services came with **prohibitively high maintenance costs** (USD 100–280/month), making the business unprofitable.

Key Requirements

- A **web-based platform** for managing company, vehicle, route, and schedule data, as well as real-time operational monitoring.
- A **mobile web application** for passengers to search and view bus schedules.
- **Infrastructure consulting** to design a low-cost, scalable backend that suits small-business operations.

Challenges

As a small business with limited budget and resources, the client needed a cost-efficient yet fully functional system; one that delivers enterprise-level capabilities without the burden of complex infrastructure or high monthly fees. They also lacked in-house IT staff, which meant the system had to be easy to maintain and operate without dedicated administrators.

Luvina's Solutions

Luvina delivered a lightweight, scalable system architecture using serverless infrastructure and microservices, enabling the client to:

- Pay only for actual usage (per request/month), eliminating fixed infrastructure costs.
- Avoid hiring system administrators, thanks to automated backend services.
- Easily scale the system as their business grows, with clear and predictable cost structures.
- We also proposed cost-effective GPS tracking by integrating with existing market-available GPS devices, removing the need for expensive in-vehicle hardware.

PROJECT OVERVIEW

Achievements

- **20% reduction** in total system operating costs
- **Average cost per vehicle:** only **USD 10/month**
- **Zero need for IT staff** to manage the system
- **No hardware installation** required on buses, using affordable GPS devices instead
- Flexible and scalable system architecture ready for future growth

FEATURES & USE CASES



KEY FEATURES

Admin (Web Interface): For Transport Operators

Vehicle Operations Monitoring

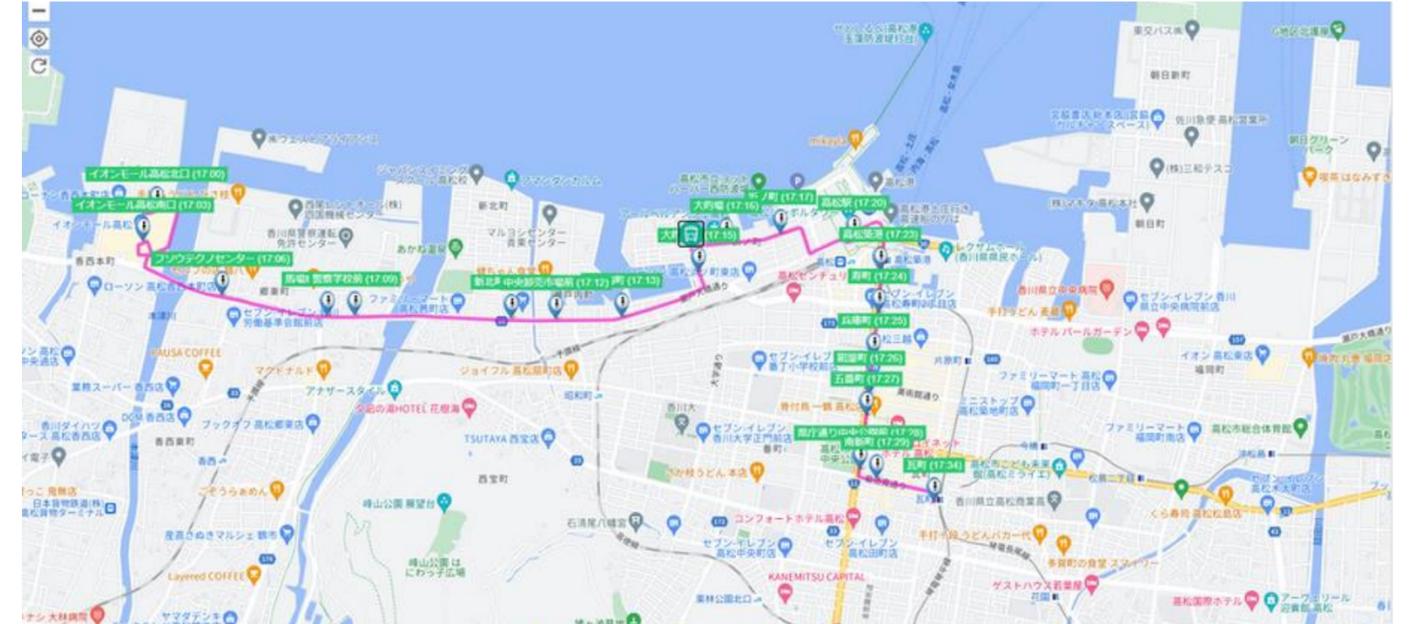
- Real-time vehicle list and map view
- Detailed view of each vehicle and bus stop

Performance Reports

- Export daily and monthly operation summaries Master Data Management
- Register and manage core data (vehicles, routes, stops)
- Configure dispatch schedules
- Edit routes, vehicles, and onboard devices

User & Account Management

- Manage system users and access rights
- Dedicated admin access



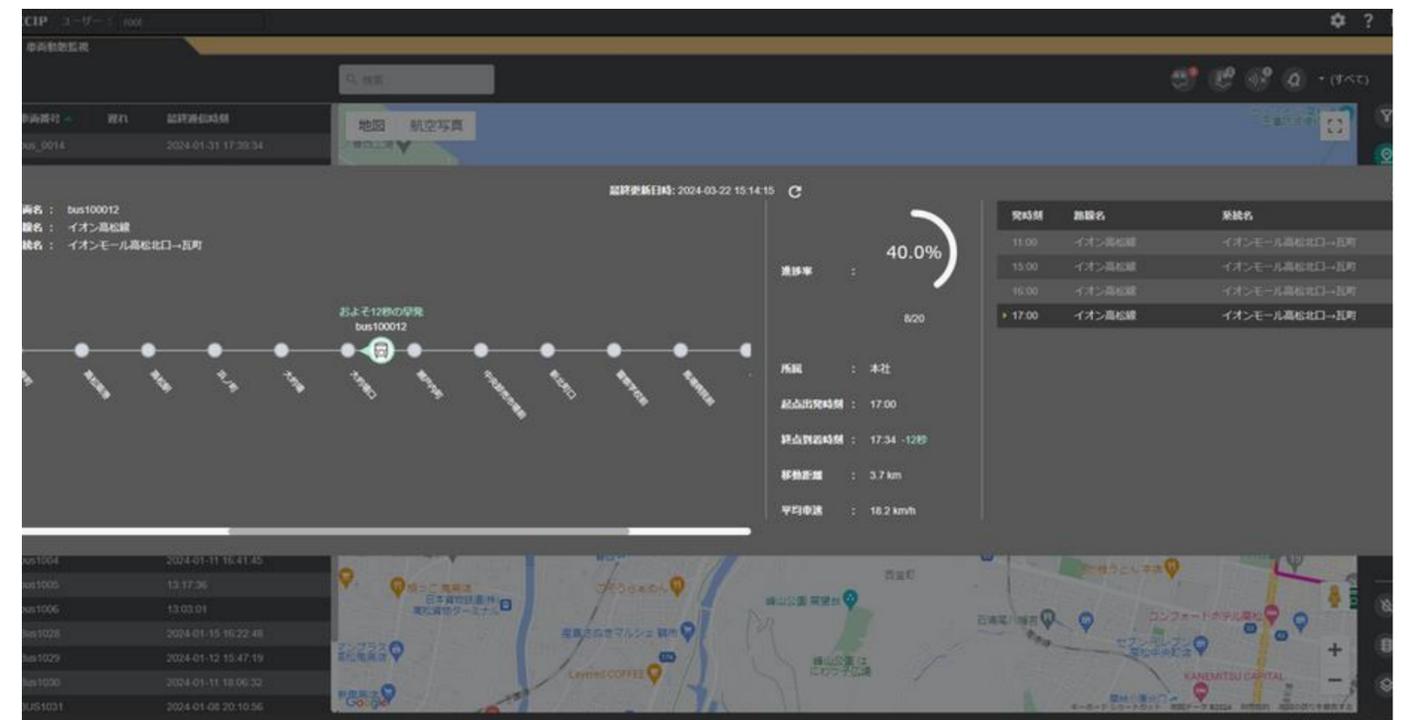
Passenger Interface (Mobile Web App)

Bus Route Tracking

- Real-time route and location update
- Notifications and service policy information
- Search by location, map, or ride history
- Select preferred language
- View detailed announcements

Bus Search Functions

User Personalization



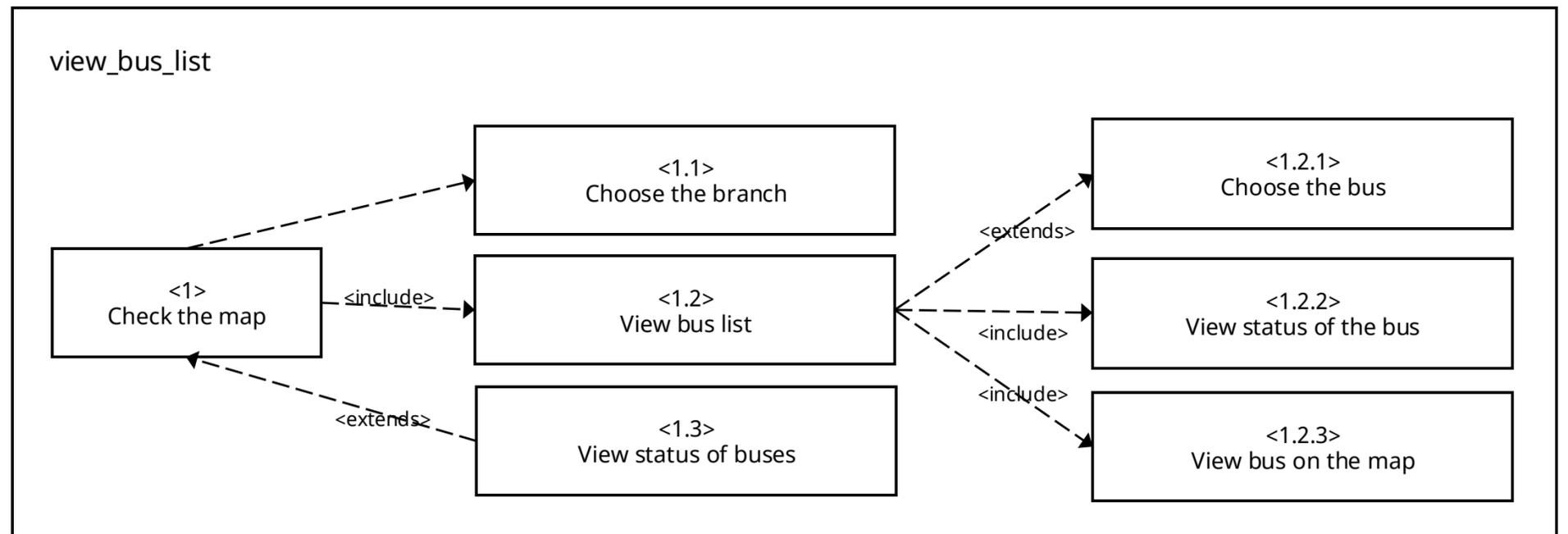
USER CASE: Real-time Vehicle Monitoring

Bus operations staff can log into the system to:

- Monitor active vehicles from a real-time vehicle list
- Filter by office/branch to view localized vehicle data
- View vehicle status notifications, such as:
 - Early departure
 - Late departure
 - Unexpected stops
 - On-time tracking
- Track vehicle positions on an interactive map
- Search for specific vehicles using keywords or filters

Supervisors can drill down into each vehicle to:

- See the current route being operated
- Track the real-time progress along that route
- View the full list of vehicles operating on the current day



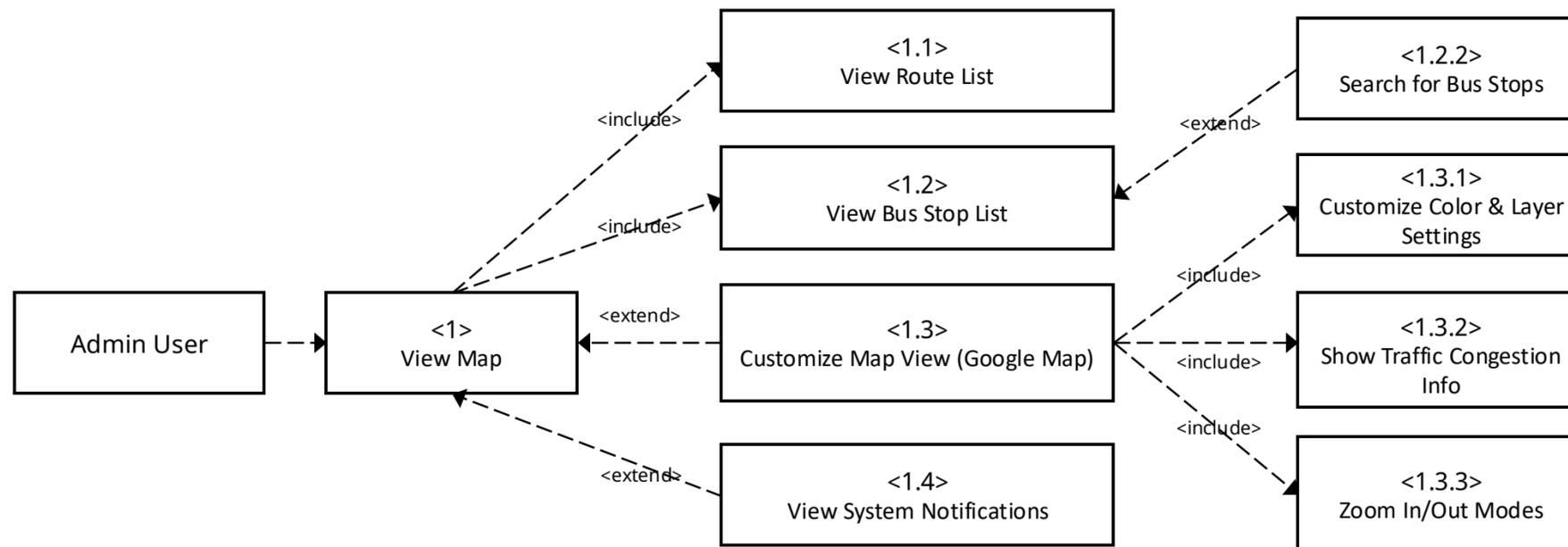
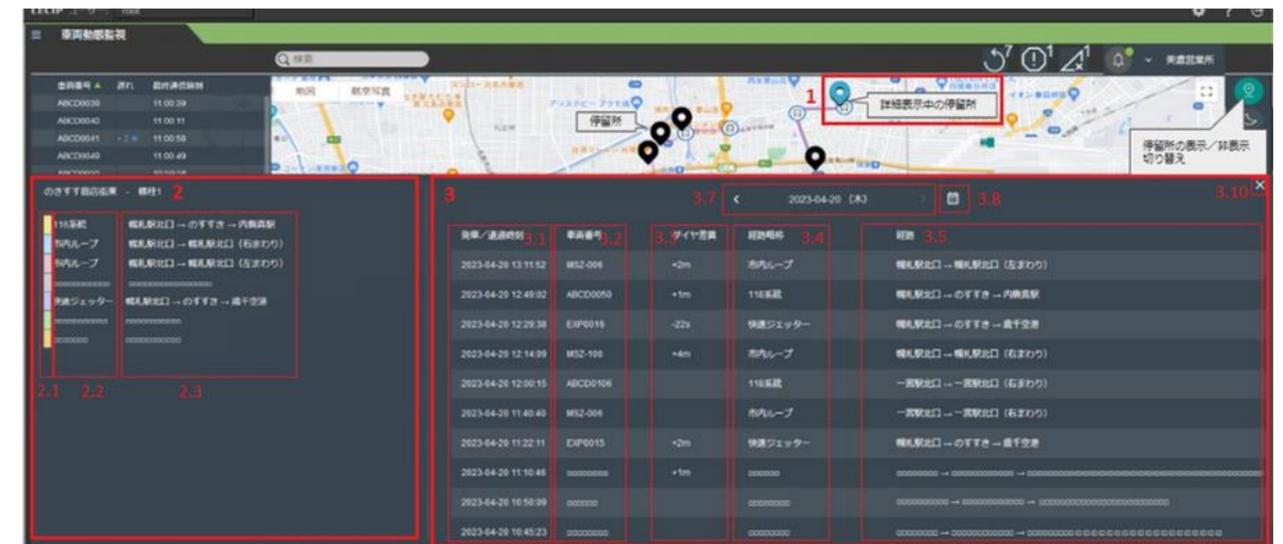
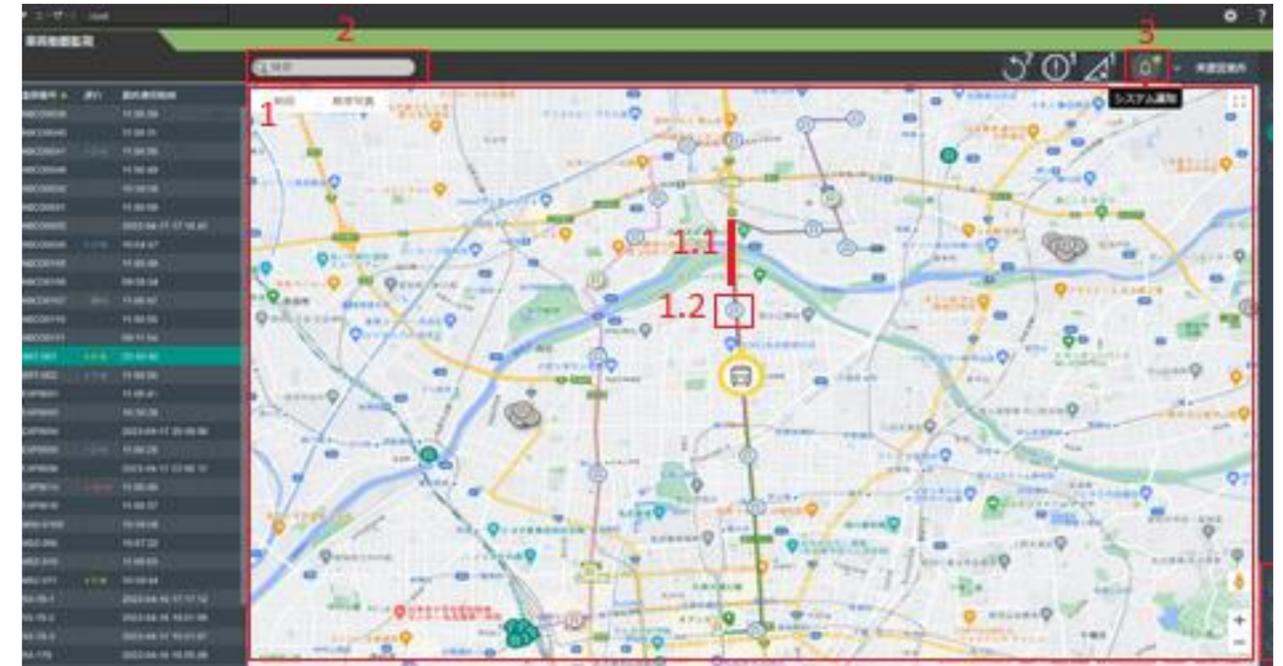
USER CASE: Bus Stop Monitoring

Operations staff can log into the system to monitor and manage **bus stops** effectively:

- **View list of all routes**
- **View and manage list of bus stops**
- **Customize and edit bus routes directly on the map**
- **Receive and view system notifications** related to stops and routes

From each stop, staff can:

- **View all routes passing through the stop**
- **Access historical data** of buses that passed through
- **Export stop history reports** for operational analysis



USER CASE: Operational History Tracking

The system provides a dedicated screen to **track historical operational data** of buses.

Key Functions:

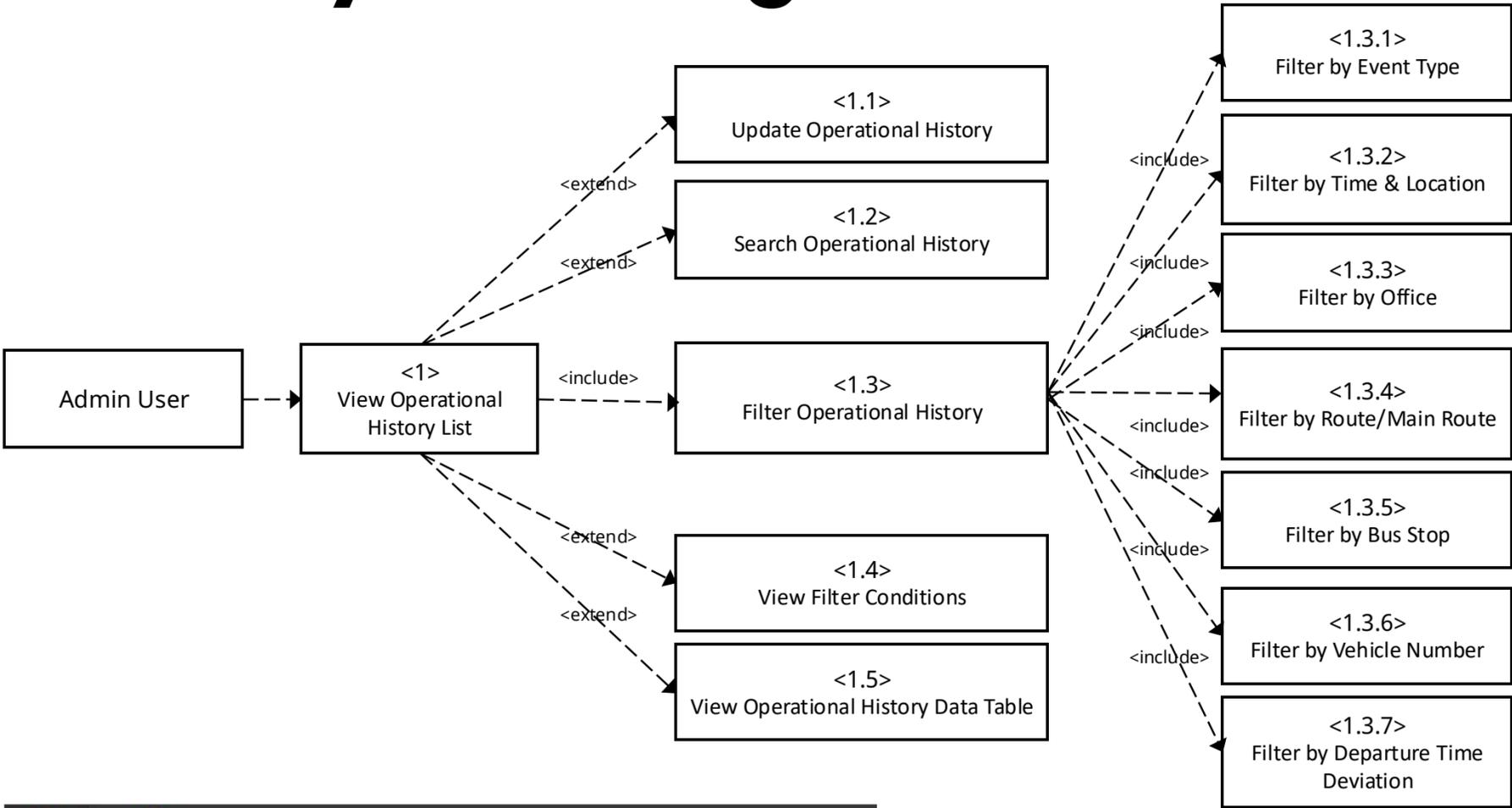
- View operational history of each bus by **office, date, or vehicle ID**
- Search and filter records within the **last 2 weeks** (data is stored in **DynamoDB** with a 14-day retention policy)
- For extended historical access, data is periodically archived to cloud storage

Automated Archival Process:

- Every day at **4:00 AM**, the system automatically:
 - Collects previous day's operational data by office
 - Converts data into **CSV format**
 - Uploads the files to **Amazon S3**

Long-Term Data Access:

- CSV files on **S3** are retained for up to **13 months**
- Admins can retrieve and export historical operational reports from S3 storage as needed



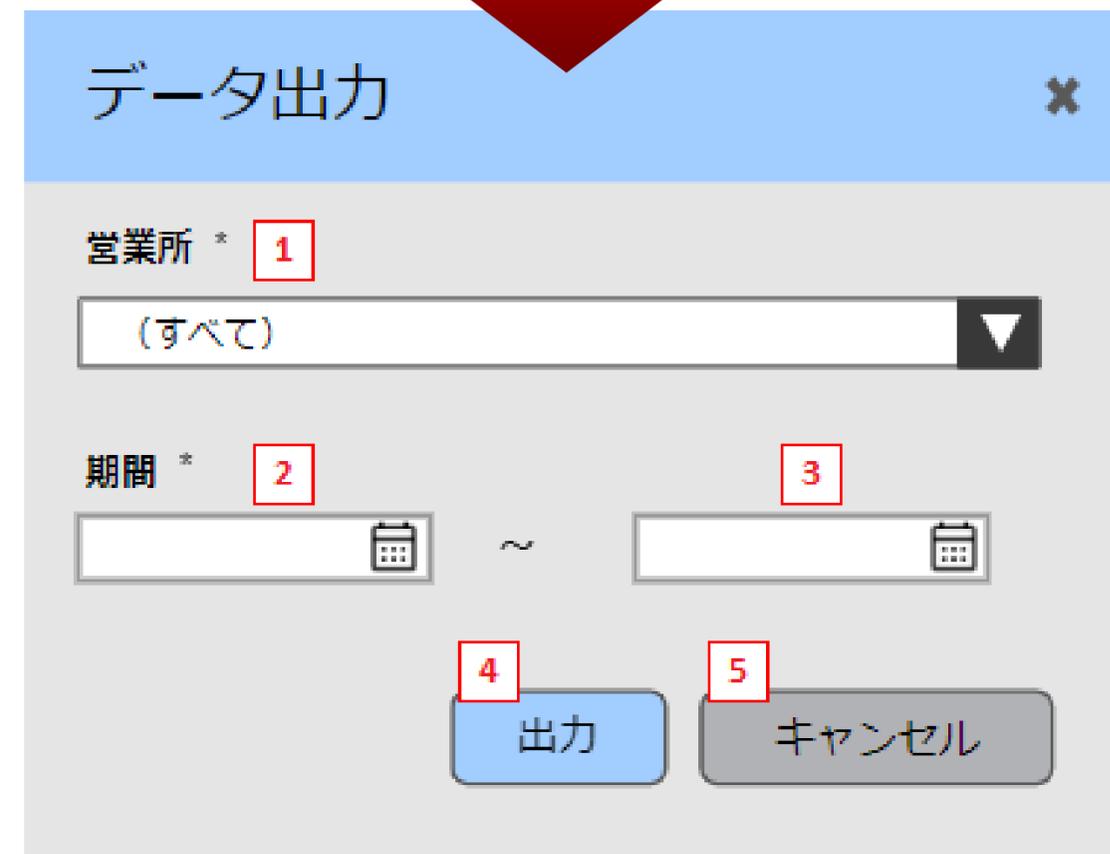
履歴ID	イベント	出発時刻	通過数	停留所名	路線	系統	車
1050	バス停到着	9:4	9:5	34/39	由佐天神	9:6	9:7
1027	バス停到着			29/36	市役所西	下笠原線	高松駅→高松公園・由佐→岩崎
1008	バス停到着	+2m		5/33	龍崎町	下笠原線	高松駅→昭和町市立図書館→高松駅
265	バス停到着	+6m		15/39	今里文庫前	レインボ-循環バス 東回り	高松駅→高松駅(東回り)
1058	バス停到着	+7m		15/28	ゆめタウン高松前	西条線	高松駅→高松公園 ゆめタウン高松前→香川中央病院
907	バス停到着	+1m		1/22	ことでん伏石駅	伏石駅サンメッセ線	ことでん伏石駅→サンメッセ香川→ことでん伏石駅
429	バス停到着	+1m		5/12	県立中央病院	朝日町線	朝日町→卸センター 県立中央病院→高松駅
240	バス停到着			8/33	下笠原支所前	下笠原線	高松駅→昭和町市立図書館→高松駅
1008	送りボタン押下				下笠原線		高松駅→昭和町市立図書館→高松駅
1006	バス停到着	+5m		19/39	新川	東山線	高松駅→国際ホテル→東山線
1070	バス停到着			15/34	西石	大学病院線	ことでん高松駅→高松駅
265	乗降終了			15/39	今里文庫前	レインボ-循環バス 東回り	高松駅→高松駅(東回り)

USER CASE: Vehicle Dispatch Scheduling

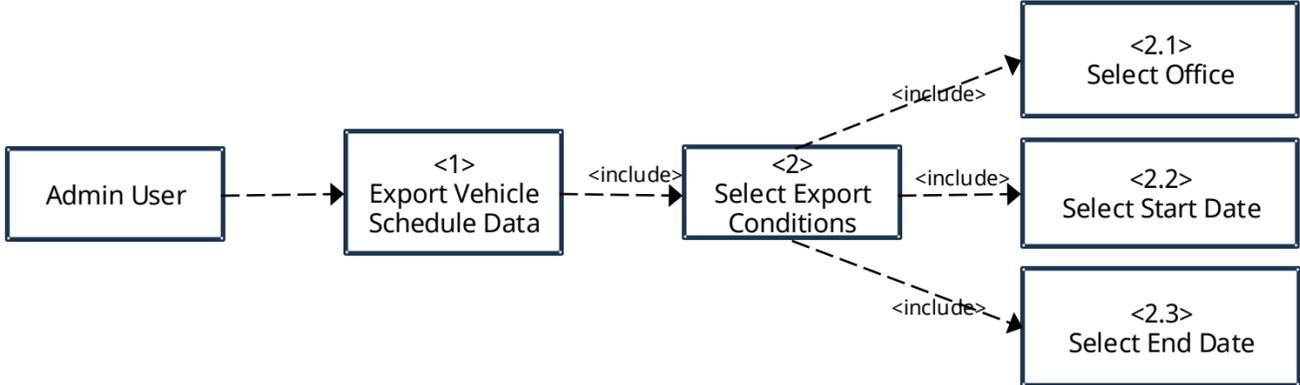
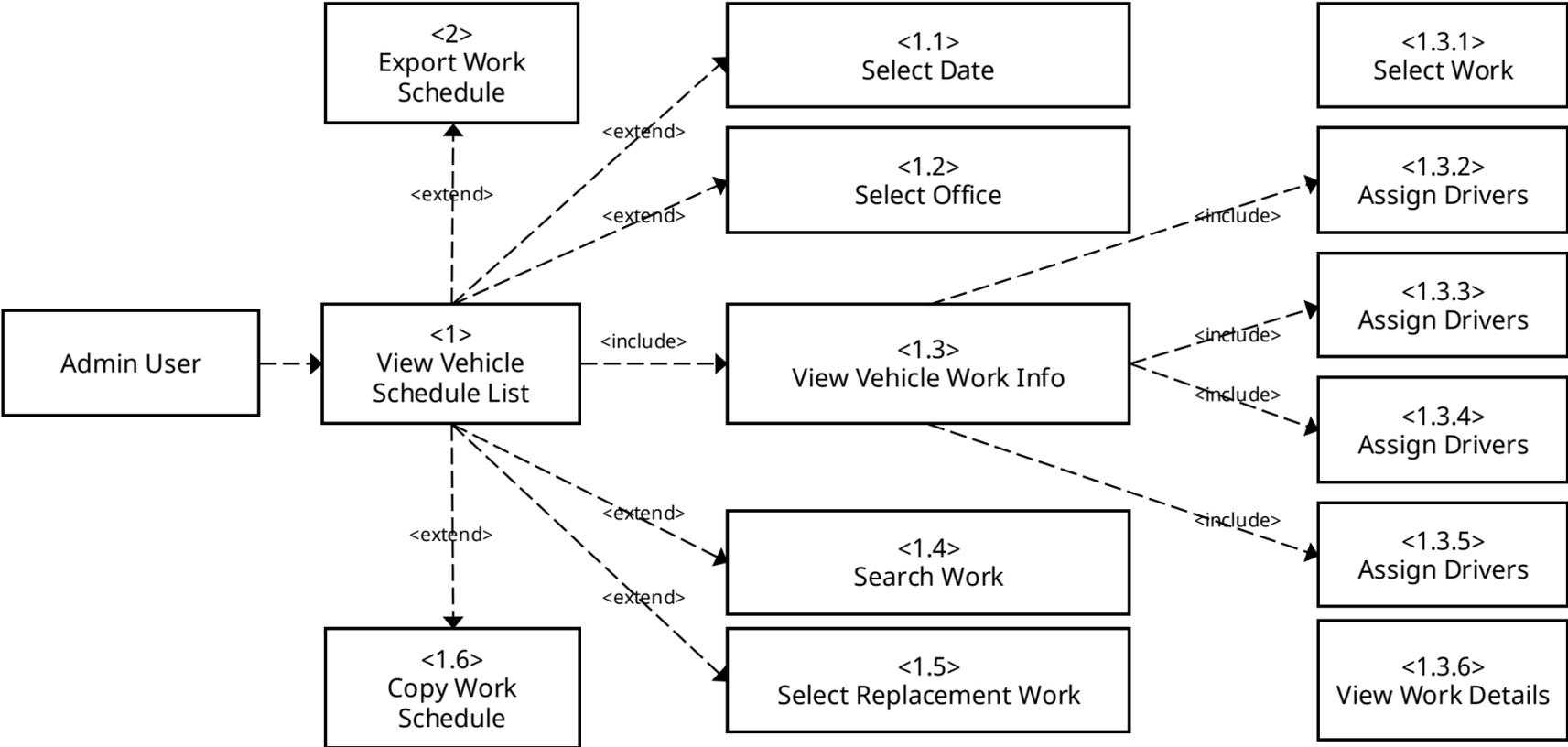
This feature enables administrators to **manage and monitor the dispatch schedules** of all buses.

Key Functions:

- View the full **dispatch schedule list**, including:
 - Assigned drivers
 - Vehicle numbers
 - Office/branch location
 - Assigned work schedules
- Search for specific vehicle operations
- Update or **replace work schedules** for individual vehicles
- View **detailed work assignments**
- Export the complete **vehicle operation schedule** as a CSV file for reporting or backup



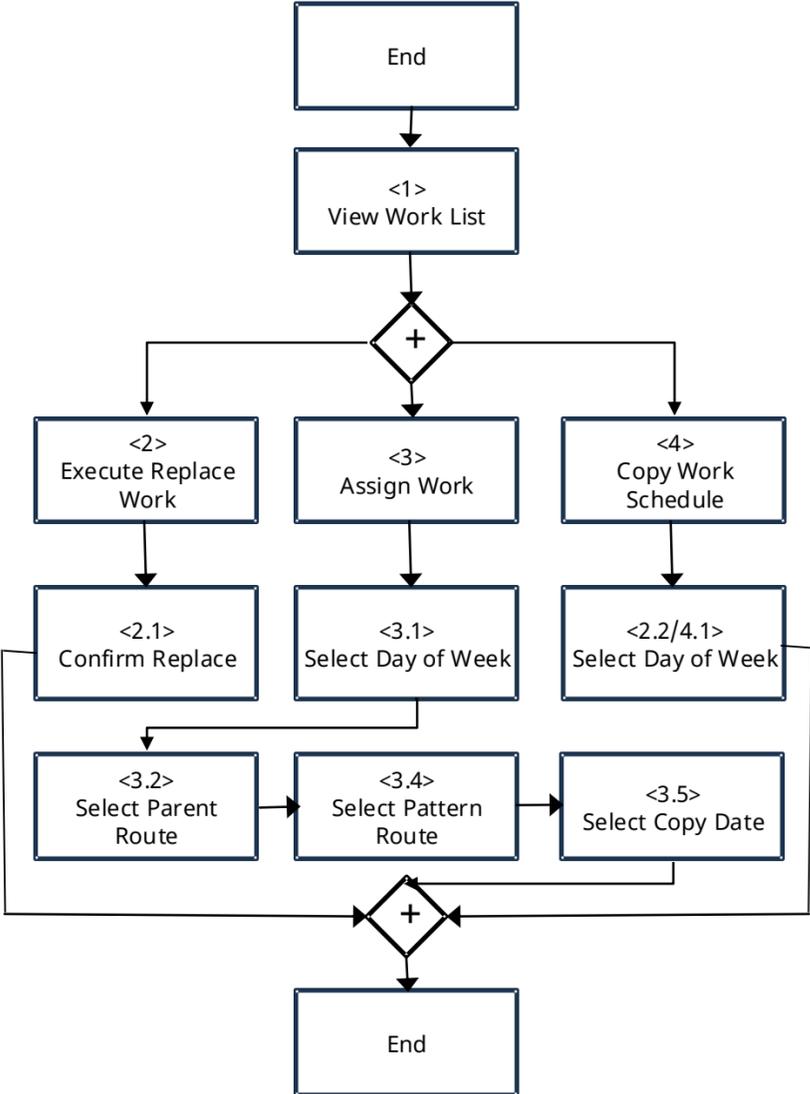
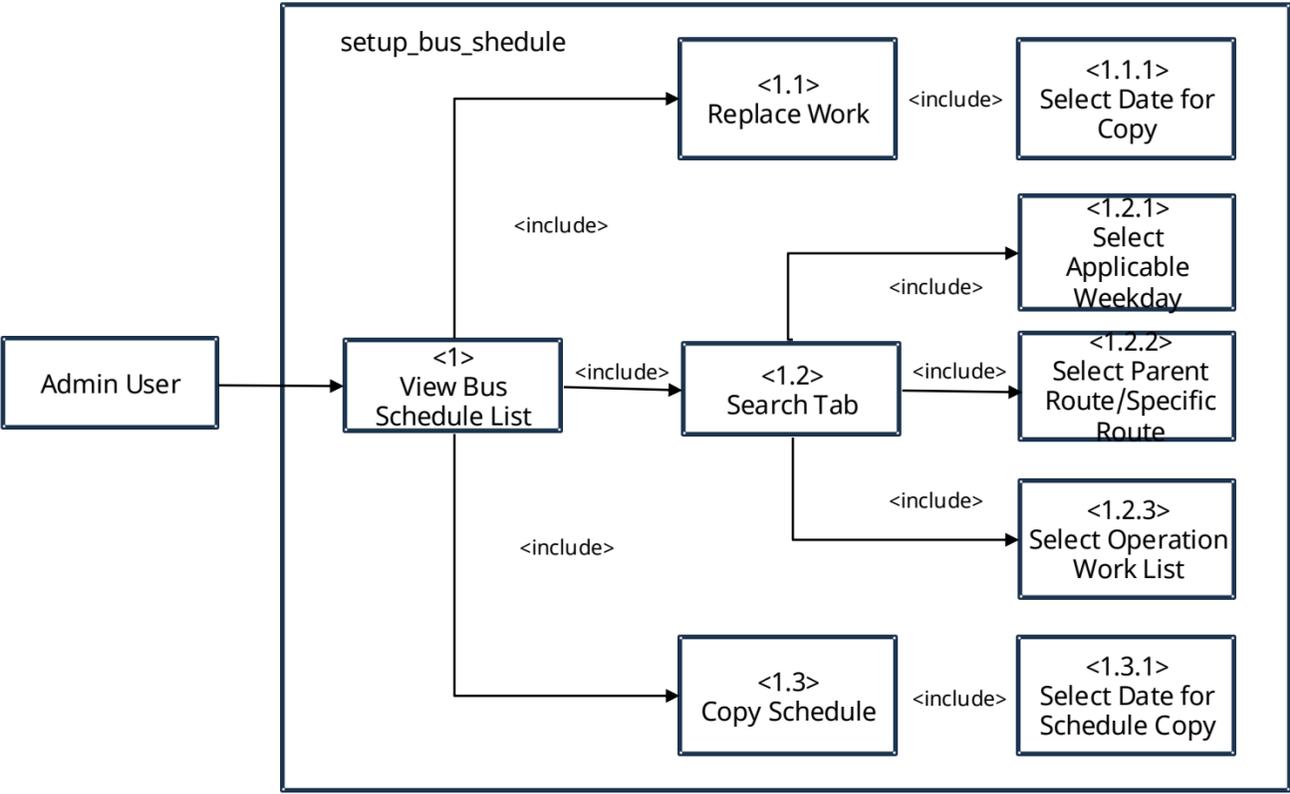
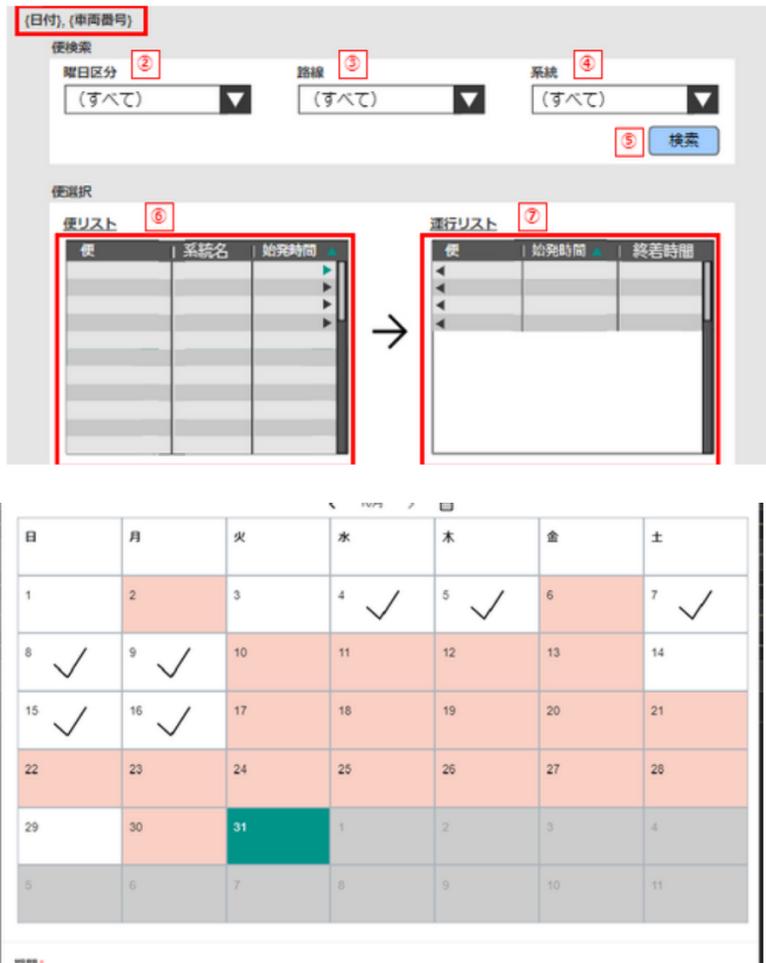
USER CASE: Vehicle Dispatch Scheduling



USER CASE: Create & Manage Vehicle Dispatch Schedules

Key Functions:

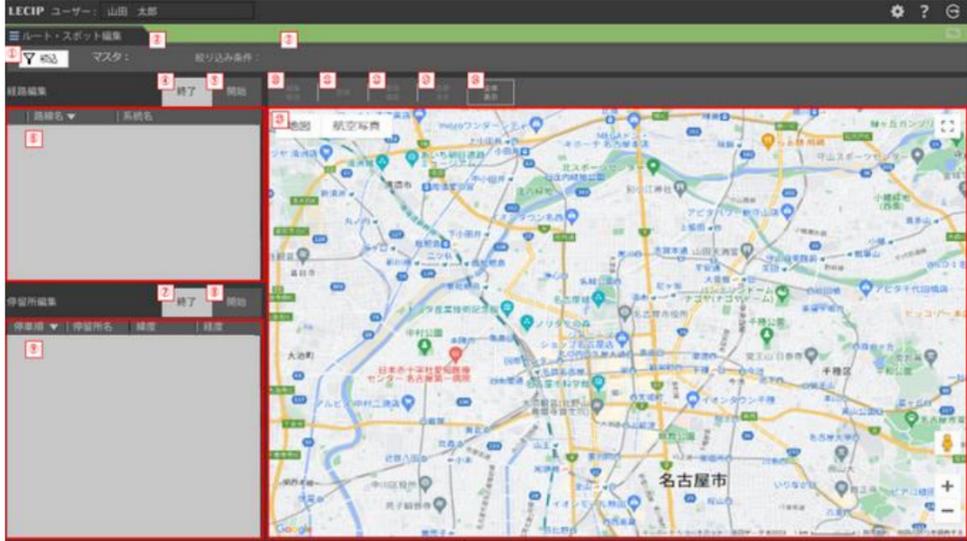
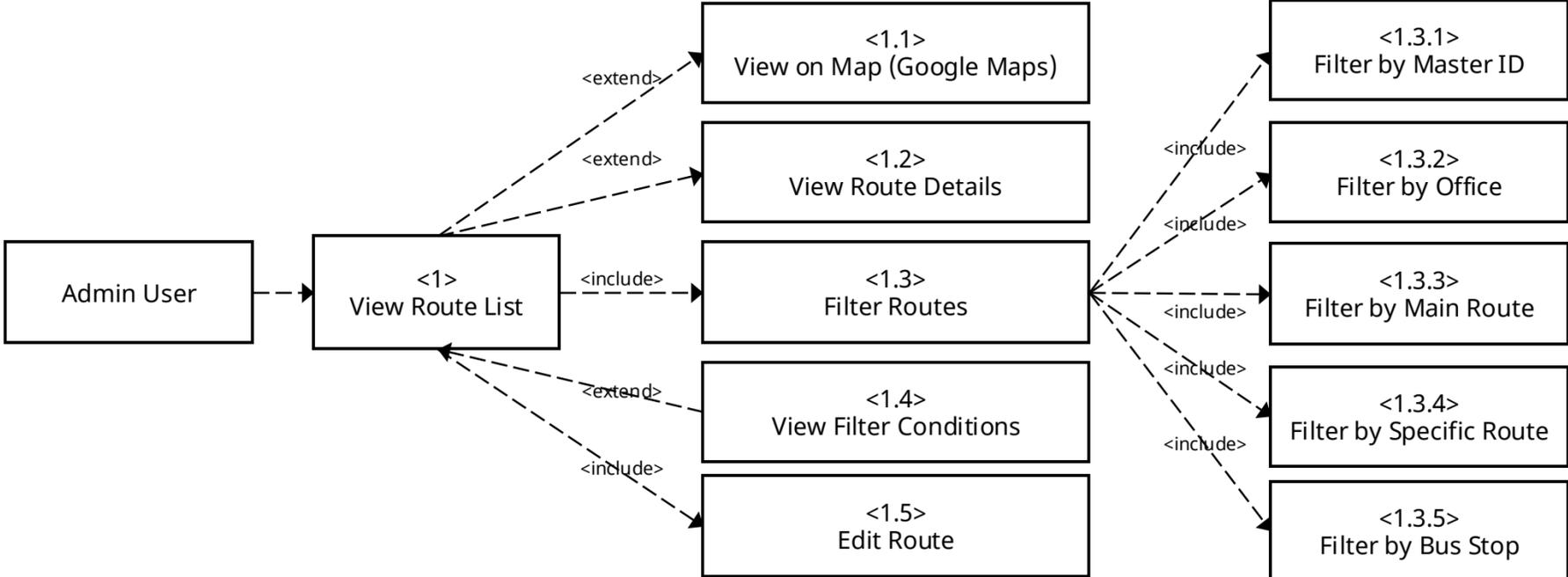
- Create and configure **bus operation schedules**
- Assign drivers and routes to each vehicle
- Set and update **working shifts** per vehicle
- Search for schedules by vehicle or date
- Export schedules as CSV files for reporting



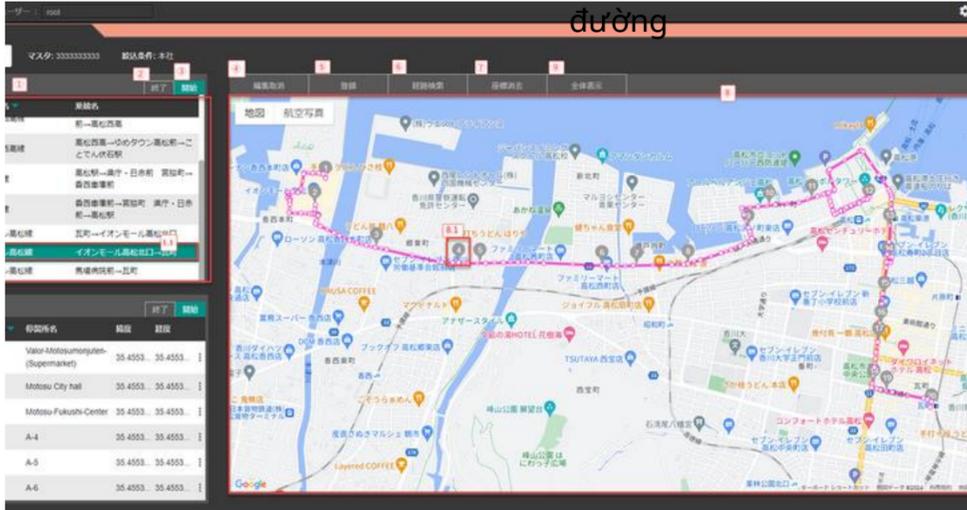
USER CASE: Route Management

Key Functions:

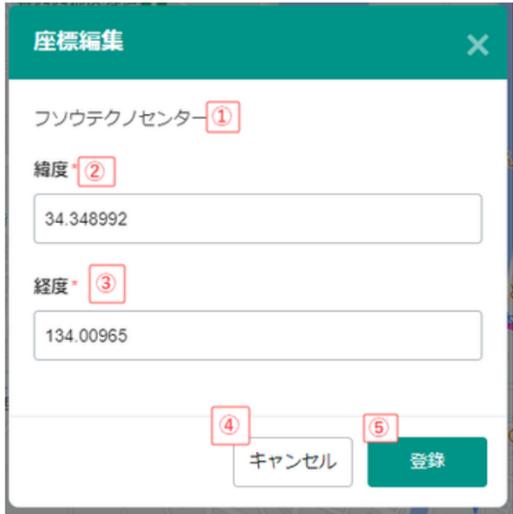
- View list of all registered bus routes
- **Edit existing routes** directly on the map
- Add, remove, or reconfigure bus stops on a route
- Monitor active/inactive route statuses



Chỉnh sửa tuyến đường



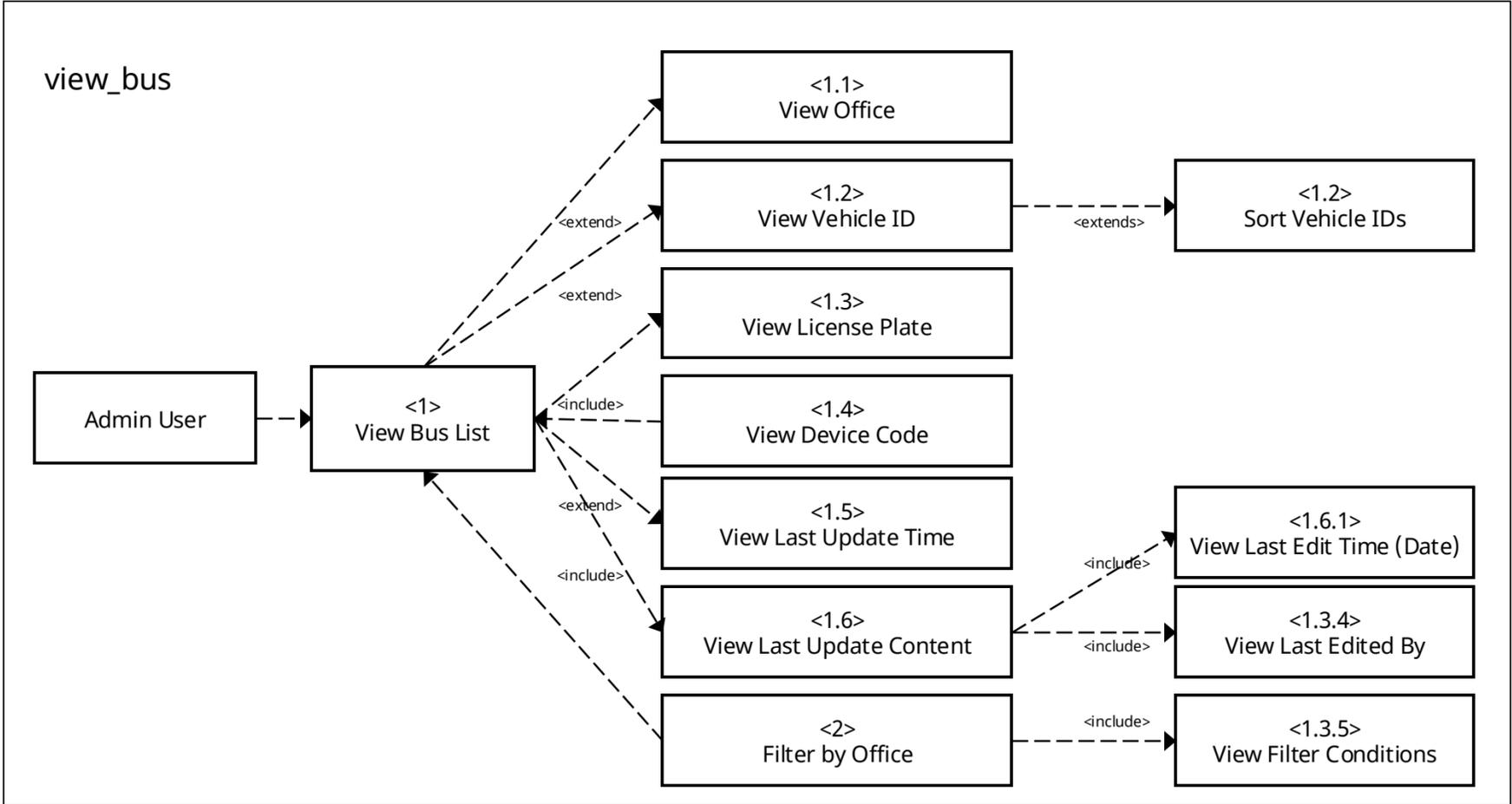
edit coordinates



USER CASE: Bus Management

Key Functions:

- Register new buses into the system
- View all registered buses
- Edit vehicle details (plate number, office, type, etc.)
- Remove buses when no longer in operation
- Export the full list of buses as CSV



USER CASE: Passenger – Bus Search

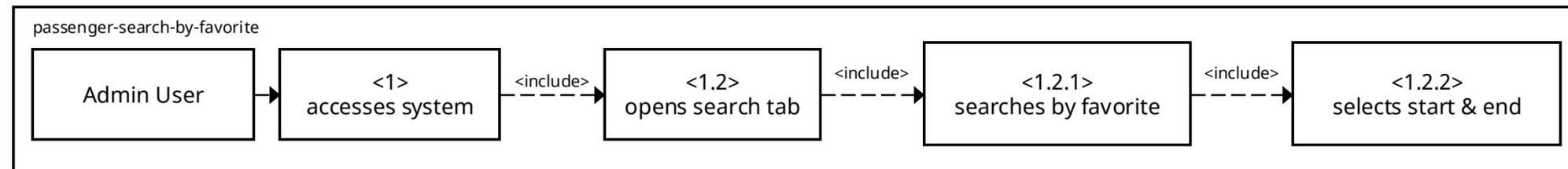
Key Functions:

Search for buses by:

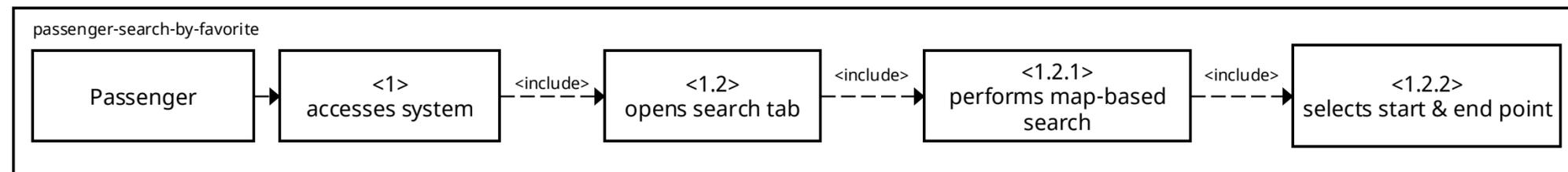
- Commonly used routes
- Destination or bus stop
- Map-based navigation

View upcoming schedules and live ETA (if available)

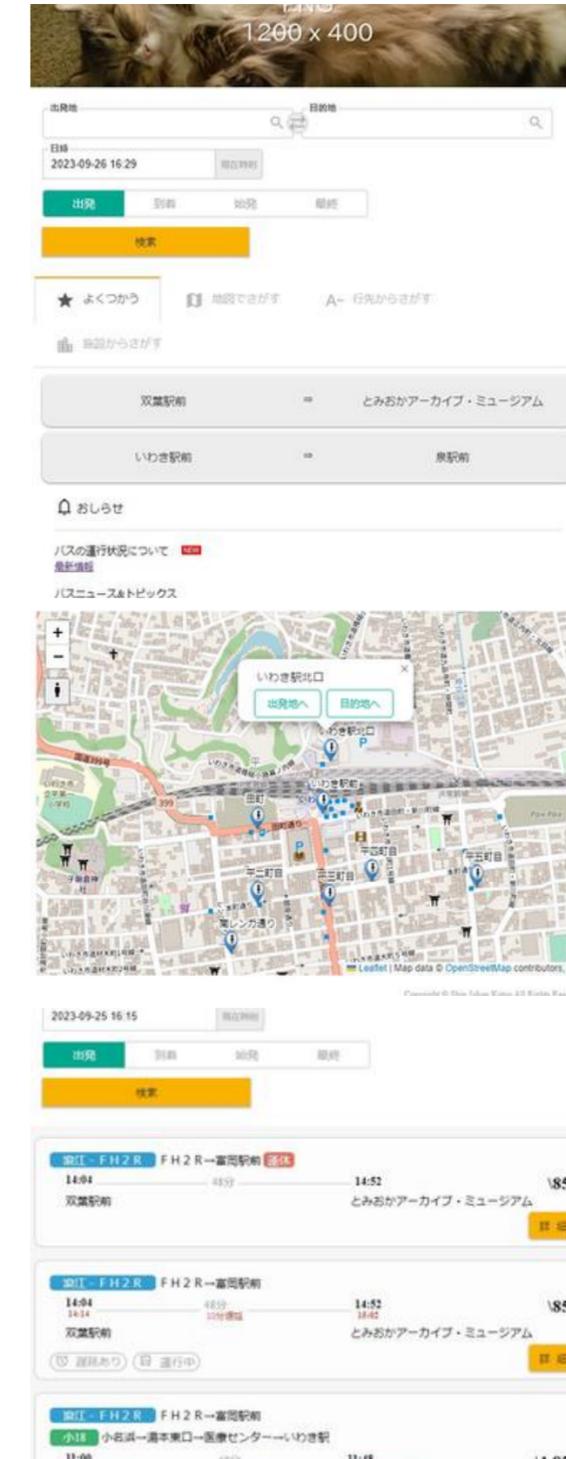
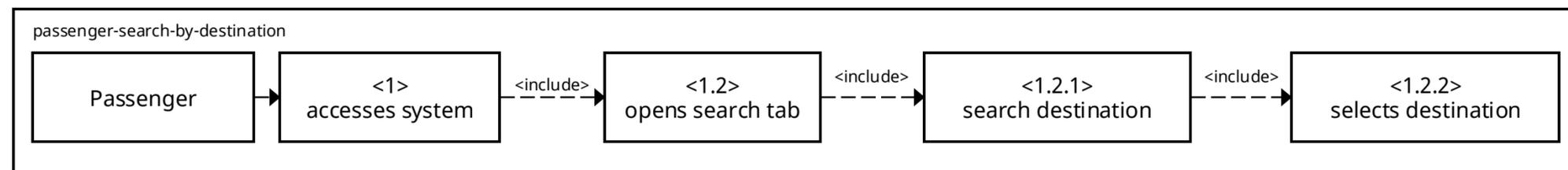
Commonly used routes



Map-based navigation



Destination or bus stop



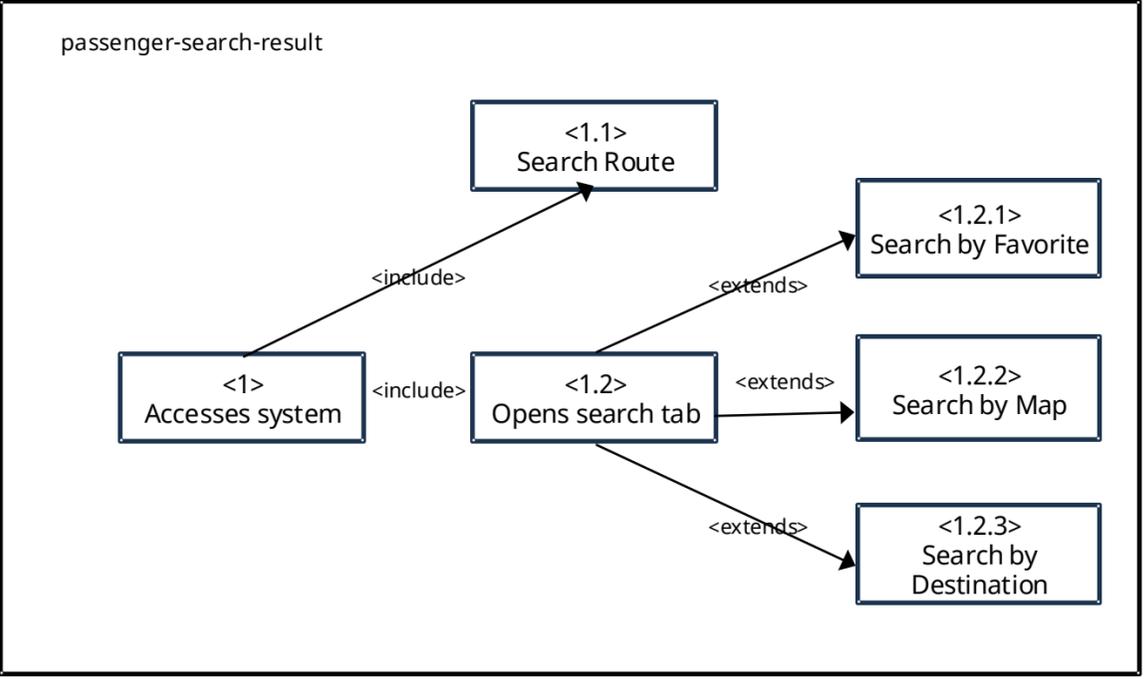
USER CASE: Passenger - Search Result & Trip Details

Key Functions:

- View **search result list** with detailed info:
 - Route, schedule, and stop info
- Access trip-related **notifications or policy changes**



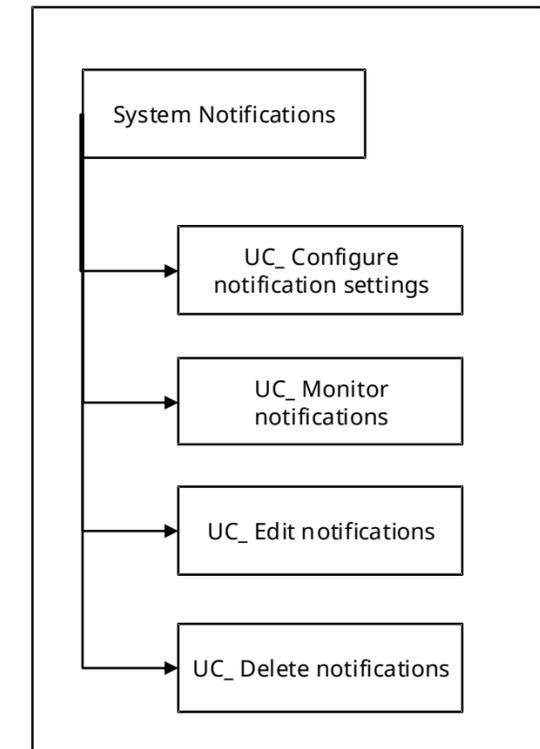
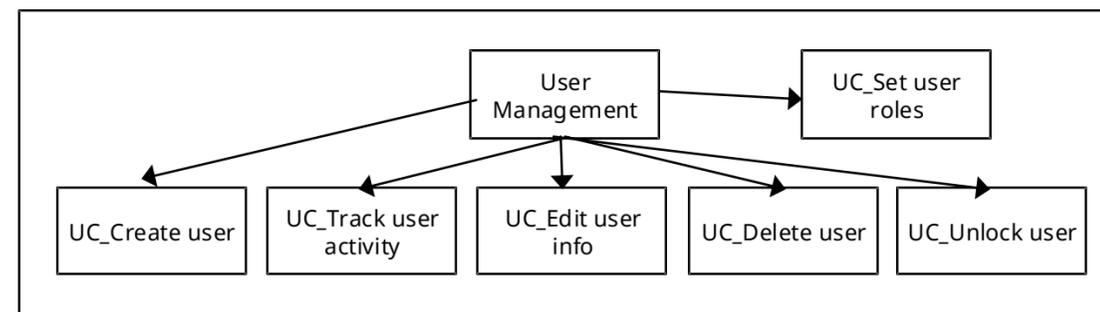
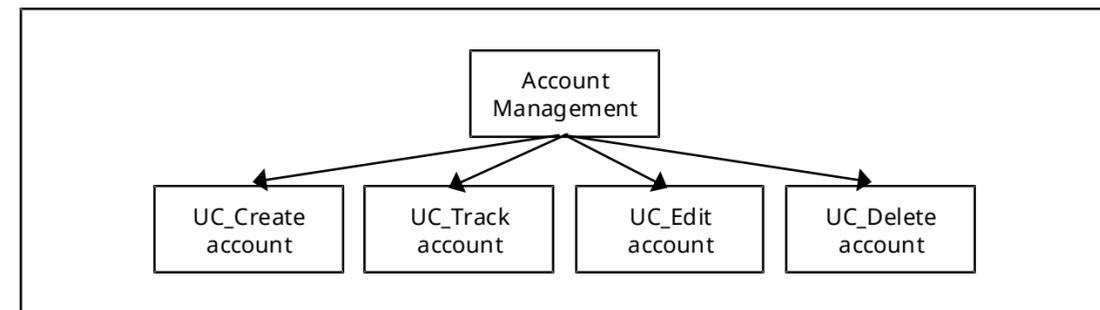
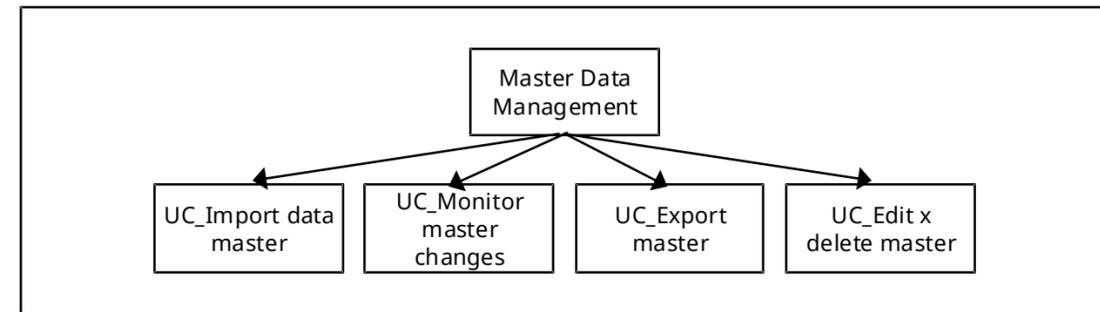
Searching result



USER CASE: Other Functionalities for admin

Other than the core features, administrators also have access to:

- **User management** (create/edit/delete accounts)
- **Access control** by roles
- System configuration and notification setup



TECHSTACKS

Infrastructure: Using cloud AWS services



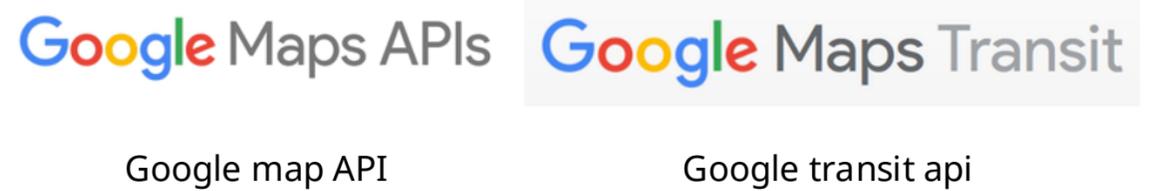
GitLab: CI/CD, auto Deploy + sonar check



Ngôn ngữ:



Google

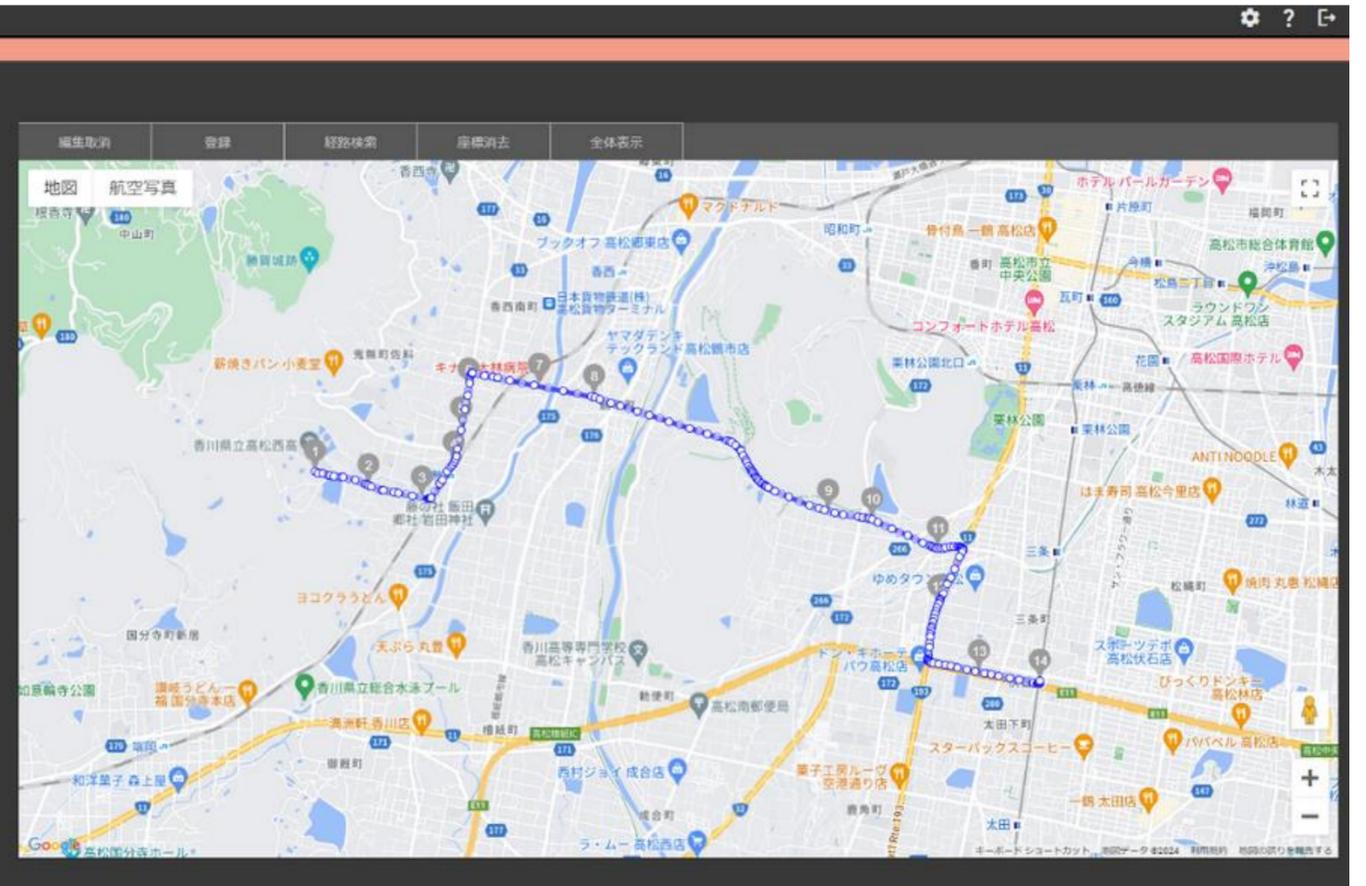


PROJECT OVERVIEW

PROJECT OVERVIEW

Luvina Software partnered with a leading Japanese public transport technology group to develop a lightweight, flexible bus operation monitoring system tailored for small-scale operators. Many of these operators were struggling with high infrastructure costs and rigid off-the-shelf solutions. By combining deep business analysis with smart system design, Luvina delivered not just a software platform, but also practical architectural consulting to help the client scale efficiently and serve a wider range of customers.

- **Region:** Japan
- **Industry:** Transportation
- **Focus Area:** Bus Operations
- **Duration:** 08/2023 ~ 11/2023
- **Size:** 30.9 MM
- **Service Offered:** End-to-end web app and mobile app development



PROJECT OVERVIEW

Client

A leading Japanese corporation specializing in public transportation technologies, with flagship solutions such as automated fare collection and traffic management systems. Headquartered in Japan, the client operates across Europe, the Americas, and other global regions.

Client Needs

- A web-based monitoring and operation platform for bus companies (PC)
- A mobile-friendly trip search interface for end-users
- Infrastructure and software architecture consulting to optimize long-term costs and maintainability

Background & Challenges

The goal was to develop a monitoring and operation system tailored for small-scale bus operators (under 15 buses per month). However, the current deployment model, requiring individual infrastructure environments connected via VPN, led to high server maintenance costs (\$100–280/month per company). Additionally, customizing a unified system for various clients proved complex and resource-intensive.

PROJECT OVERVIEW

Luvina's Solution

- Collaborated closely with the client from the early concept stage: defined business flows, built mockups, and iteratively refined the system design to match real operational needs
- Proposed a **serverless** and **microservices** architecture to minimize operational and maintenance costs
- Designed a lightweight, modular system that is easy to scale and maintain, enabling rapid rollout to multiple small operators with minimal infrastructure requirements



PROJECT OVERVIEW

Achievements

Fast delivery with reusable architecture

Within just four months, Luvina successfully developed the bus operation monitoring system and delivered a reusable software architecture. This enables the client to cut development time by up to 70% for future similar products.

Cost-efficient infrastructure

By proposing an alternative to Google Transit, Luvina helped reduce infrastructure costs by up to 40%, while maintaining system functionality and scalability.

Strong technical impact

The client highly valued both the software architecture and infra solution, which effectively addressed their challenges in a resource-constrained environment.

Project excellence

The project was praised for its timely delivery, quality assurance, and consulting capabilities. Luvina's proactive support helped detect and resolve potential issues early, contributing to a smooth development process.

High-quality standards

Luvina strictly followed quality assurance processes and industry best practices, demonstrating a strong commitment to delivering reliable, maintainable software.

Innovation in requirements design

Despite receiving only high-level requirements, Luvina actively proposed detailed BPMN diagrams, UX/UI flows, and clear documentation, minimizing change requests and improving communication.



The client was impressed with the team's technical capability and professionalism, and expressed strong interest in continuing collaboration on future projects.

Performance



Project management



Consulting





TECHNICAL DETAILS

LUVINA SOFTWARE

TECHNICAL DETAILS – OVERVIEW



Môi trường thật

AWS WAF	Amazon CloudFront	Amazon Simple Storage Service (Amazon S3)	Amazon Cognito	Amazon API Gateway	AWS Lambda	Amazon DynamoDB	Amazon OpenSearch Service

Môi trường staging

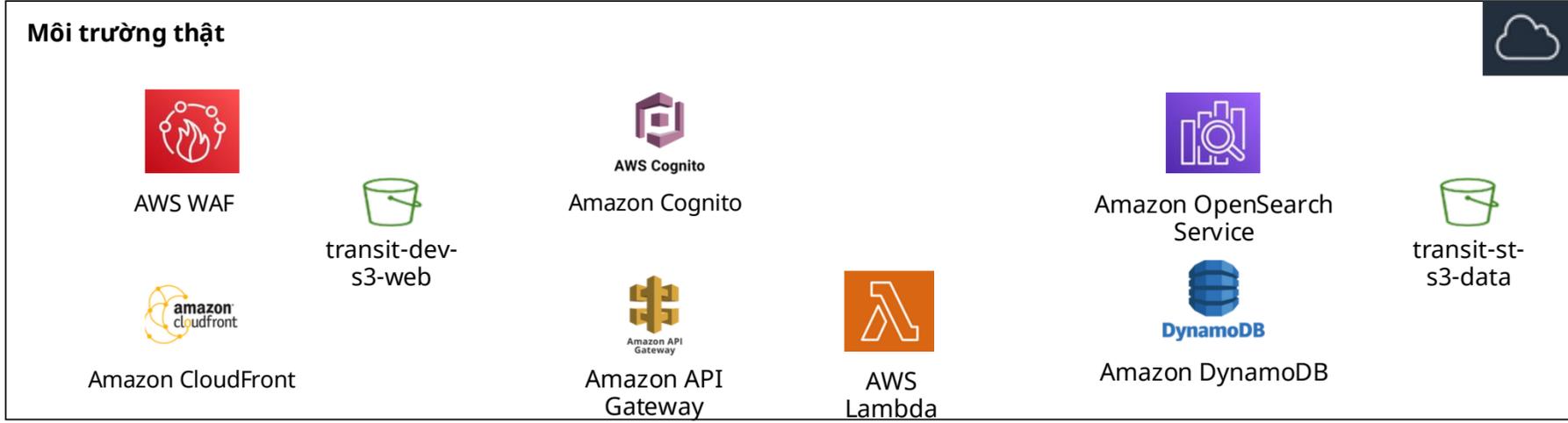
Amazon CloudFront	Amazon Simple Storage Service (Amazon S3)	Amazon Cognito	Amazon API Gateway	AWS Lambda	Amazon DynamoDB	Amazon OpenSearch Service

Môi trường phát triển

Amazon CloudFront	Amazon Simple Storage Service (Amazon S3)	Amazon Cognito	Amazon API Gateway	AWS Lambda	Amazon DynamoDB	Amazon OpenSearch Service

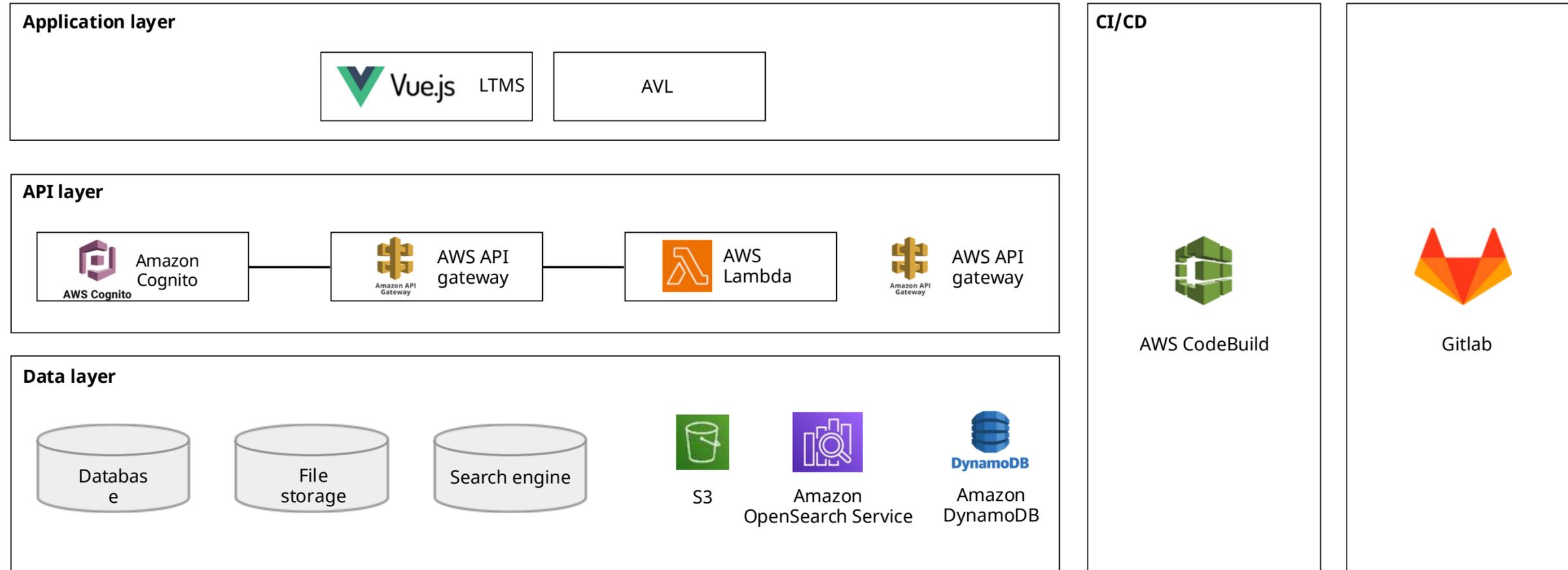


TECHNICAL DETAILS – OVERVIEW



TECHNICAL DETAILS – OVERVIEW

SOLUTION ARCHITECTURE



Application layer	Provides an interface that users can access.
API layer	The REST API layer provides an interface that has been divided specifically for data or functionality, of 1 or more applications. It provides a general, and language-independent, method for interacting with an application.
Data layer	This is the layer that holds all the data.



LUVINA SOFTWARE

PROJECT IMPLEMENTATION & MANAGEMENT



PROJECT LIFE CYCLE

Project life cycle (Master schedule imagine)

Do the same in the next Parts

	•Week 1	•Week 2	•Week 3	•Week 4	•Week 5	•Week 6
•URD	Part 1		Part 2		Part 3	
•SRS & UI						
•Mockup			Part 1		Part 2	
•API	Design part 1		Coding part 1	Design part 2	Coding part 2	Design part 2
•Frontend			Coding part 1		Coding part 2	
•Smock test			Create part 1	Test part 1	Create part 2	Test part 2
•SAD	Update					
•Infra Design						

PROJECT LIFE CYCLE

Project life cycle (Master schedule imagine)

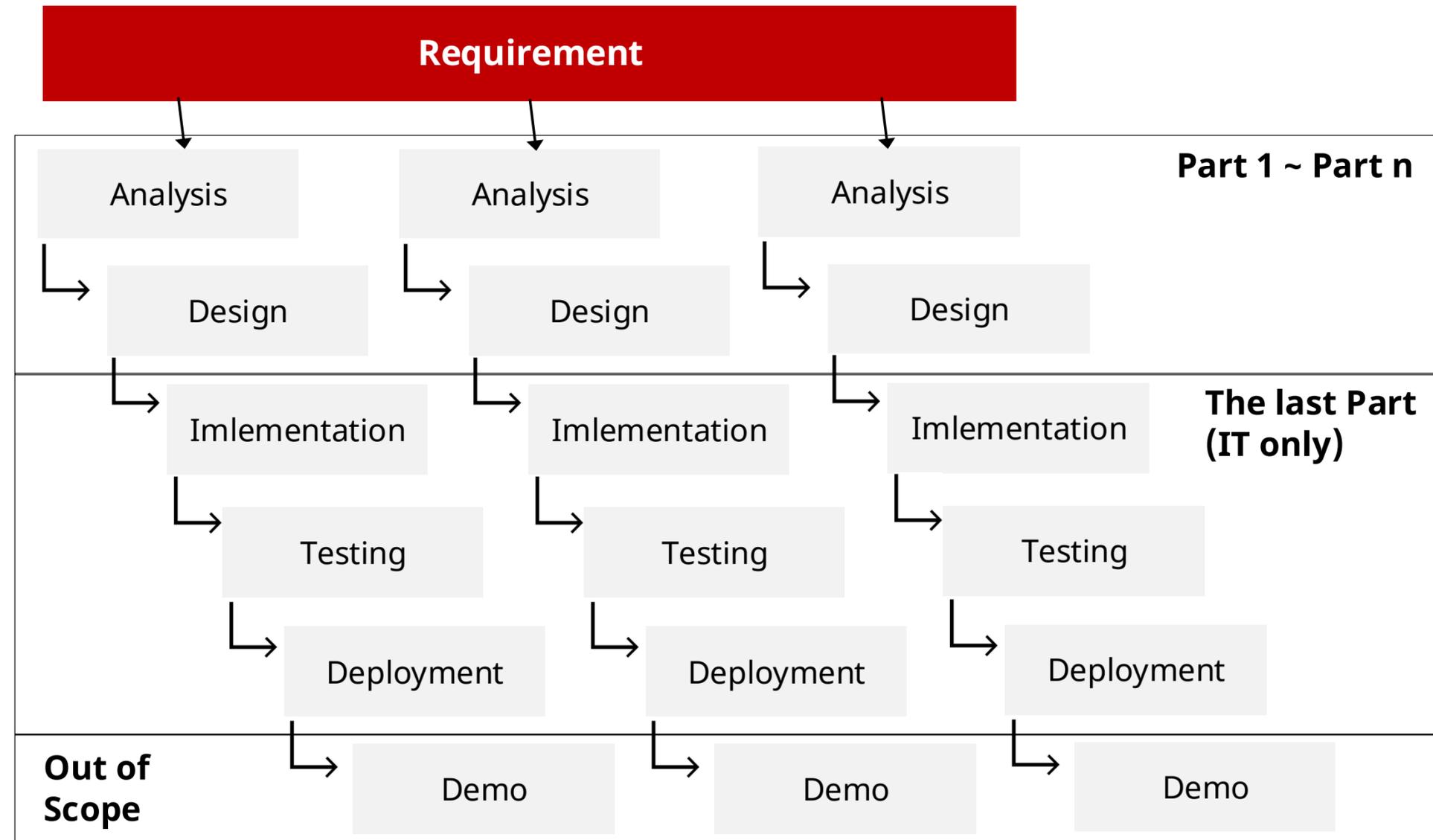
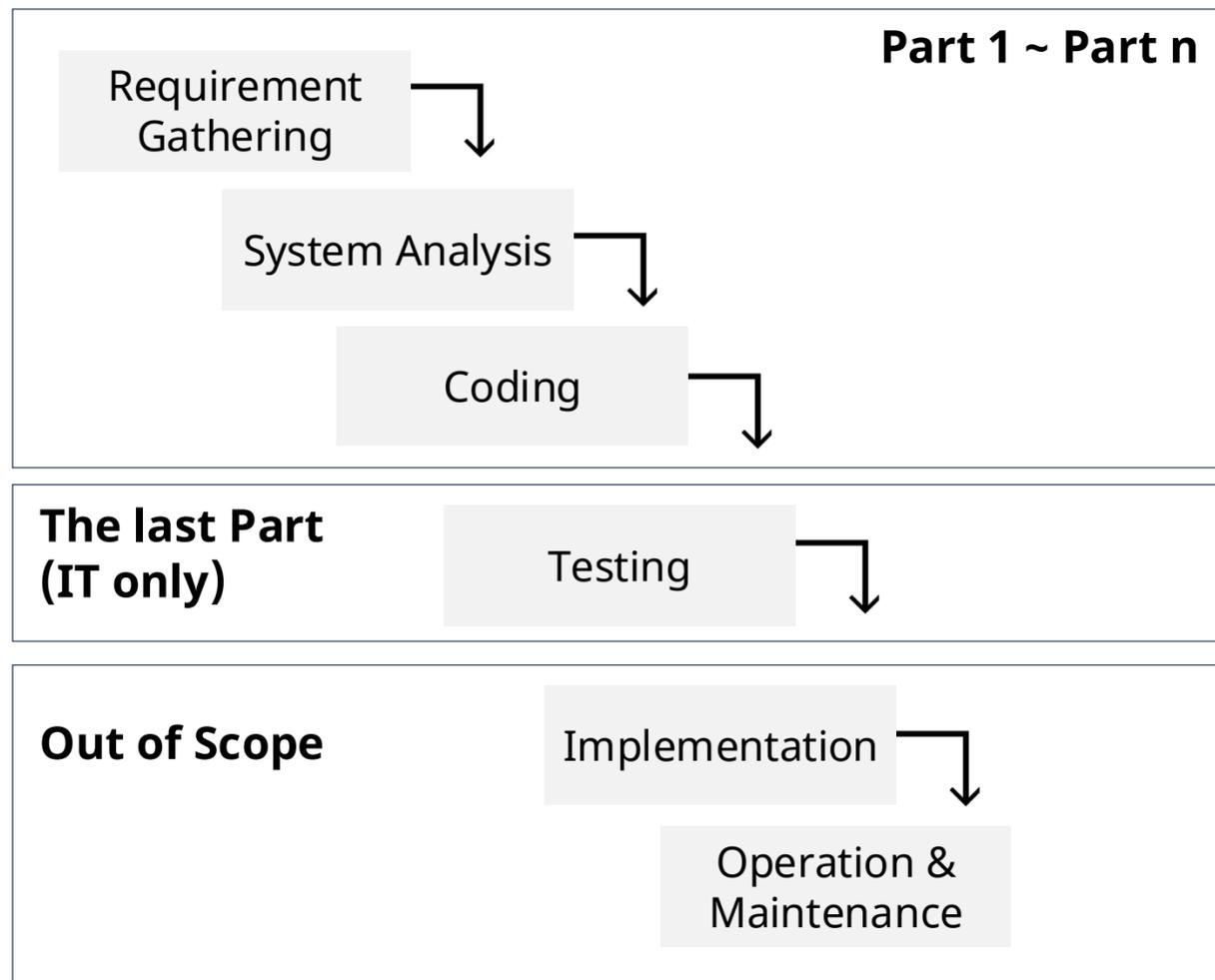
Do the same in the next Parts

•	◦Part 0 - Week 1	◦Part 0 - Week2	◦Part 1 - Week 1	◦Part 1 - Week2	◦Part 2 - Week 1	◦Part 2 - Week2
•URD	•Part 1 - URD	•	•Part 2 - URD	•	•Part 3 - URD	•
•SRS & UI	•Part 1 - SRS & UI	•	•Part 2 - SRS & UI	•	•Part 3 - SRS & UI	•
•Mockup	--	--	•Part 1 - Mockup	•	•Part 2 - Mockup	•
•API	•Part 1 - API design	•	•Part 1 - API coding	•Part 2 - API design	•Part 2 - API coding	•Part 3 - API design
•Frontend	--	--	•Part 1 - FE coding	•	•Part 2 - FE coding	•
•Smock test	--	--	•Part 1 - smock test point create	•Part 1 - smock testing	•Part 2 - smock test point create	•Part 2 - smock testing
•Small IT	--	--	--	--	--	--
•Large IT	--	--	--	--	--	--
•	•	•	•	•	•	•
•SAD	•Update	•Update	•Update	•Update	•Update	•Update
•Infra Design	•Update	•Update	•Update	•Update	•Update	•Update

Project file cycle visualization

PROJECT LIFE CYCLE

Project file cycle visualization



TIMELINE

DESIGN-CODE

Design:

- + SAD
- + Infra Design
- + URD
- + SRS
- + API Design

Code:

- + Font End
- + Backend
- + Smock

TEST

01/2023 - 12/2023

Development

Part 1: Account Authentication & User Roles

- UC1: Admin User Login
- UC2: Root User Account Management
- UC4: Root User Login
- UC12: General User Login

Part 2: User & Master Data Management

- UC5: Manage Non-Root Users
- UC6: Master Data Management

Part 3: Bus Operation Monitoring

- UC11: Operation Report Monitoring
- UC13: Route Tracking
- UC14: Bus Tracking

Part 4: Bus Devices & Scheduling

- UC9: Bus Device Management
- UC10: Bus Schedule Management

Part 5: Route & Vehicle Management

- UC7: Route Management
- UC8: Bus Management

Part 6: Notifications, Settings, Search

- UC3: Notification Management
- UC18: System Settings
- UC16.1: Search by Destination
- UC16.2: Search via Map

Part 7: UI Personalization & Language Options

- UC15: Policy Information Display
- UC16.3: Search by Trip History
- UC17: Language Preferences

Test:
Test IT
Test System

12/2023 - 03/2024

CR

- Additional features were developed beyond the original scope, based on evolving business needs.
- Luvina handled CRs efficiently to ensure smooth deployment and alignment with customer expectations.

Test:
Test IT
Test System

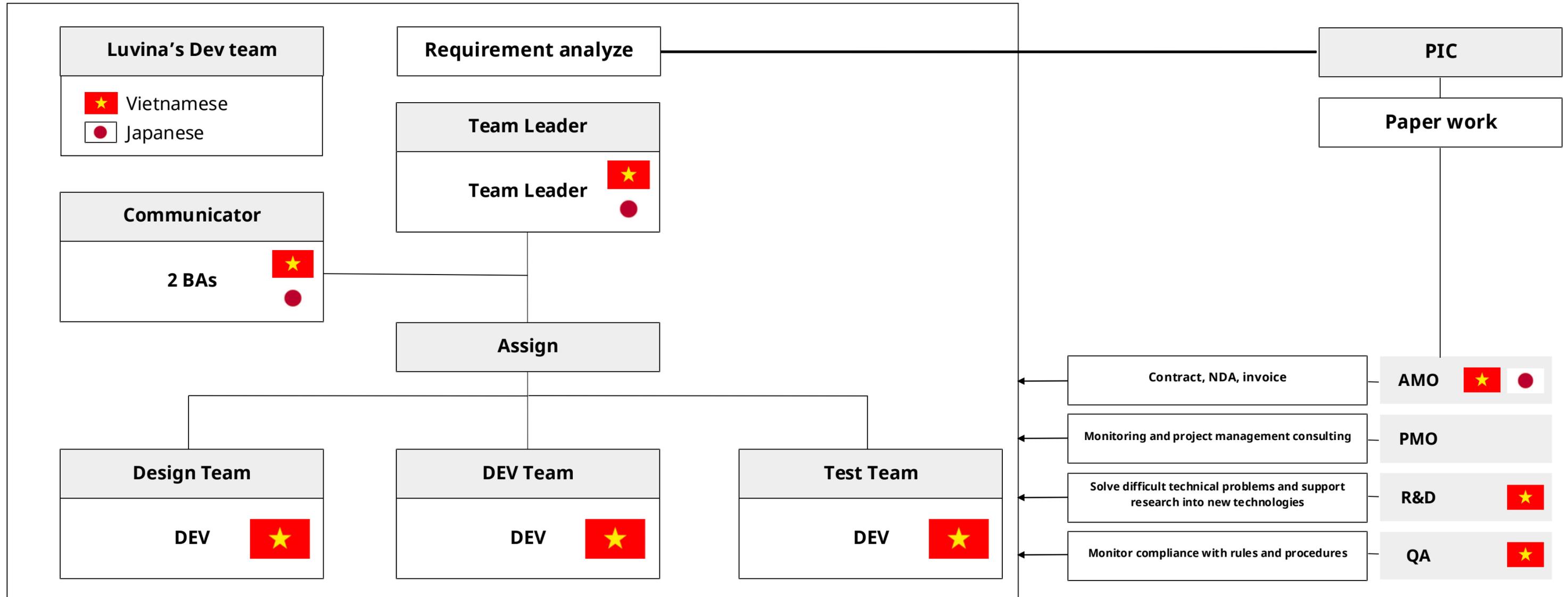
04/2024 - now

Post-launch Maintenance

- Continued support for feature enhancements and system maintenance.
- Implementation of new feature modules as per customer feedback and operational needs.

Test:
Test IT
Test System

TEAM STRUCTURE



Thank You

CONTACT US



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