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FACULTY OF APPLIED INFORMATION TECHNOLOGY

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Public Transportation Scheduling System

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CASE Tools Methodology

Rzeszów 2024

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Introduction

This document outlines the System Requirements Specification (SRS) for the Valley Transportation System a Public Transportation Scheduling System (PTSS). The purpose of the PTSS is to enhance the efficiency and effectiveness of public transportation services through improved route planning, ticketing, and passenger information services. This SRS includes a detailed description of the problem domain, business context, functional and non-functional requirements, Business Modeling View and Requirements Managements View. The goal of this document is to provide a comprehensive guide for the successful development and implementation of the PTSS.



Fig. 1: Public Transportation
Source: Own Study (19.05.2024)

Chapter 1

Business Context Description

1.1 Business Context

The Public Transportation Scheduling System (PTSS) is designed to enhance the efficiency and effectiveness of public transportation services in urban areas. This system will support route planning, ticketing, and passenger information services, aiming to improve the overall experience for commuters and streamline operations for transportation authorities.

Operational Overview

PTSS will manage and optimize the core functions of public transportation, including scheduling buses, trams, and trains; issuing tickets; and providing real-time information to passengers. The system will operate across multiple modes of transport and coordinate with various stakeholders to ensure seamless service delivery.

Key Components and Responsibilities

1. Route Planning:

Responsibilities:

- Designing efficient routes that cover maximum areas while minimizing travel time.
- Adjusting routes based on traffic conditions, passenger demand, and special events.
- Coordinating with city planning departments for route updates and expansions.

2. Ticketing:

Responsibilities:

- Managing different ticketing options (single journey, daily, weekly, monthly passes).
- Implementing and maintaining electronic ticketing systems (e.g., contactless payments).
- Handling fare collection and financial reconciliation.

3. Passenger Information Services:

Responsibilities:

- Providing real-time updates on schedules, delays, and route changes.
- Offering journey planning tools via mobile apps and web platforms.
- Maintaining customer communication channels (helplines, social media, in-station kiosks).

1.2 Business Processes

Route Development and Adjustment:

- Analyzing passenger data and traffic reports.
- Conducting public consultations and surveys.
- Implementing route changes and informing the public.

Ticketing and Fare Collection:

- Issuing tickets through various channels (online, in-station, mobile apps).
- Ensuring secure and accurate fare collection.
- Auditing and reconciling ticket sales.

Passenger Information Management:

- Collecting and processing real-time data from various sources (GPS, traffic reports).
- Updating passengers through multiple platforms (apps, websites, in-station displays).
- Handling passenger feedback and complaints.

1.3 Business Documents

1. Route Plans: Detailed maps and schedules of all public transport routes.
2. Ticketing Reports: Daily, weekly, and monthly reports on ticket sales and fare collection.
3. Passenger Feedback Logs: Records of passenger complaints, suggestions, and feedback.
4. Operational Dashboards: Real-time data on system performance, traffic conditions, and passenger flow.

1.4 Problems to Solve

1. Inefficient Route Planning: Need for optimizing routes to reduce travel time and improve coverage.
2. Complex Ticketing Processes: Need for a unified, easy-to-use electronic ticketing system.
3. Lack of Real-Time Information: Need for providing passengers with accurate and timely updates.
4. High Operational Costs: Need to streamline operations to reduce costs and improve efficiency.
5. Passenger Dissatisfaction: Need to improve overall service quality to enhance passenger experience.

1.5 System Goals

1. Efficiency: Streamline route planning and ticketing processes to reduce operational costs and travel time.
2. Accuracy: Provide real-time, reliable information to passengers.
3. User-Friendliness: Develop an intuitive interface for both passengers and staff.
4. Scalability: Ensure the system can adapt to increasing passenger numbers and expanded routes.
5. Integration: Coordinate seamlessly with other urban transport systems and services.

Chapter 2

Business Modeling View

2.1 Business Actors

Key business actors and their roles:

- Passengers: Individuals using the transport system.
- Transportation Operators: Ensure smooth transport operations.
- Technology Providers: Supply and maintain IT systems for the transport system.
- Government Agencies: Regulatory bodies overseeing operations.

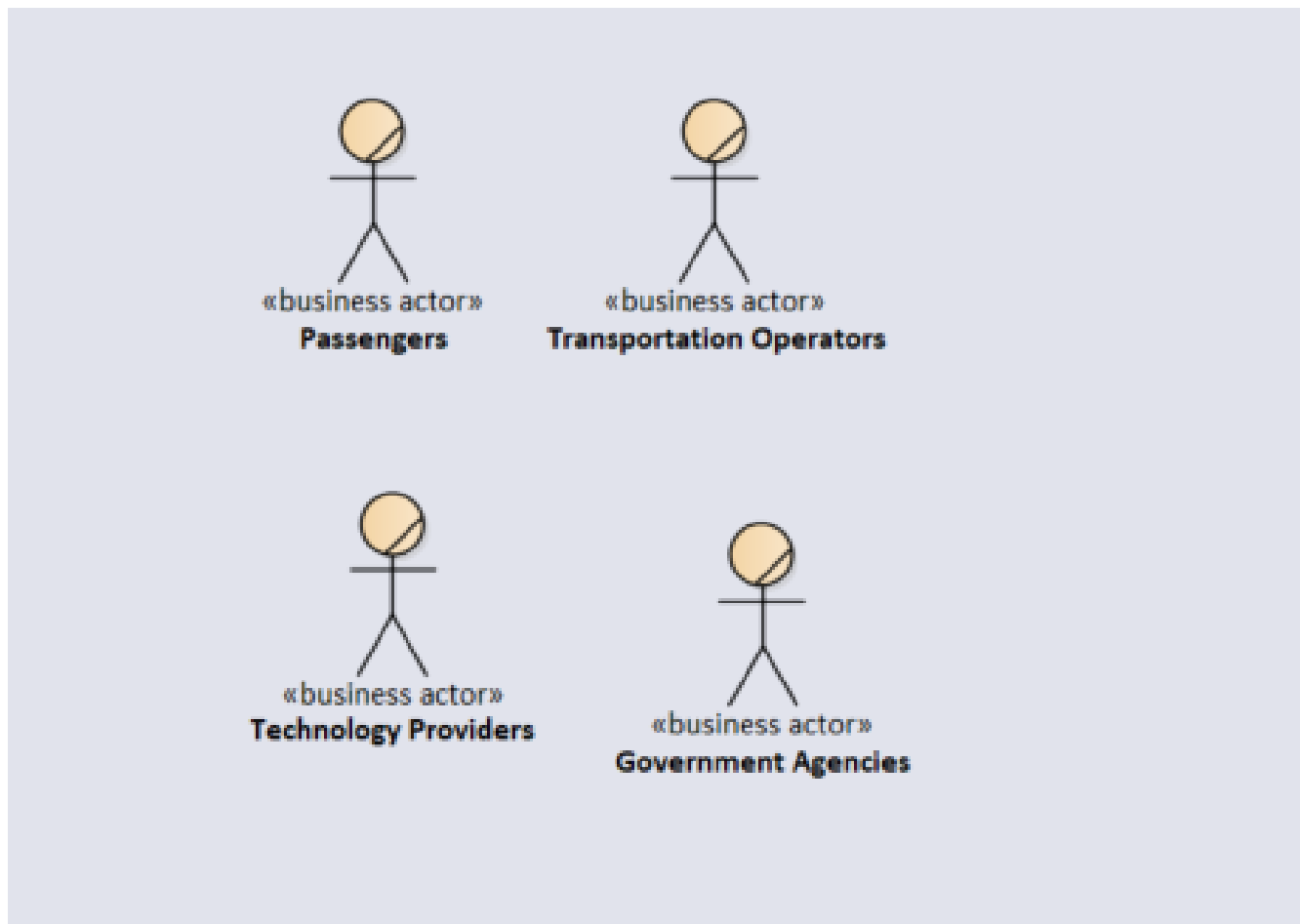


Fig. 2.1: Business Actors
Source: Own Study (27.12.2024)

2.2 Business Workers

The system relies on specialized workers:

- GIS Specialists: Analyze geospatial data.
- Route Planners: Plan and optimize transportation routes.
- Traffic Analysts: Monitor traffic flow and identify areas for improvement.
- Mobile and Web Developers: Develop and maintain the system's interface.
- Customer Support Staff: Address passenger needs and concerns.
- Ticketing Officers: Manage ticket issuance and payments.
- Maintenance Crew: Ensure infrastructure and vehicles are operational.

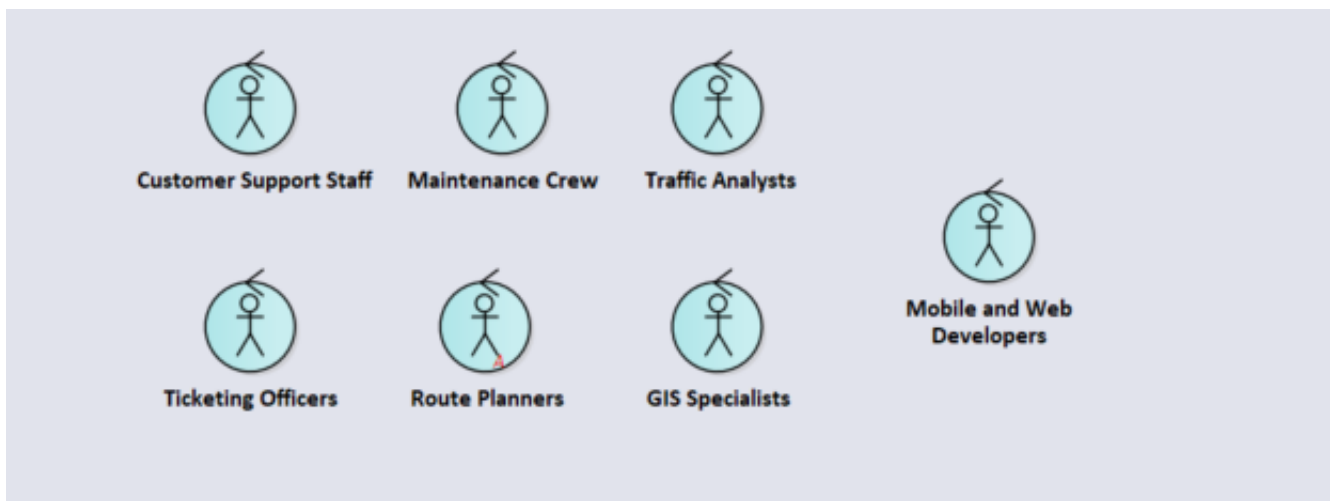


Fig. 2.2: Business Workers
Source: Own Study (27.12.2024)

2.3 Business Processes

The core processes of the system include:

- Route Planning Process: Optimizing routes based on traffic patterns and passenger demand.
- Ticketing Process: Facilitating ticket purchase and payment.
- Passenger Information Management: Providing real-time updates to passengers.
- Traffic Data Integration: Consolidating data from multiple sources.
- Customer Feedback Management: Capturing and acting on passenger feedback.

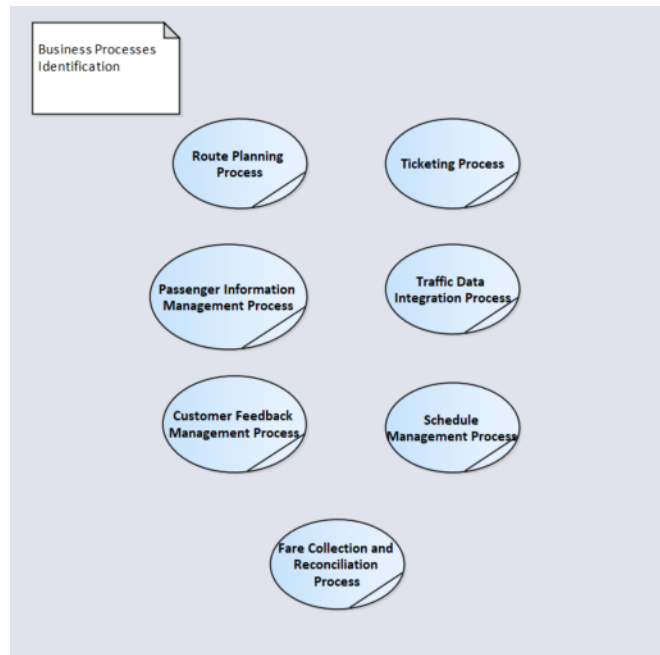


Fig. 2.3: Business Processes
Source: Own Study (27.12.2024)

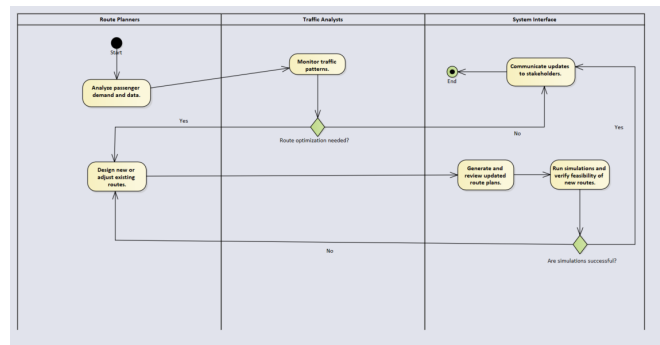


Fig. 2.4: Route Planning Process (Activity Diagram)
Source: Own Study (27.12.2024)

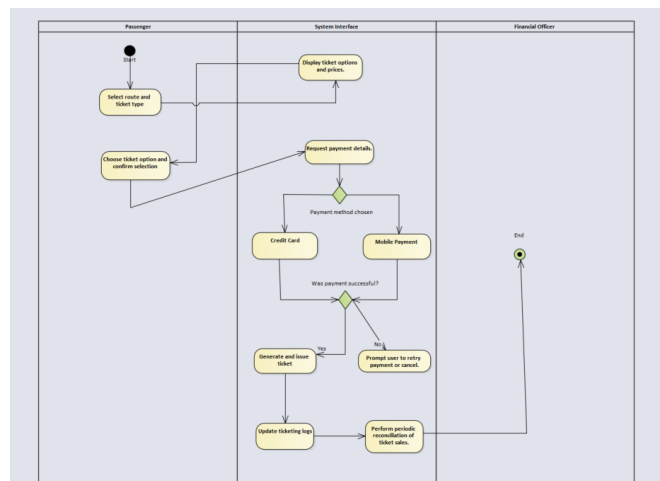


Fig. 2.5: Ticketing Process (Activity Diagram)
Source: Own Study (27.12.2024)

2.4 Business Entities

Key domain objects include:

- Ticket: Represents a passenger's booking.
- Traffic Report: Contains traffic analysis data.
- Route Map: Visual representation of planned routes.
- Passenger Feedback: Captures user insights and complaints.
- Traffic Data: Data collected from traffic analysis, used for route planning.
- Schedule: Timetables for transportation services, linked to routes.
- Transaction Report: Record of financial transactions, including ticket sales and reconciliations.
- Fare: Details of pricing and payment structures for transportation services.
- Passenger Feedback: Captures feedback and complaints from passengers for service improvement.
- Information Request: Requests for route, ticket, or scheduling information from users.
- Response: System-generated responses to passenger queries or requests.
- Feedback: Specific feedback collected from passengers for analysis.
- Maintenance Request: Requests for vehicle or infrastructure maintenance to ensure system reliability.

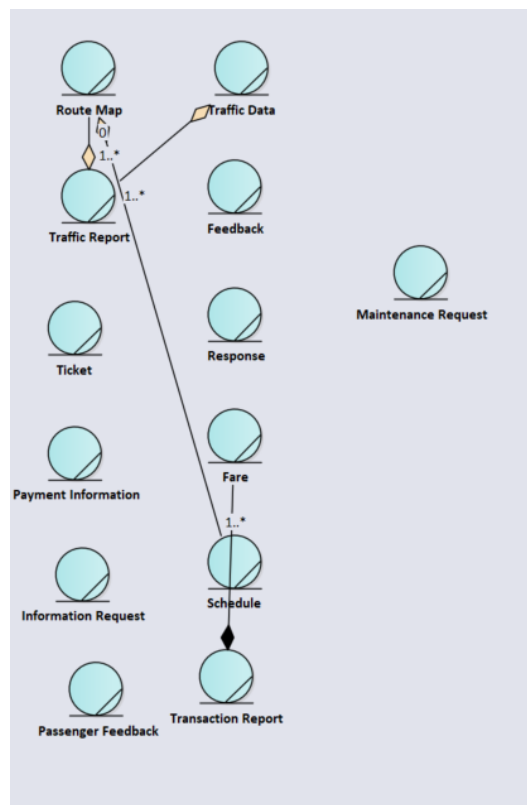


Fig. 2.6: Domain Objects
Source: Own Study (27.12.2024)

2.5 Business Context

The Business Context diagram highlights interactions between actors and processes, illustrating the overall structure and relationships within the system.

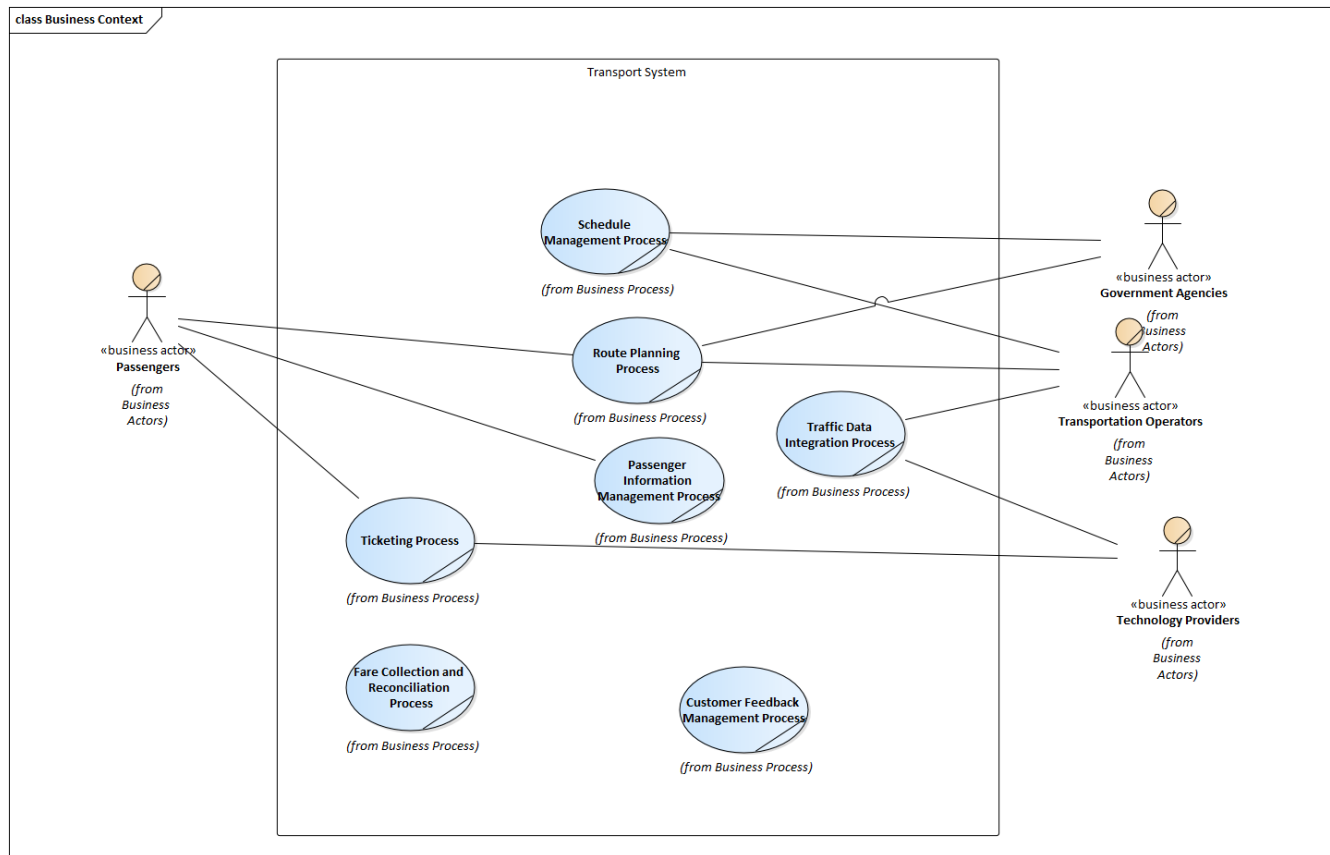


Fig. 2.7: Business Context
Source: Own Study (27.12.2024)

2.6 Process Map

The Process Map depicts the interconnections between business processes, ensuring a comprehensive understanding of the workflow.

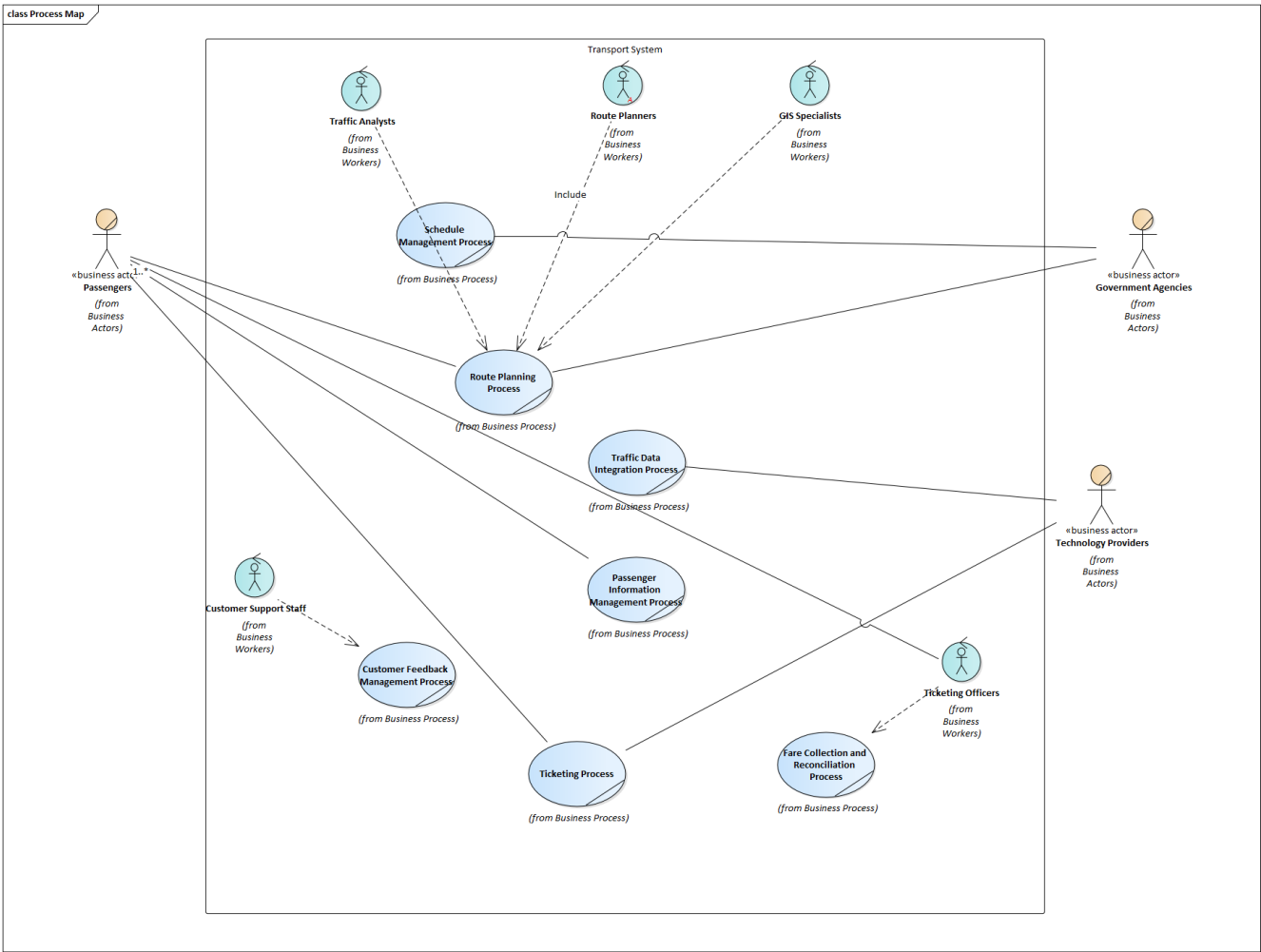


Fig. 2.8: Process Map
Source: Own Study (27.12.2024)

2.7 Organizational Units

The Organizational Units diagram showcases the roles and responsibilities within the system, ensuring clarity in operations.

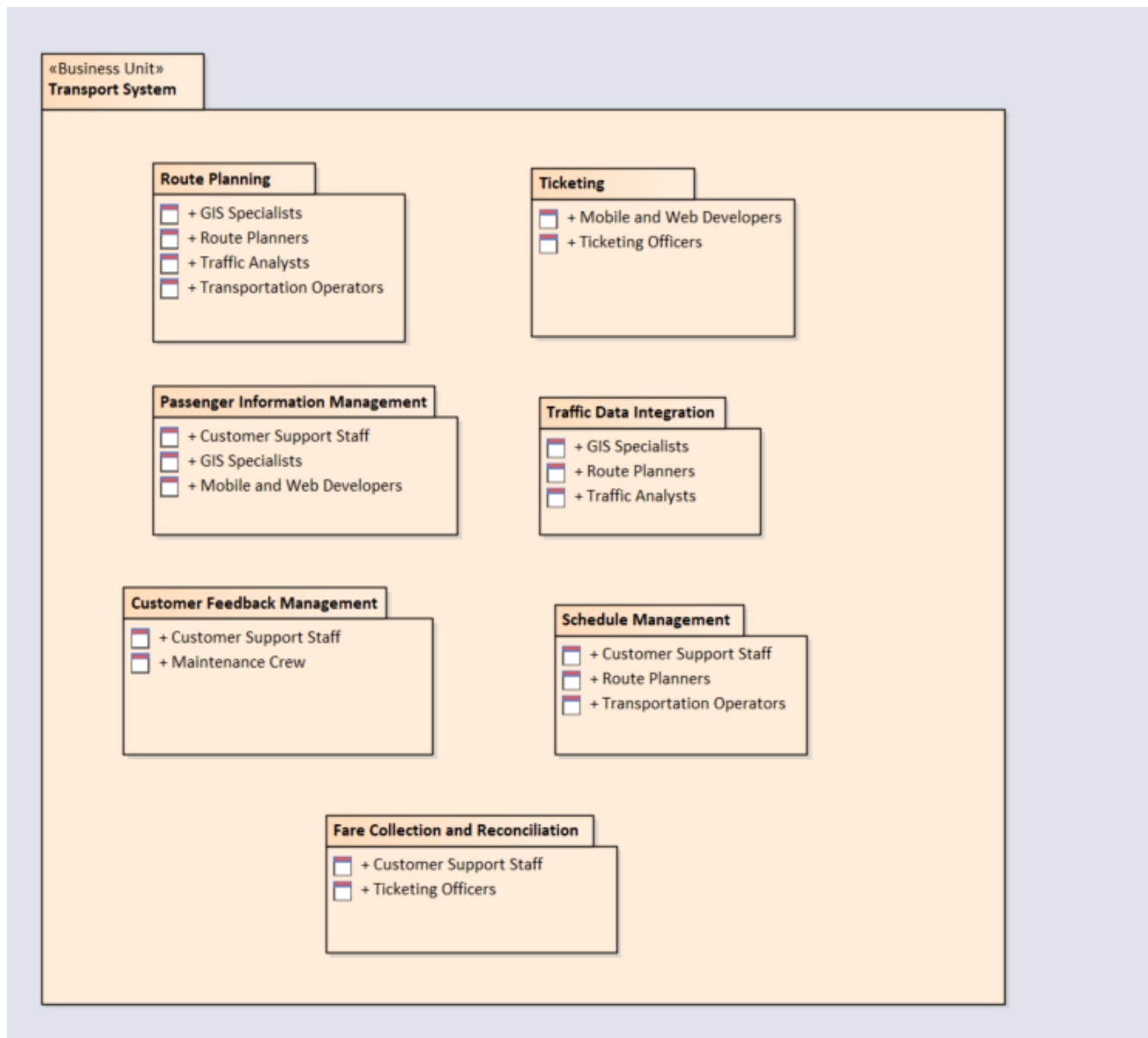


Fig. 2.9: Organizational Units
Source: Own Study (27.12.2024)

2.8 Business Class Diagrams for Entities

Static model of resources related to every business process.

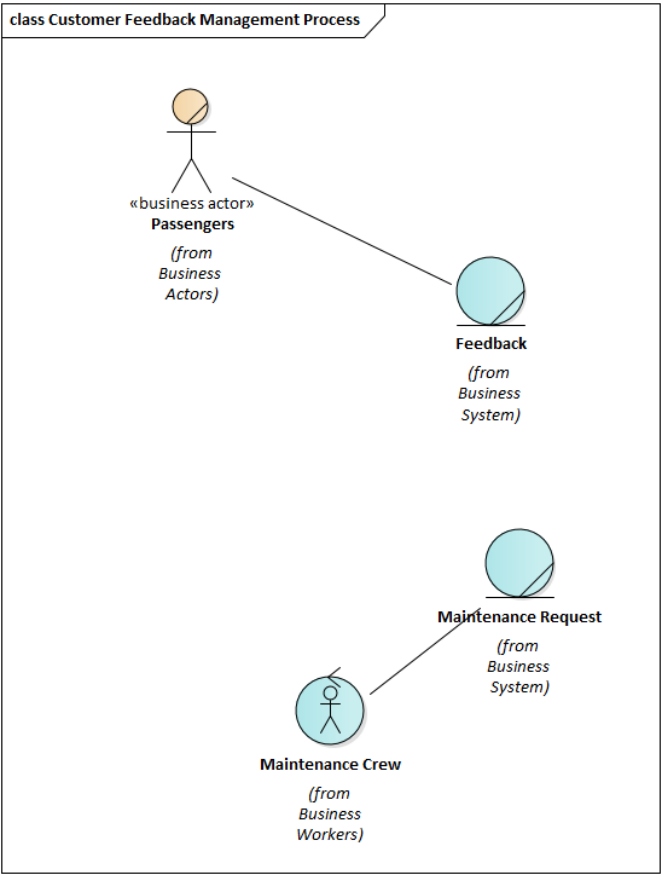


Fig. 2.10: Customer Feedback Managment process
Source: Own Study (27.12.2024)

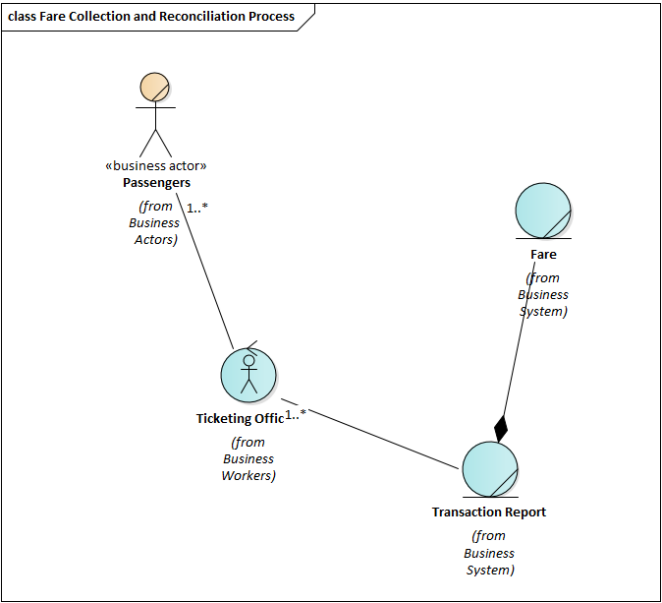


Fig. 2.11: Fare Collection and Reconcillation process
Source: Own Study (27.12.2024)

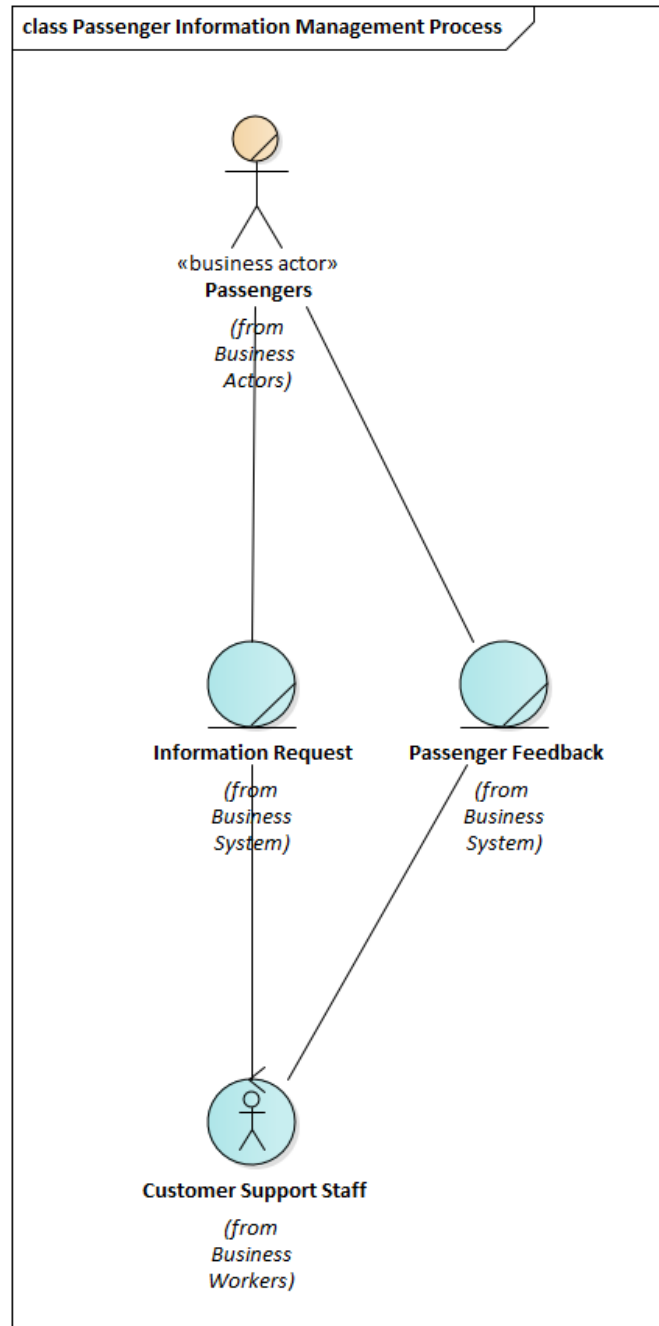


Fig. 2.12: Passenger information Management
Source: Own Study (27.12.2024)

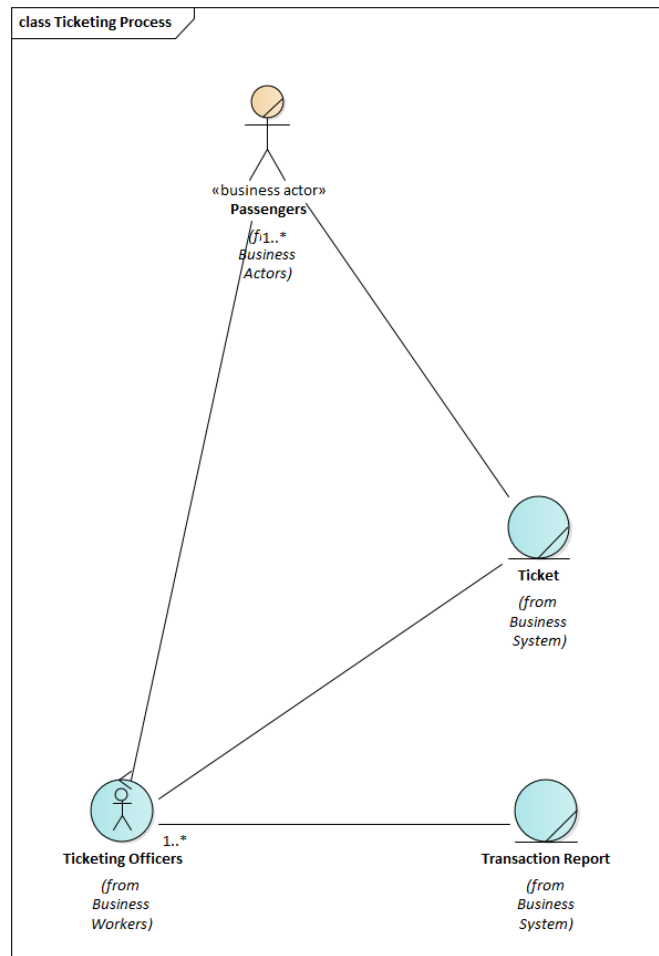


Fig. 2.13: Ticketing Process
Source: Own Study (27.12.2024)

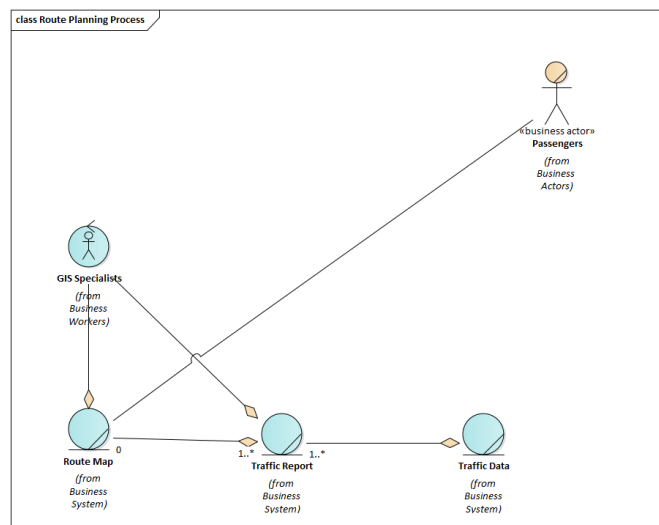


Fig. 2.14: Route Planning Process
Source: Own Study (27.12.2024)

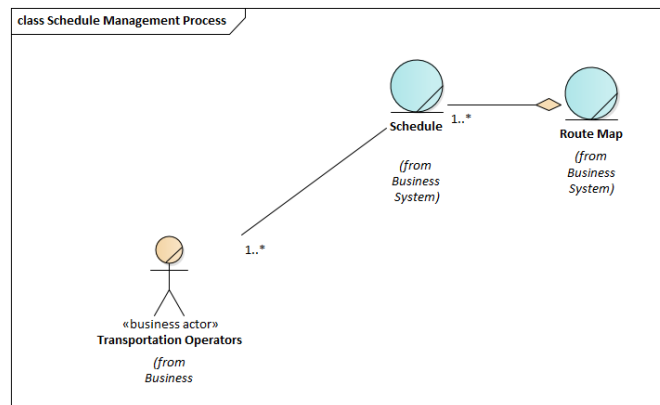


Fig. 2.15: Schedule Management Process
Source: Own Study (27.12.2024)

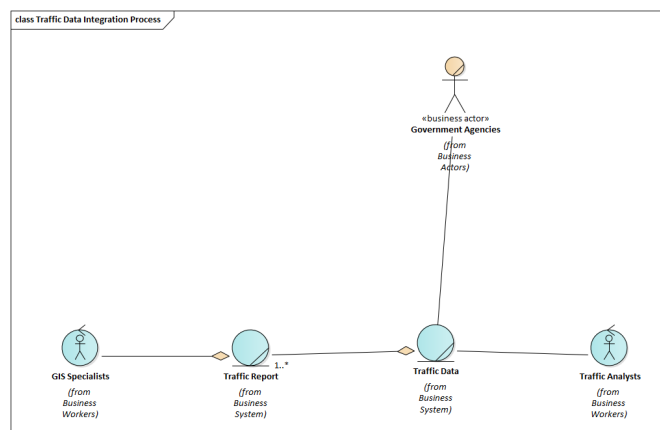


Fig. 2.16: Traffic Data Integration Process
Source: Own Study (27.12.2024)

2.9 Project Glossary

- **Route Planner:** A tool or person responsible for creating transportation schedules and pathways.
- **GIS:** Geographic Information System used to analyze spatial and geographic data.
- **Fare Reconciliation:** The process of matching payments received with issued tickets.
- **Transportation Operator:** An individual or team responsible for the physical operation of vehicles.
- **Traffic Analyst:** A specialist focused on studying and interpreting traffic data patterns.
- **Real-Time Update:** Immediate information on delays or changes to schedules.
- **Scalability:** The system's ability to handle increased demand.
- **Dashboard:** A graphical interface showing key performance indicators for stakeholders.
- **System Availability:** The percentage of time a system is operational.
- **Passenger Feedback System:** A mechanism for passengers to submit reviews or complaints.

Chapter 3

Requirements Management View

3.1 Stakeholders

Key stakeholders include:

- Government Agencies
- Software Developers
- Transportation Operators
- Passengers
- Route Planners
- GIS Specialists
- Customer Service Representatives

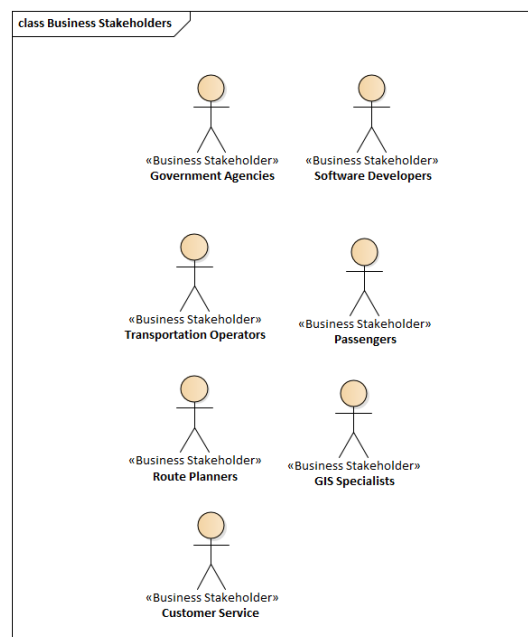


Fig. 3.1: Stakeholders
Source: Own Study (27.12.2024)

3.2 Stakeholder Requirements

- Passengers: Easy access to ticketing options, real-time notifications.
- Route Planners: Tools for route correction and automation.
- Transportation Operators: Improved scheduling and real-time data synchronization.

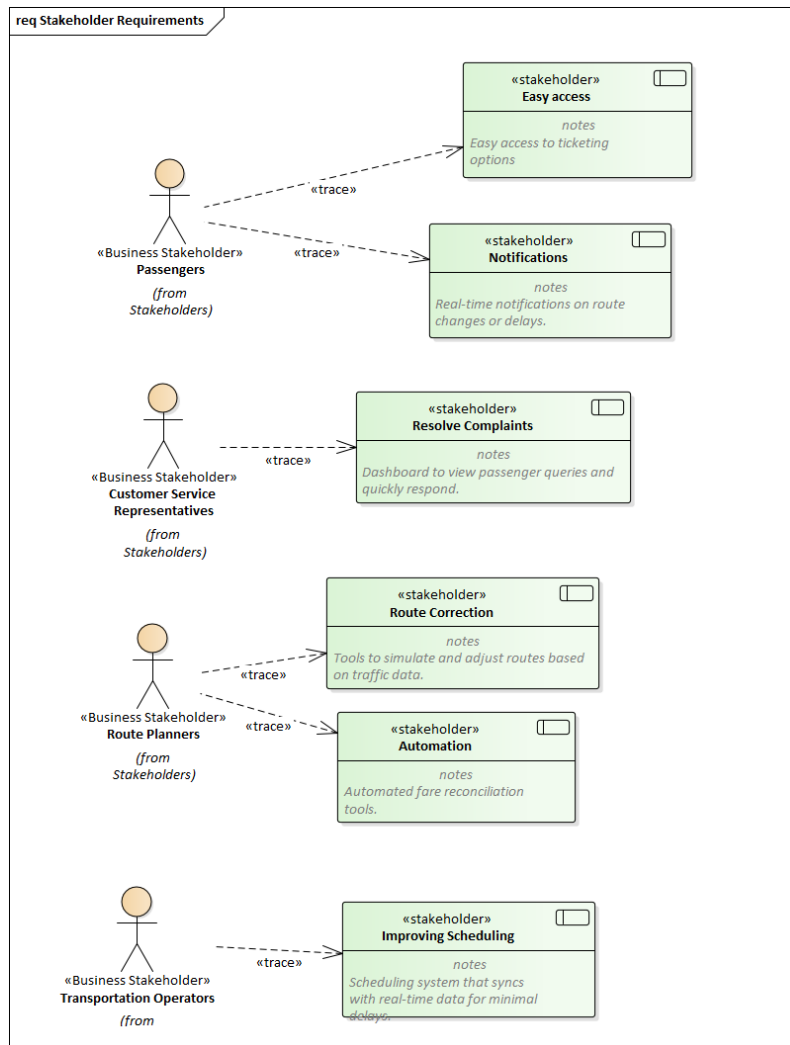


Fig. 3.2: Stakeholder Requirements
Source: Own Study (27.12.2024)

3.3 Business Requirements

Key requirements include:

- Improve Efficiency: Optimize route planning and transportation schedules.
- Support Scalability: Handle increasing passengers and routes.
- Enhance Customer Experience: Provide accurate updates and responsive support.
- Integrate Data: Centralize traffic, route, and passenger information.

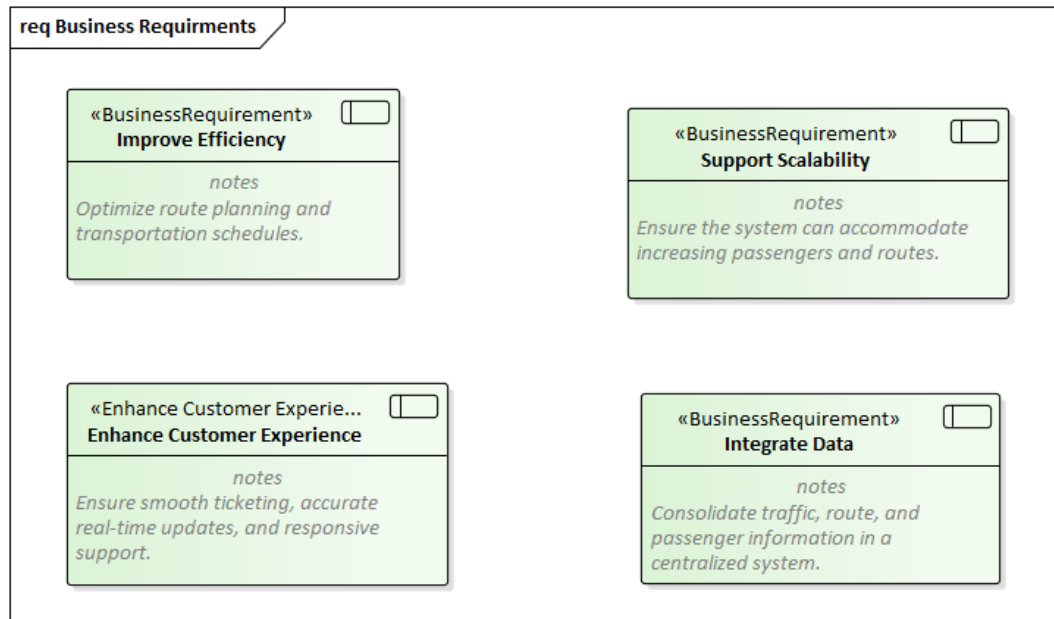


Fig. 3.3: Business Requirements
Source: Own Study (27.12.2024)

3.4 Business Rules

The defined rules include the following:

- Booking Timing: Tickets must be booked at least 10 minutes before departure.
- Refund Policy: Cancellations must be made 24 hours in advance.
- User Registration: Only registered users can save routes.
- Vehicle Capacity Limit: Cannot exceed 100
- Data Retention: Passenger history limited to 12 months.

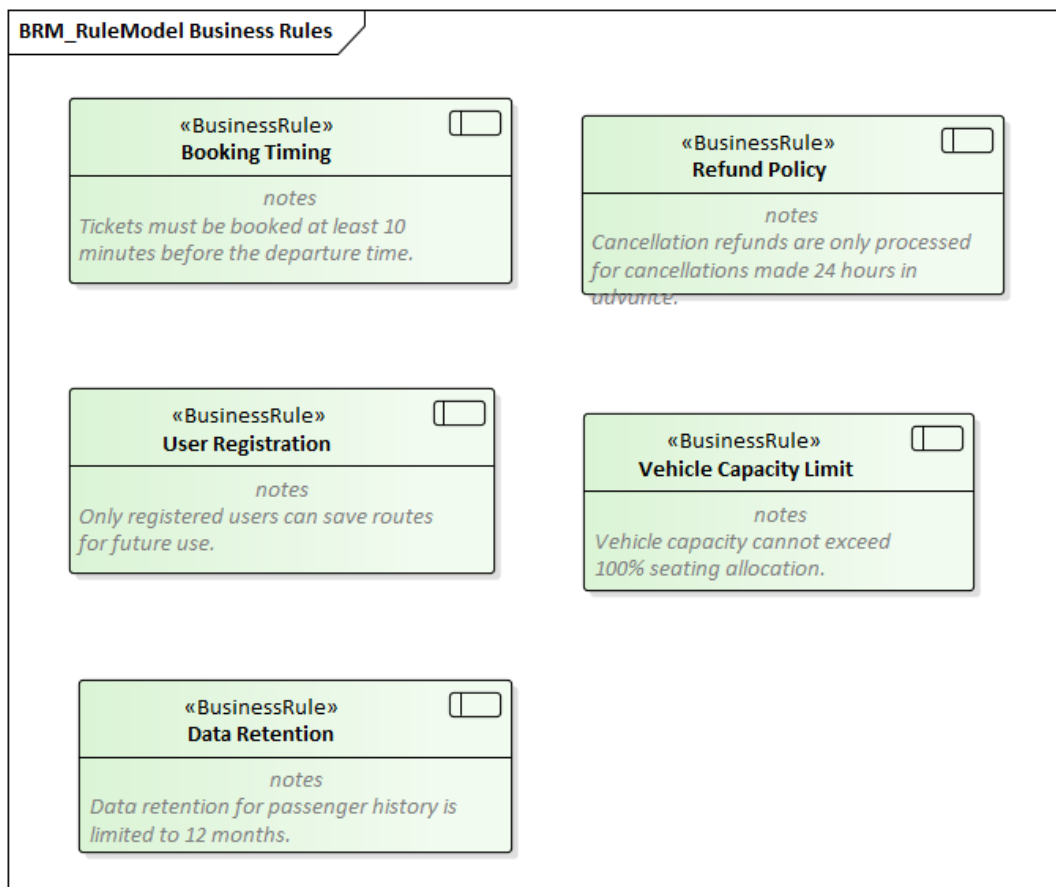


Fig. 3.4: Business Rules
Source: Own Study (27.12.2024)

3.5 Solution Requirements

3.5.1 System Features

- Geo-Location Integration
- Scalable Infrastructure
- Multi-Language Support

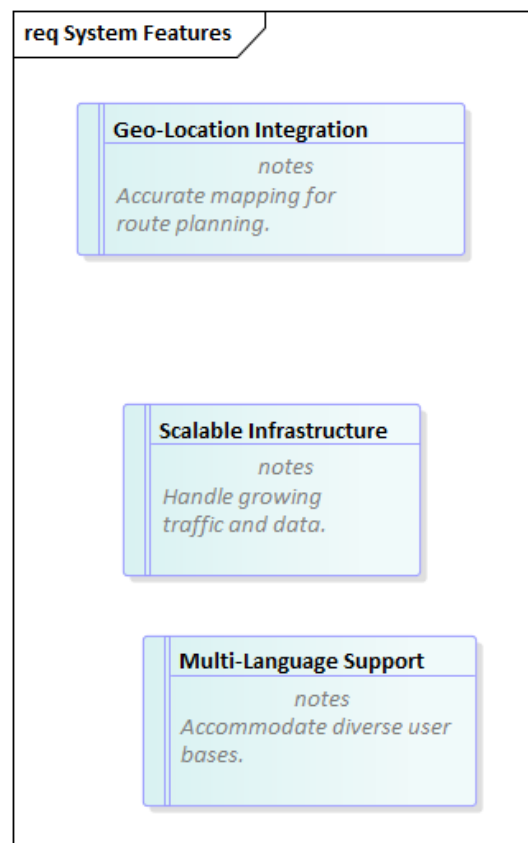


Fig. 3.5: System Features
Source: Own Study (27.12.2024)

3.5.2 Functional Requirements

- Real-Time Updates: Operators update routes, and users receive notifications in real-time.
- Route Visualization: Displays optimized routes with travel times.
- Ticket Booking System: Facilitates trip selection, passenger detail submission, and payment.

3.5.3 Non-Functional Requirements

- Availability: System uptime of 99.9
- Performance: Ability to process 1000 transactions per minute.
- Security: Data encryption and role-based access control.

3.6 Use Case Diagrams

- Real-Time Updates: Operators update routes, and users receive notifications in real-time.
- Route Visualization: Displays optimized routes with travel times.
- Ticket Booking System: Facilitates trip selection, passenger detail submission, and payment.

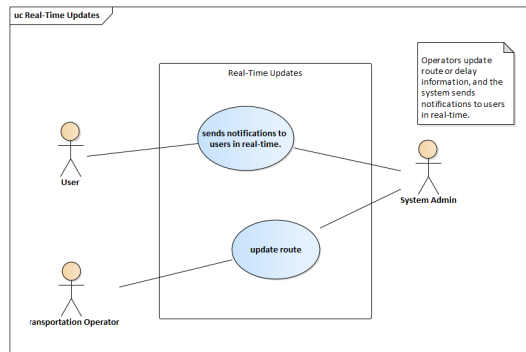


Fig. 3.6: Real-Time Updates
Source: Own Study (27.12.2024)

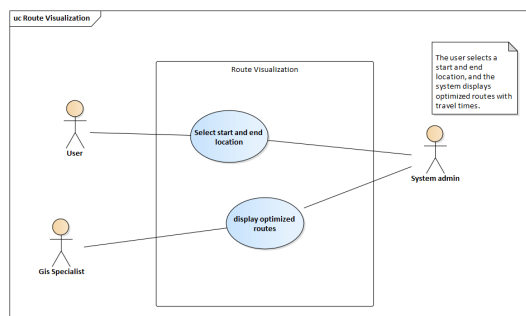


Fig. 3.7: Route Visualization
Source: Own Study (27.12.2024)

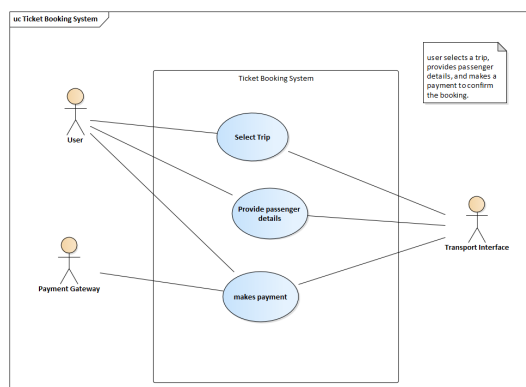


Fig. 3.8: Ticket Booking System
Source: Own Study (27.12.2024)

Chapter 4

Anaysis and Design View

4.1 Design Class Diagrams

Ticket Booking Use Case

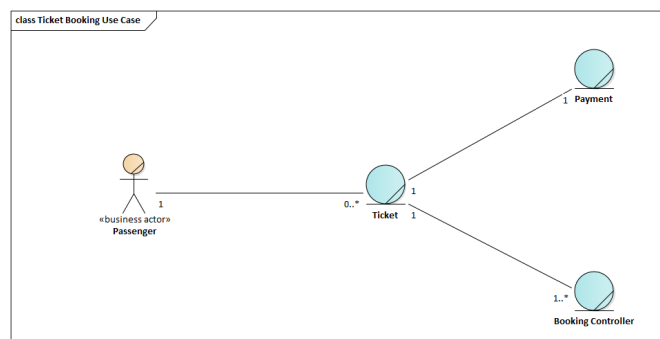


Fig. 4.1: Ticket Booking
Source: Own Study (28.12.2024)

Route Visualization

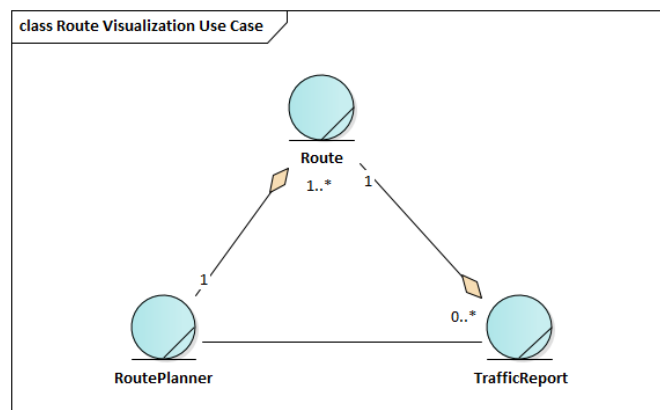


Fig. 4.2: Route Visualization
Source: Own Study (28.12.2024)

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Summary

Public Transportation Scheduling System

Author: Ahmed Alkali Mohammed

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This project demonstrates a comprehensive approach to modeling a Public Transport System. From business modeling to requirements management and use case realization, each aspect aligns with the system's goals. Future improvements could include expanding functionality for predictive analytics and enhanced user interfaces.