Shiva Exports Ltd

Logistics Management System

Requirements Analysis and Design

Saad Khan, 101157307

Veronyque Lemieux, 101106553

Sergio Lombana, 101137768

Ian Miranda, 101163981

Jeremy Thibeau, 101157911

Table of Contents

1.0 Introduction

1.1   Purpose

The purpose of this document is to present a detailed description of the Logistics Management System. It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external input. This document is intended for both the stakeholders and the developers of the system and will be proposed to Shiva Exports Ltd. for its approval.

1.2   Scope

This software system will be a Logistics Management System for a mid-size family-owned business that specializes in wholesale, domestic sale and export of used photocopying machines. The system will provide the Purchase department and Logistics department the ability to track the movement of purchased assets from purchase locations to Shiva warehouses, assisting in weight and space management of each truckload and providing live GPS data of the truck as it transfers equipment between purchase location to warehouse as well as between Shiva's four warehouses: Toronto, Philadelphia, New Jersey, and Dallas. Currently, departure/arrival times are notified manually via an informal social media group-chat of Logistics Coordinators between different warehouses. By automating email notifications of departure/arrival times and displaying live GPS data through a visual mapping interface Coordinators are provided with standardized, detailed, and up-to-date information of shipment progress. While tracking the current GPS location of the truck, the system will also provide efficient routing based on pickup/delivery needs as entered by the Purchase Coordinator. A form will be available for the Purchase Coordinator to enter/update order information for a purchase list that will be viewable by all users. Rerouting capabilities will be implemented for cases where Coordinators deem necessary i.e., traffic conditions, weather conditions, or other fringe cases that require human intervention in the system.

The system will also provide the Logistics & Exports Supervisor graphical tools to build and optimize container layouts to increase shipment efficiency. Using product dimensions such as width, depth and height, the system provides computations for the most efficient configuration of products within the shipping container while also adhering to both Canadian and American truck axle load laws. Customizability to the shipping container configurations will also be implemented in cases that require human intervention.

2.0 System Overview

2.1 Project Perspective

The project is intended to be a new self-contained web-based Logistics Management System, to be used in conjunction with Shiva Exports' custom warehouse inventory system.
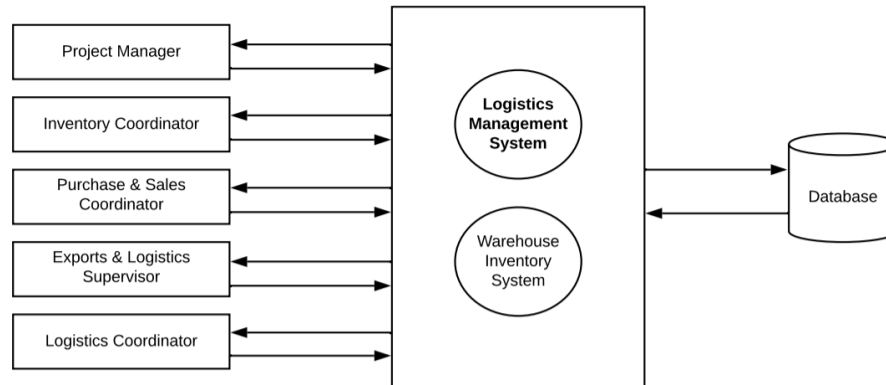
2.2 System Context

The system is aiming to address a few business challenges such as a lack of centralized documentation and tracking of equipment when it is purchased but not yet delivered to a Shiva warehouse and entered into their current inventory system, a lack of efficiency when planning pickup/delivery routes, a lack of automation when planning truck loads, and a lack of convenience and ease when tracking the truck and equipment. It will aid the various departments of Shiva Exports in streamlining everyday logistical processes and ultimately resulting in facilitating timely and accurate business decisions.

2.3 General Constraints

The system's scope was established with a few constraints in mind: time, resources and quality. Due to the small size of our team of developers who also need to act as testers and quality assurance analysts, the scope had to be restricted to allow us to deliver a valuable product by the scheduled completed date. Due to time restrictions, our team will be unable to include any other additional features demanded by the stakeholder in the first release.

The design and implementation phases were planned with the stakeholder's ideas and perspectives in mind, thus setting a limit to our creative input. The system will be tested on desktop systems with popular internet browsers connected through a high speed internet connection, which will set the minimum standard for user experience.

2.4 Assumptions and Dependencies

During the project's initiation phase, our team made the following assumptions: that equipment data will be provided by the Purchase or Inventory Coordinator by adding their order lists, importing excel files, or copy-pasting tables in the system; that live data will be provided by their current inventory system to be used when cross-referencing order lists and updating the status of machines arriving at their warehouse; that an equipment's weight and dimensions be obtained from Buyers Lab software; that live data from Shiva Exports' current GPS tracking solution, Arion Trak, can be accessed. The success of the system is thus dependent on data from the users, Buyers Lab and Arion Trak, but also on Google Maps' APIs for truck routing purposes. Moreover, it will be dependent on the software's connection to a well-structured database to help support and ensure the accuracy and integrity of Shiva Exports' information.

3.0 Functional Requirements

3.1   Functional Requirements

3.1.1 View and Edit Order Details

Introduction:

User logs on to the system and uses Order attributes to search and view individual orders, as well as their contents.

Inputs:

1. The user logs into the system with valid credentials.
2. The user puts an Order attribute into the search box
3. Selection of Order results to get an individual order.
4. Modify Order attributes as needed prior to submission.

Processing:

1. System validates user credentials provided with database credentials.
2. System verifies the search parameters entered against Orders saved in the database.
3. System saves updated Order attributes to database.

Outputs:

1. The system returns the User's class Home screen if the user has authenticated successfully, otherwise it returns an error page.
2. System return a list of Orders that match the search criteria. Users can click on these results to view an individual Order.
3. Individual Order details are displayed.
4. Confirmation message of updates to Order details is displayed.

3.1.2 View Item Details

Purchase and Sales Coordinator
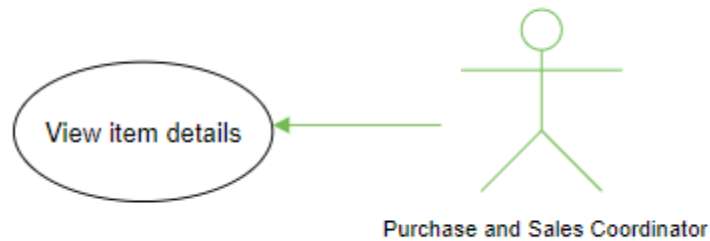
Introduction:

User enters various Copier attributes into search and is returned a list of copiers based on the results. User can view individual copiers to view full details.

Inputs:

1. The user logs into the system with valid credentials.
2. User enters attributes of a Copier into the search bar.
3. User can update status of individual items based on serial number.

Processing:

1. System validates user credentials provided with database credentials.
2. System selects results from the Copier table that match the search criteria.
3. System updates information in database.

Outputs:

1. The system returns the User's class Home screen if the user has authenticated successfully, otherwise returns an error page.
2. System return results and displays them.
3. System displays updated information.

3.1.3 View and Export Vendor Information

Purchase and Sales Coordinator

Introduction:

User can search vendor information using various parameters. User can then export this information into a file.

Inputs:

1. The User logs into the system with valid credentials.
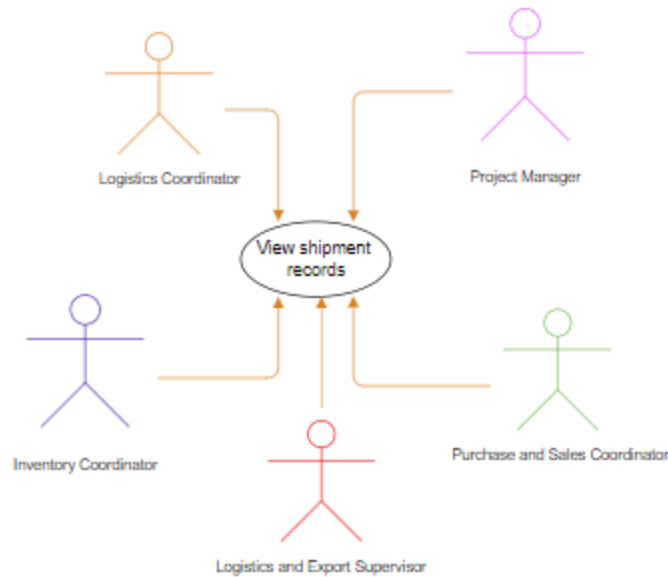2. User enters parameters into the search bar.

Processing:

1. System validates user credentials provided with database credentials.
2. System selects Vendors from the database that match the parameters entered by the User.

Outputs:

1. The system returns the User's class Home screen if the user has authenticated successfully, otherwise it returns an error page.
2. System returns results of search for Vendor Information.
3. System saves information to a file.

3.1.4 View Shipment Records

Introduction:

Users logs on to the system and sue shipment attributes to search and view individual shipments, as well as their contents.

Inputs:

1. The user logs into the system with valid credentials.
2. The user puts a shipment attribute into a search box.
3. Selection of shipment results to get an individual order.
4. Use can then opt for change order items status to "Delivered" or "Shipped".

Processing:

1. System validates user credentials provided with database credentials.
2. System verifies the search parameters entered against Shipment saved in the database.
3. System stored item status in the database.

Outputs:

1. The system returns the User's class Home screen if the user has authenticated successfully, otherwise it returns an error page
2. System returns a list of Shipments that match the search criteria. Users can click on these results to view an individual Shipment.
3. Individual Shipment details are displayed.

3.1.5 Schedule Pickups and Deliveries

Introduction:

The Logistics & Exports Supervisor schedules a truck's itinerary based on new orders and warehouses inventory.

Inputs:

1. The Supervisor provides credentials to login.
2. The Supervisor clicks navbar button to access the "Trucks" page.
3. The Supervisor selects button "Assign route" of the preferred route.
4. The Supervisor sets the starting and the ending location for the desired truck's route
5. The Supervisor sets the time and day for the delivery.
6. The Supervisor clicks the "Assign" button at the bottom of the page.

Processing:

1. The system validates credentials provided with the credentials in the database.
2. The system calculates the most efficient route considering time, traffic, gas prices, weather and possible closures
3. The system stores new route into database and assigns it to truck's unique id.

Outputs:

1. The system provides the Supervisor home page or an error message if the credentials are invalid.
2. The system provides the "Trucks" page.
3. The system provides a form for the route details.
4. The system provides the coordinator the recommended route.
5. The system provides the coordinator a status message confirming the selection.

3.1.6 Audit Orders for Accuracy

Inventory Coordinator

Introduction:

The Inventory Coordinator confirms that the machines shipped coincide with machines received after cross-check of unique serial number identifier.

Inputs:

1. The Inventory Coordinator provides credentials to login
2. The Inventory Coordinator accepts notification confirming the number of machines received coincide with the number of machines shipped.

Processing:

1. The system validates credentials provided with the credentials in the database.
2. The system reads Boolean value coming from the notification box.
3. The system stores Boolean in database and sends a notification to the warehouse that sent the shipment.

Outputs:

1. The system provides the coordinator home page or an error message if the credentials are invalid.
2. The system displays notification box asking the coordinator to confirm shipment.
3. The system displays status box confirming coordinator selection.

3.1.7 Plan Most Efficient Route for the Truck

Introduction:

The Logistics and Exports Supervisor can see the fastest route possible for the truck's route.

Inputs:

1. The Supervisor provides credentials to login.
2. The Supervisor clicks navbar button to access the "Trucks" page.
3. The Supervisor selects button "Assign route" of the preferred route.
4. The Supervisor sets the starting and the ending location for the desired truck's route.

Processing:

1. The system validates the credentials provided with the credentials in the database.
2. The system calculates the most efficient route considering time, traffic, weather and possible closures

Outputs:

1. The system provides the Supervisor home page or an error message if credentials are invalid.
2. The system provides the "Trucks" page and a list of available trucks.
3. The system provides a form for the route details.
4. The system provides the coordinator the recommended route.

3.1.8 Plan Truck Container Layout

Logistics and Export Supervisor

Introduction:

The Logistics and Exports Supervisor logs into the system to get the exact number of how many printers the team can be placed into the truck storage.

Inputs:

1.   The Supervisor provides credentials to login.
2.   The Supervisor clicks navbar button to access the "Shipments" page.
3.   The Supervisor selects shipment.
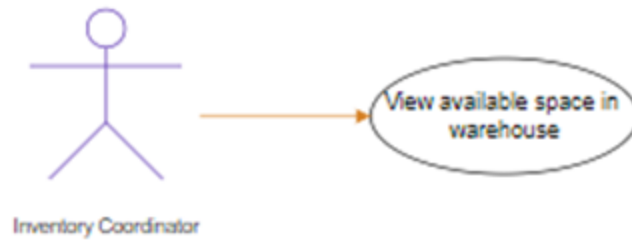4.   The Supervisor selects "Truck details" button

Processing:

1.   The system validates credentials provided with the credentials in the database.
2.   The system calculates how many printers can fit into the truck storage based on dimensions given of the truck and printers.

Outputs:

1.   The system provides the Supervisor home page or an error message if the credentials are invalid.
2.   The system renders and displays the "Shipments" page.
3.   The system renders and displays the "Truck Details" page with calculated dimensions.

3.1.9 View Available Space in Warehouse

Inventory Coordinator

Introduction:

The inventory coordinator views how much space is available in the warehouse to organize orders.

Inputs:

1. The inventory coordinator provides credentials to login.
2. The inventory coordinator clicks the" Warehouse" navbar option.

Processing:

1. The system validates credentials provided with the credentials in the database.
2. The system calculates available space in the warehouse based on previously inserted values for current items, items shipped, and items received.

Outputs:

1. The system provides the coordinator home page or an error message if the credentials are invalid.
2. The system provides Warehouse page.
3. The system provides the number of current items and available space in the warehouse.

3.1.10 View and Edit Logistics Cost

Project Manager

Introduction:

Project manager logs into the system, and then views a current model of costs for different logistics items.

Inputs:

1. The user logs into the system with valid credentials.
2. User adjusts variables of costs for logistics.

Processing:

1. System validates user credentials provided with database credentials.
2. Based on the variables that are modified, system will perform calculations.

Outputs:

1. The system returns the User's class Home screen if the user has authenticated successfully, otherwise it returns an error page.
2. System displays costs based on new results from the calculations performed.

3.1.11 View Updates on Truck Route
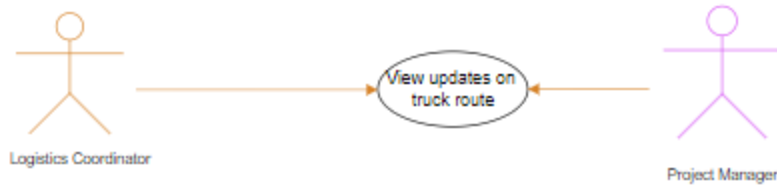
Introduction:

User logs into the system. From the dashboard of truck position view, User can view any alerts that affect the Truck's travel on its current route.

Inputs:

1. The user logs into the system with valid credentials.

Processing:

1. System validates user credentials provided with database credentials.
2. System keeps up to date with travel/ weather/ construction alerts that appear on the current truck route.

Outputs:

1. System shows those alerts to the User.
2. The system returns the User's class Home screen if the user has authenticated successfully, otherwise it returns an error page.

3.1.12 View Truck Position during Shipment Process
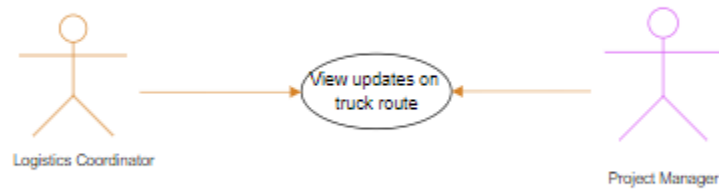
Introduction:

The Logistics Coordinator logs into the system after truck has started its route and is able to see a graphic with truck's live position.

Inputs:

1. The coordinator provides credentials to login.

Processing:

1. The system validates the credentials provided with database credentials.
2. The system confirms id and retrieves shipment details
3. The system communicates with truck's GPS and obtains location.

Outputs:

1. The system provides the home page for the coordinator or error message if credentials are invalid.
2. The system provides a graphical UI with truck's location in the Coordinators dashboard page.

3.2 Use Cases
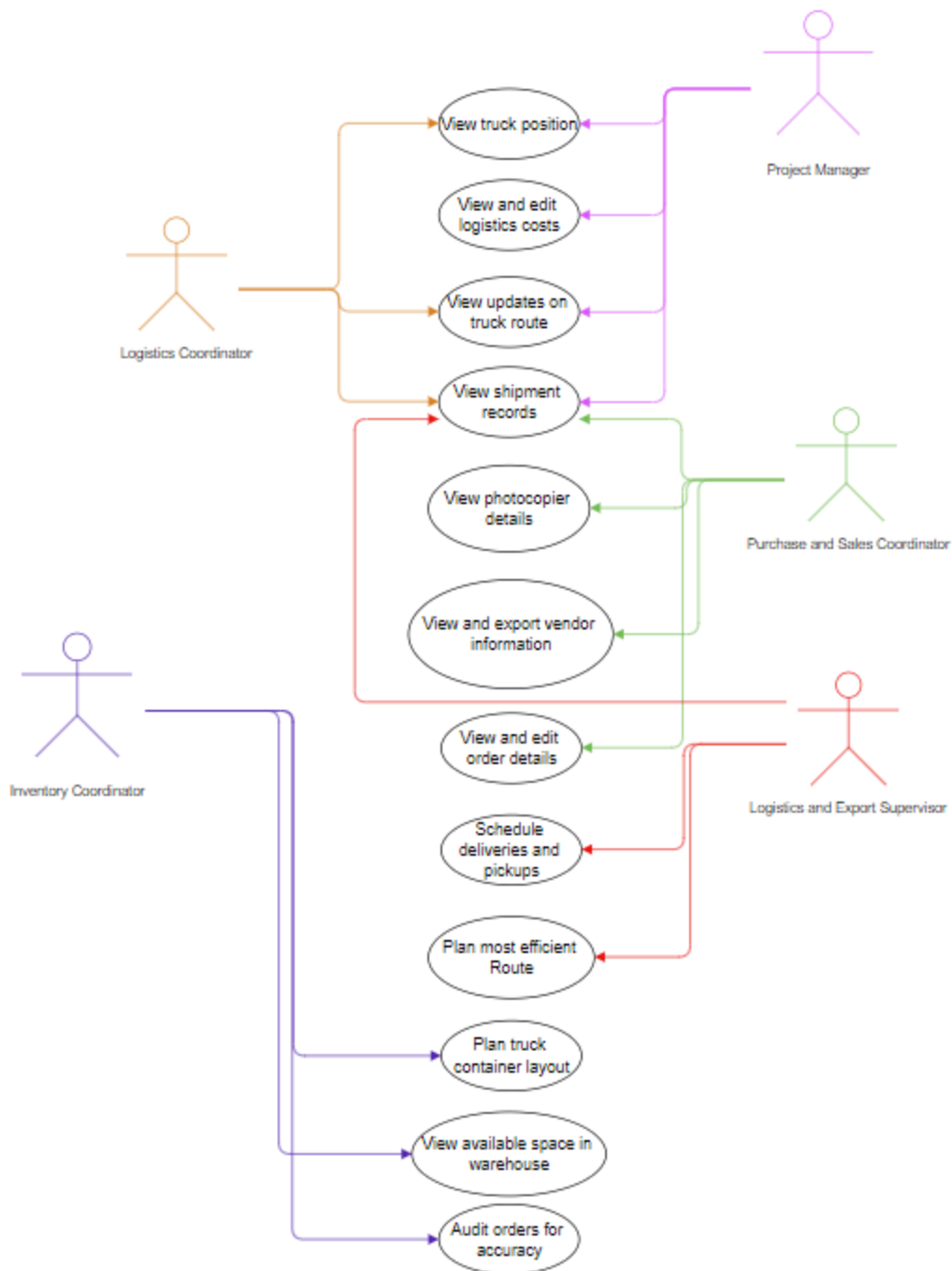
3.3 Data Modelling and Analysis

3.3.1 Normalized Data Model Diagram

User

UserID: int
First_Name: str
Last_Name: str
Email: str
Password: str
Phone Number: str

← Has a

Role

RoleID: int
Role_Name: str

Vendor

VendorID: int
Vendor_Name: str
Vendor_Address: str
Vendor_Phone_Number: str
Vendor_Email: str

Places

Order

OrderID: int
Order_Type: str
Order_Price: double
Order_Tax: double
Order_Currency: str
Order_Date: str
Order_Fulfilled: str
Order_Shipped: str
Order_Paid: boolean
Order_Paid_Date: str
Order_Completed: boolean

Truck

Date_Time: str
Position_Y: float
Position_X: float

Travels on

Route

RouteID: int
Route_Start: string
Route_Destination: string
Distance: double
Start_Date: string
End_Date: string
Stops: int
Gas_Total: double

Copier

Copier_ID: int
Serial_Number: str
Copier_Model: str
Copier_Make: str
Meter_Reading: str
Copier_Price: double
Logistics_Cost: double
Height: float
Depth: float
Width: float
Weight: float
Printer_Memory: int
Vendor_Cost: str

Contains

Picked up / Dropped off at

Warehouse

WarehouseID: int
Warehouse_Name: str
Warehouse_Address: str
Warehouse_Phone_Number: str
Warehouse_Space: float
Warehouse_Rows: int
Warehouse_Columns: int

3.3.2 Activity Diagrams

3.2.2.1 View and Edit Order Details
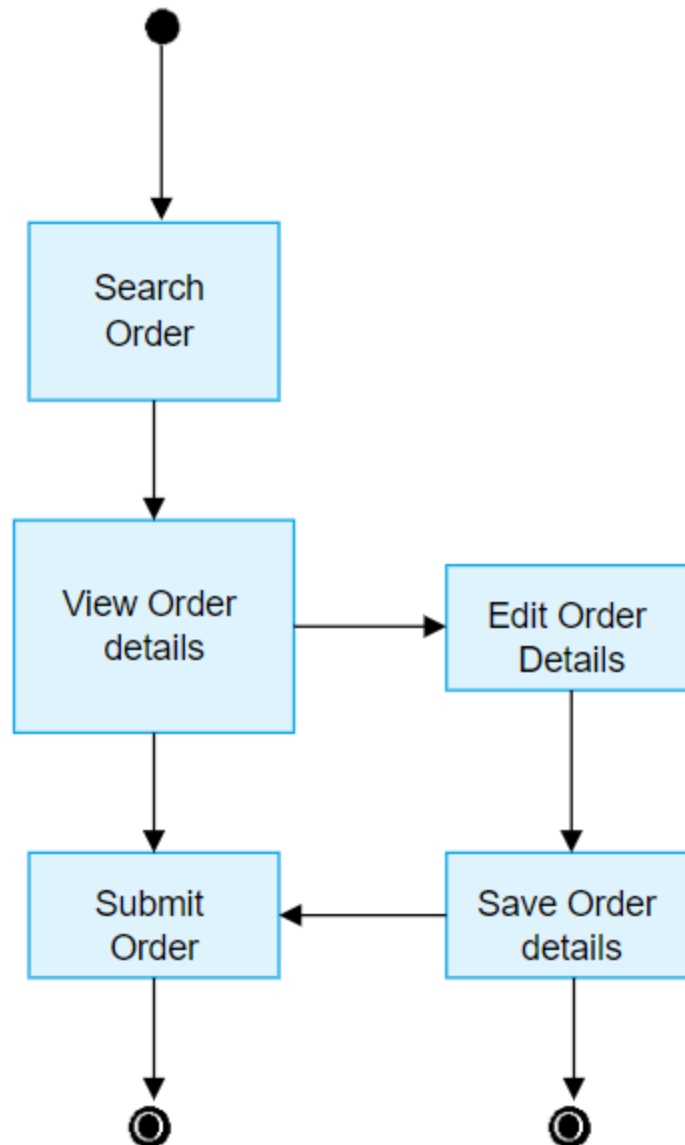
3.2.2.2 View Item Details
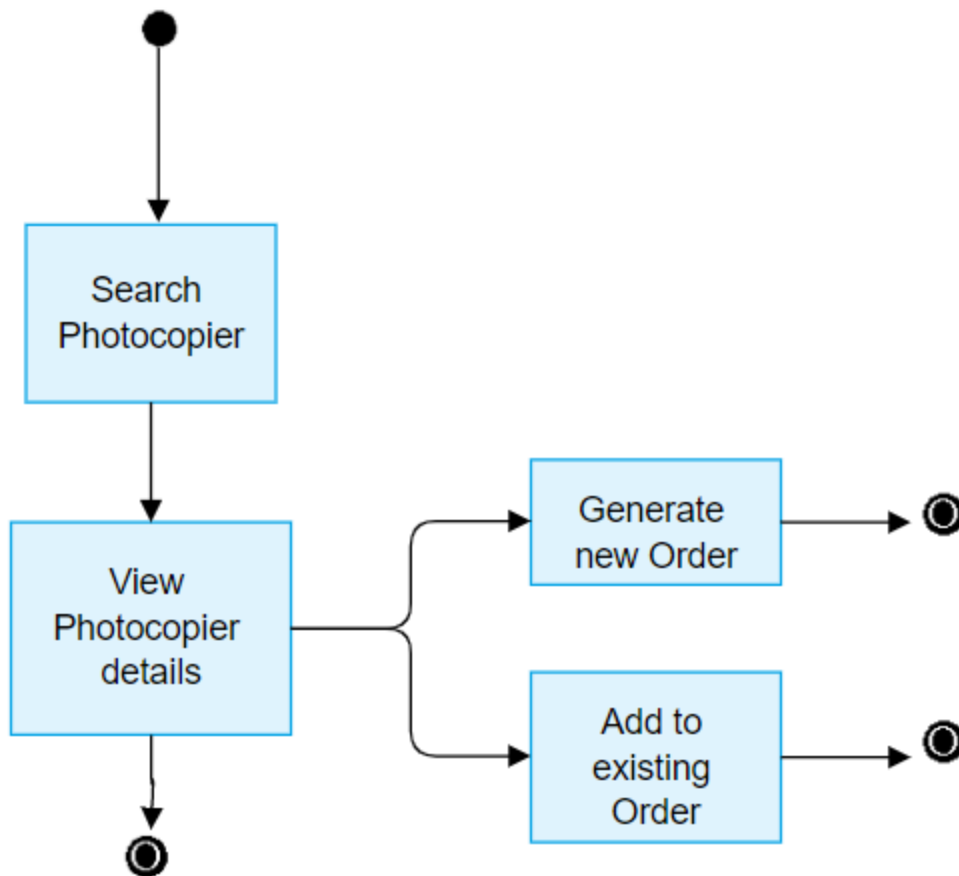
3.2.2.3 View and Export Vendor Information

3.2.2.4 View Shipment Records

Search shipment records based on various parameters

Generate Reports based on searched data
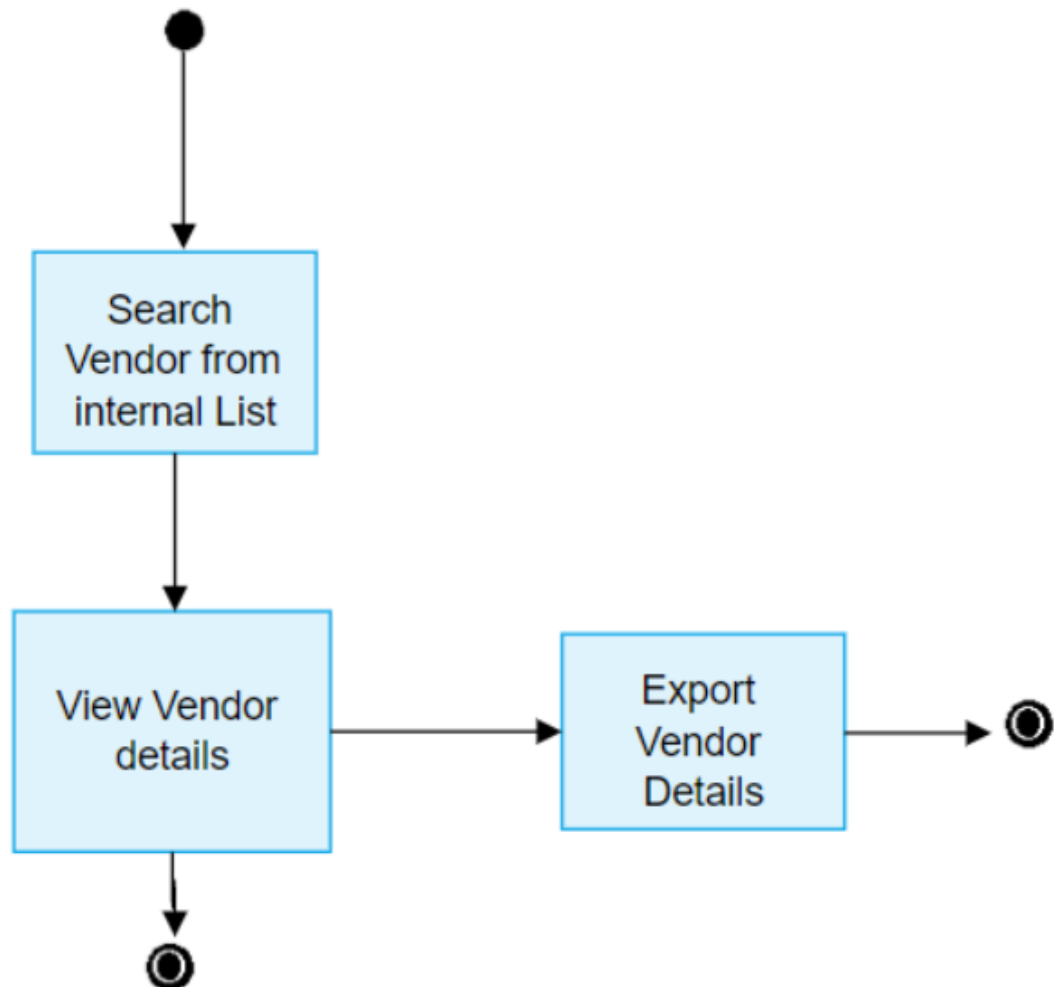
Export Reports
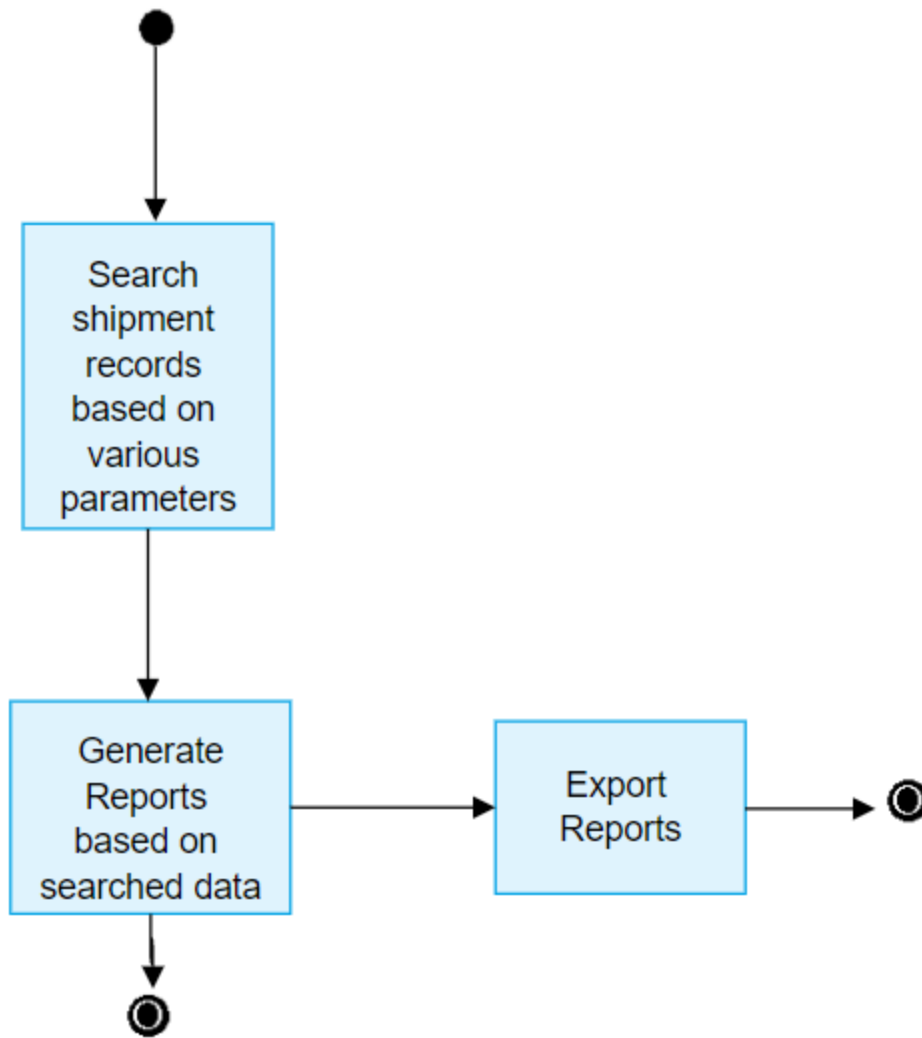
3.2.2.5 Schedule Deliveries and Pickups

3.2.2.6 Audit Orders for Accuracy

Receive items from shipment

Verify Order list against items received

Discrepancy

Contact vendor

No discrepancy

Discrepancy not reconciled

Discrepancy reconciled

Store received items

Mark order complete
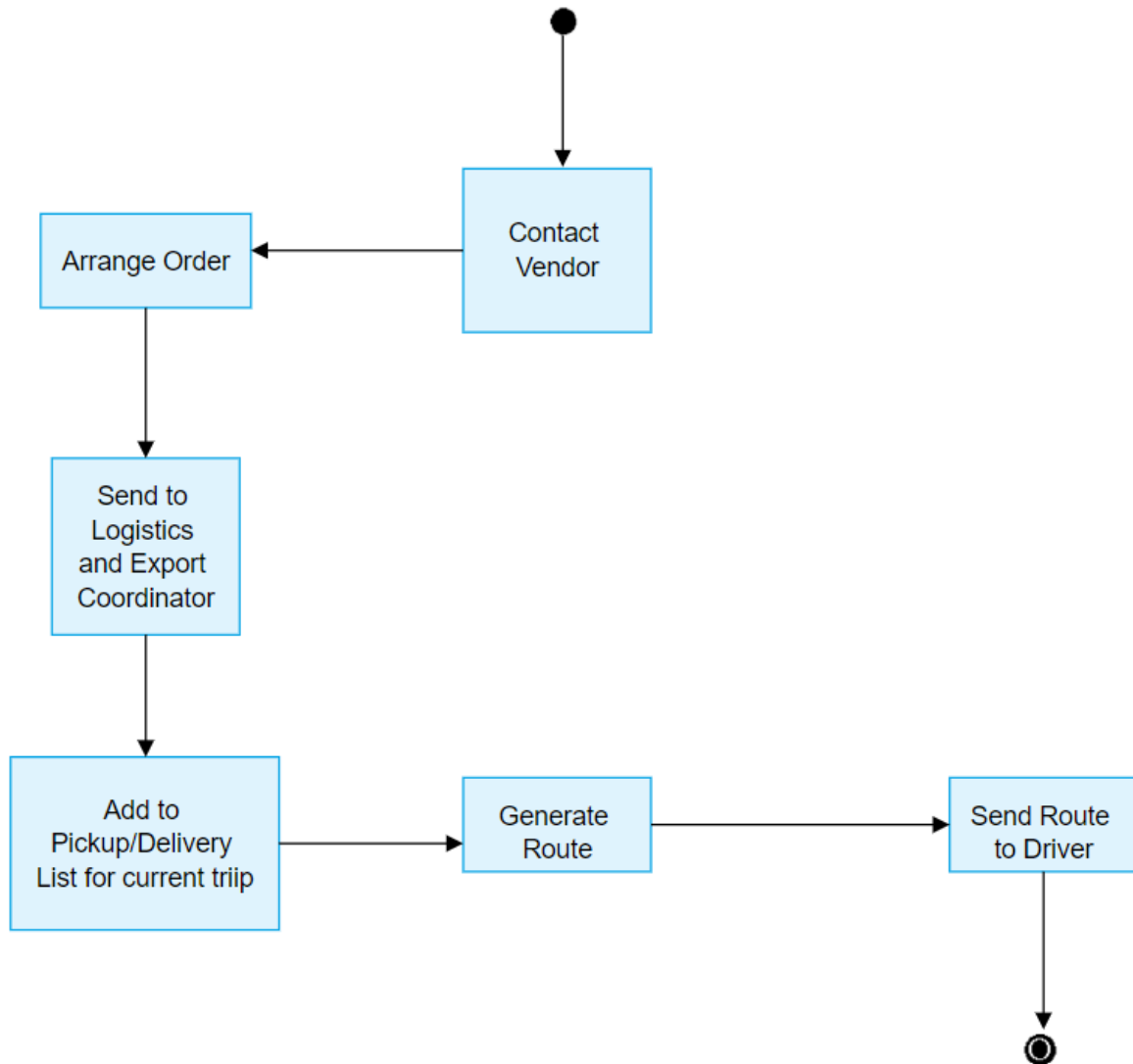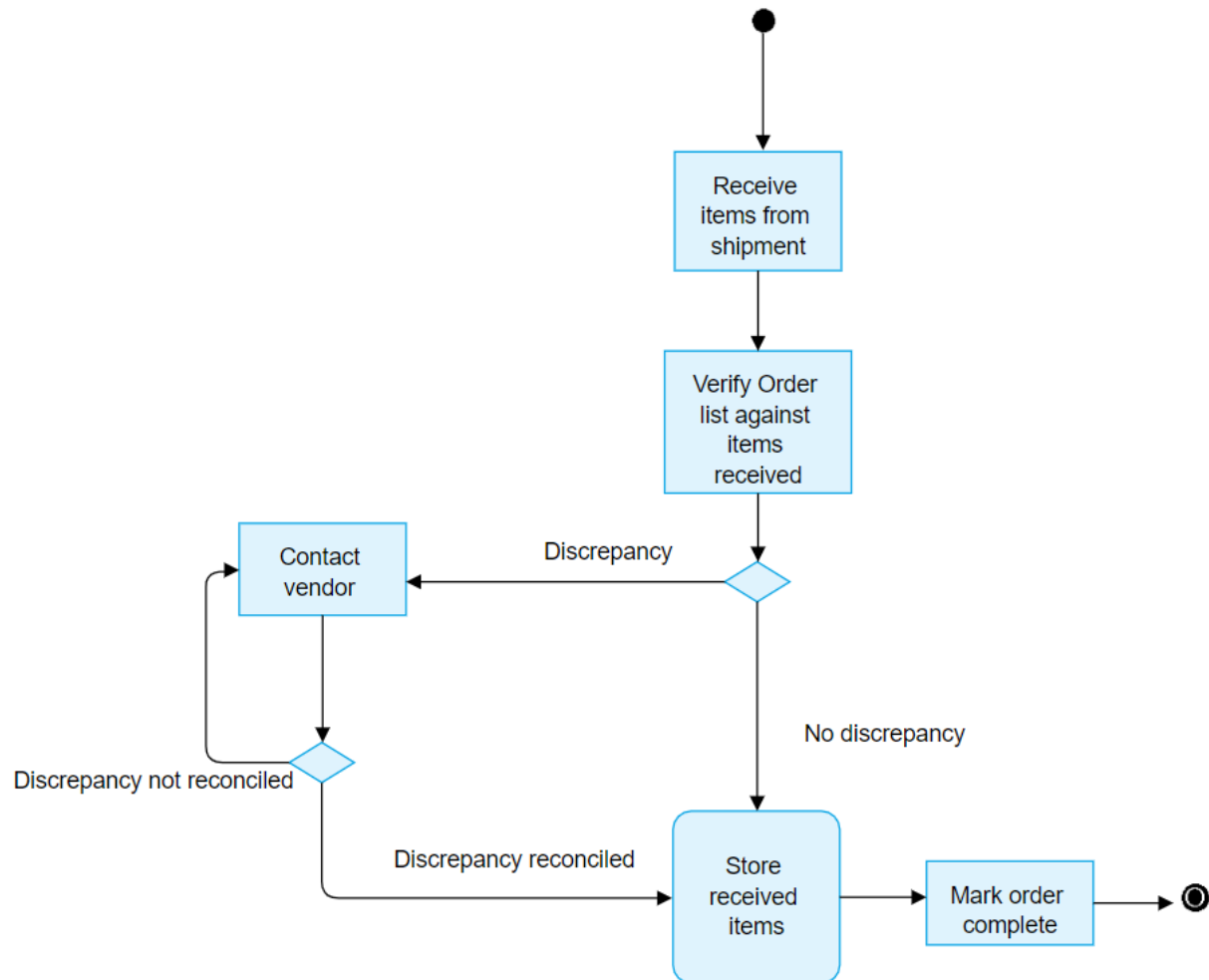
3.3.2.7 Plan Most Efficient Route
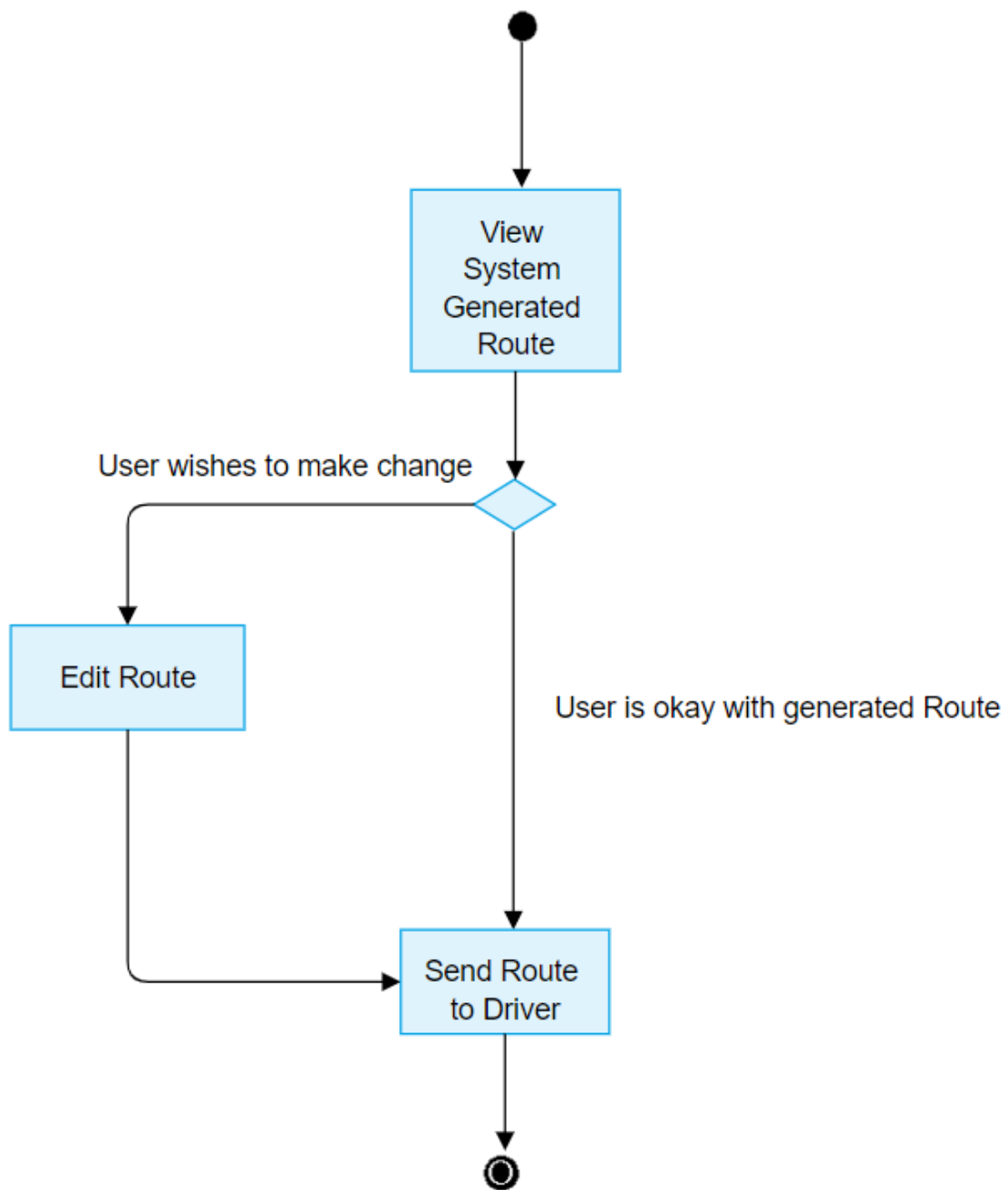
3.2.2.8 Plan Truck Container Layout
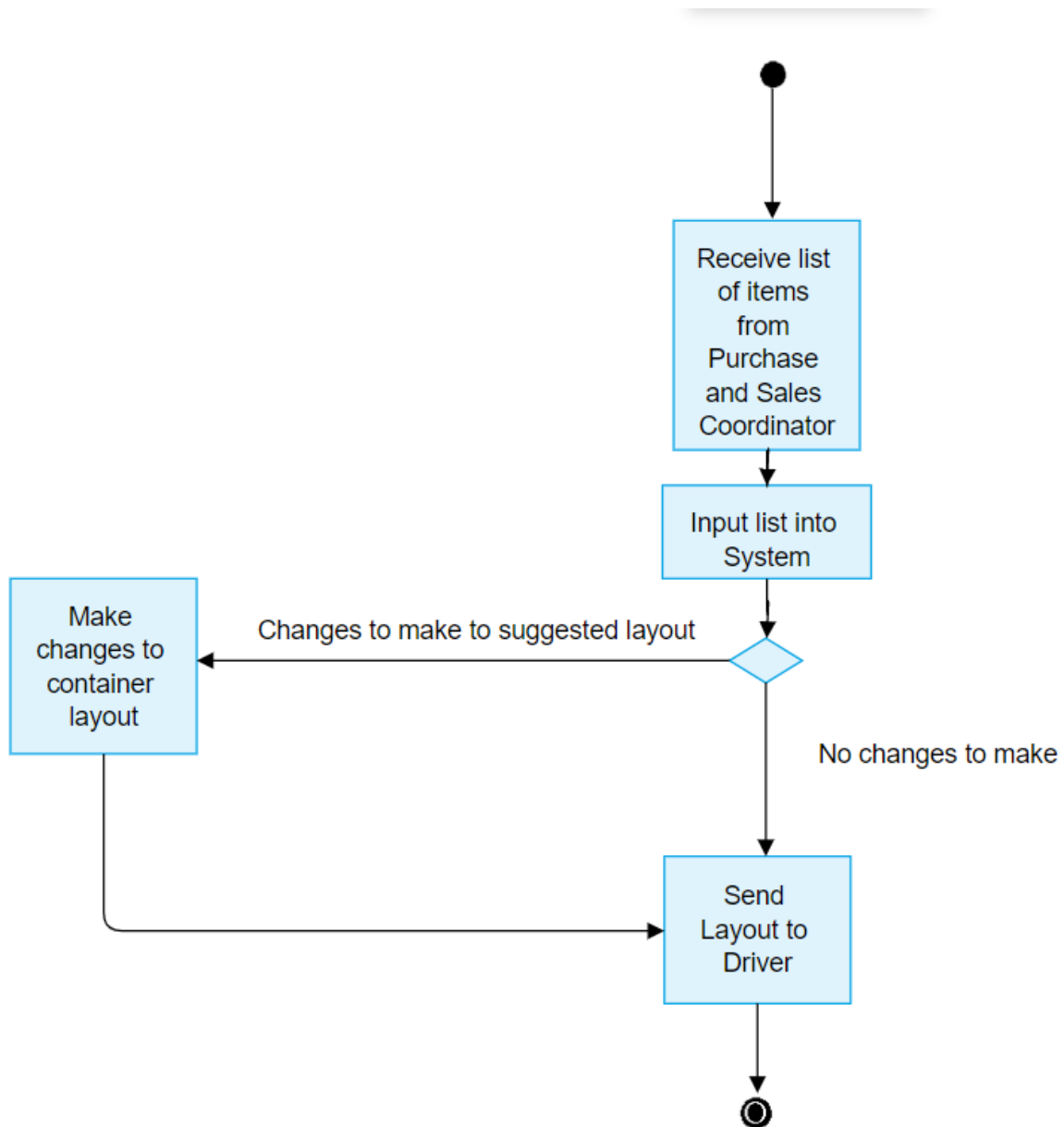
3.2.2.9 View Available Space in Warehouse

3.2.2.10 View and Edit Logistics Costs

Access overall costs

Select a cost category

Modify cost to view impact on overall costs
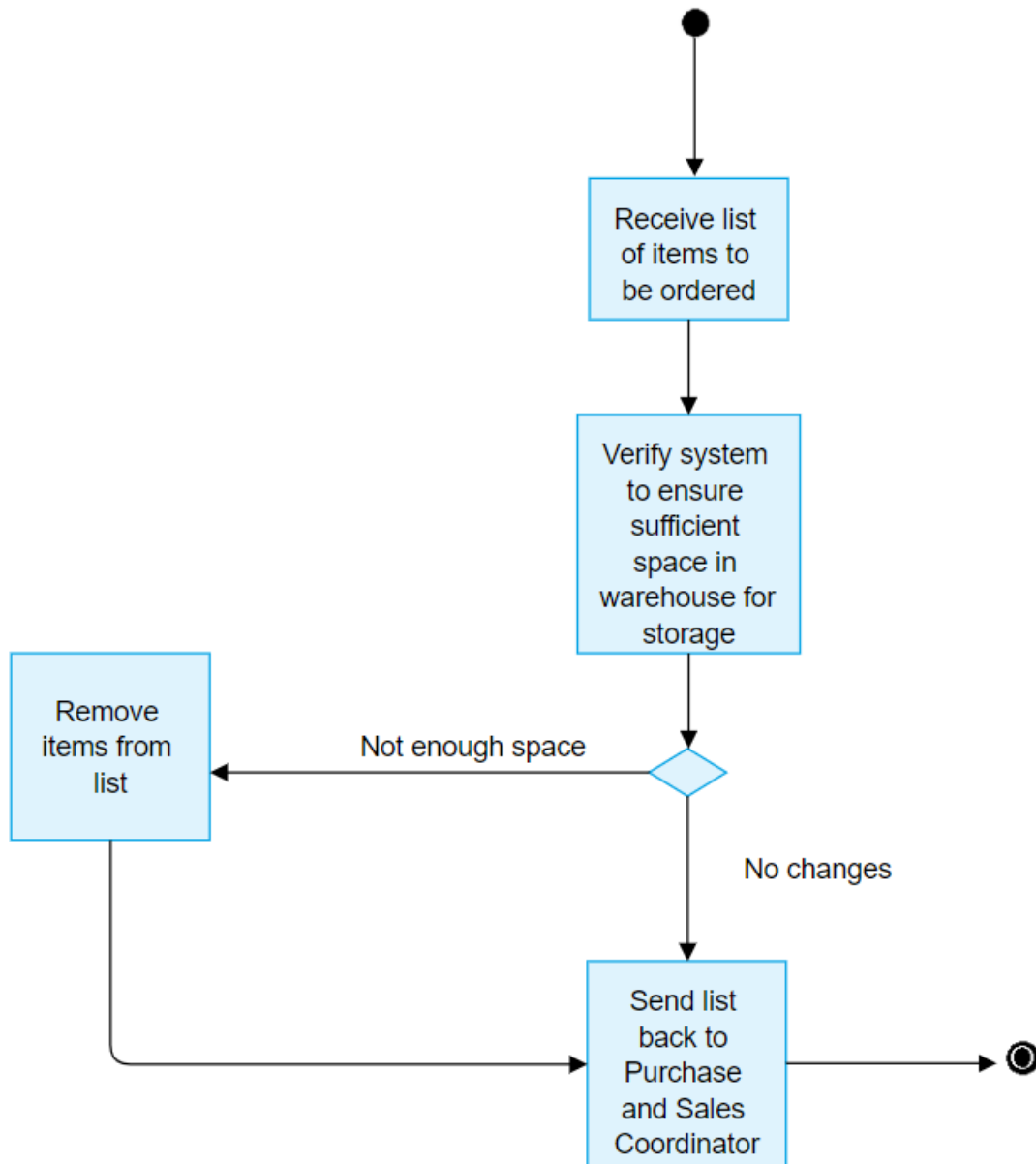
Export information
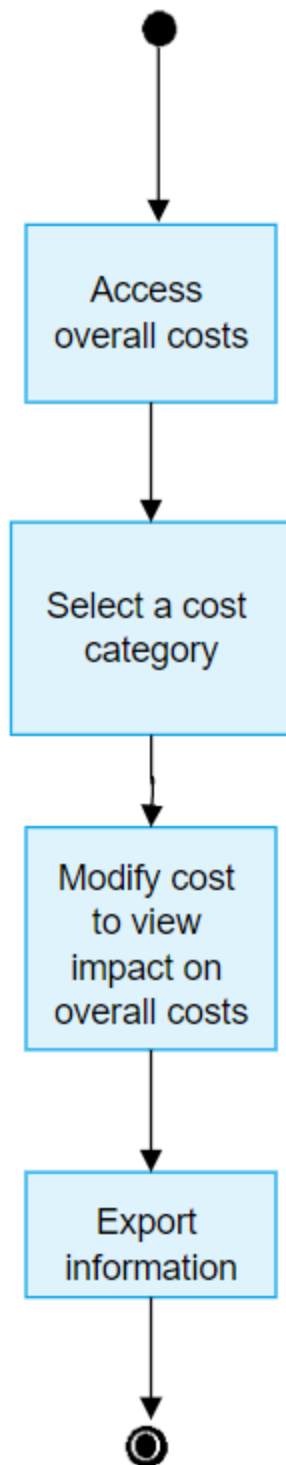
3.3.2.11 View Updates on Truck Route + 3.3.2.12 View Truck Position during Shipment Process

View Truck Position

Change in Truck Route

No change in Truck Route

Close Alert
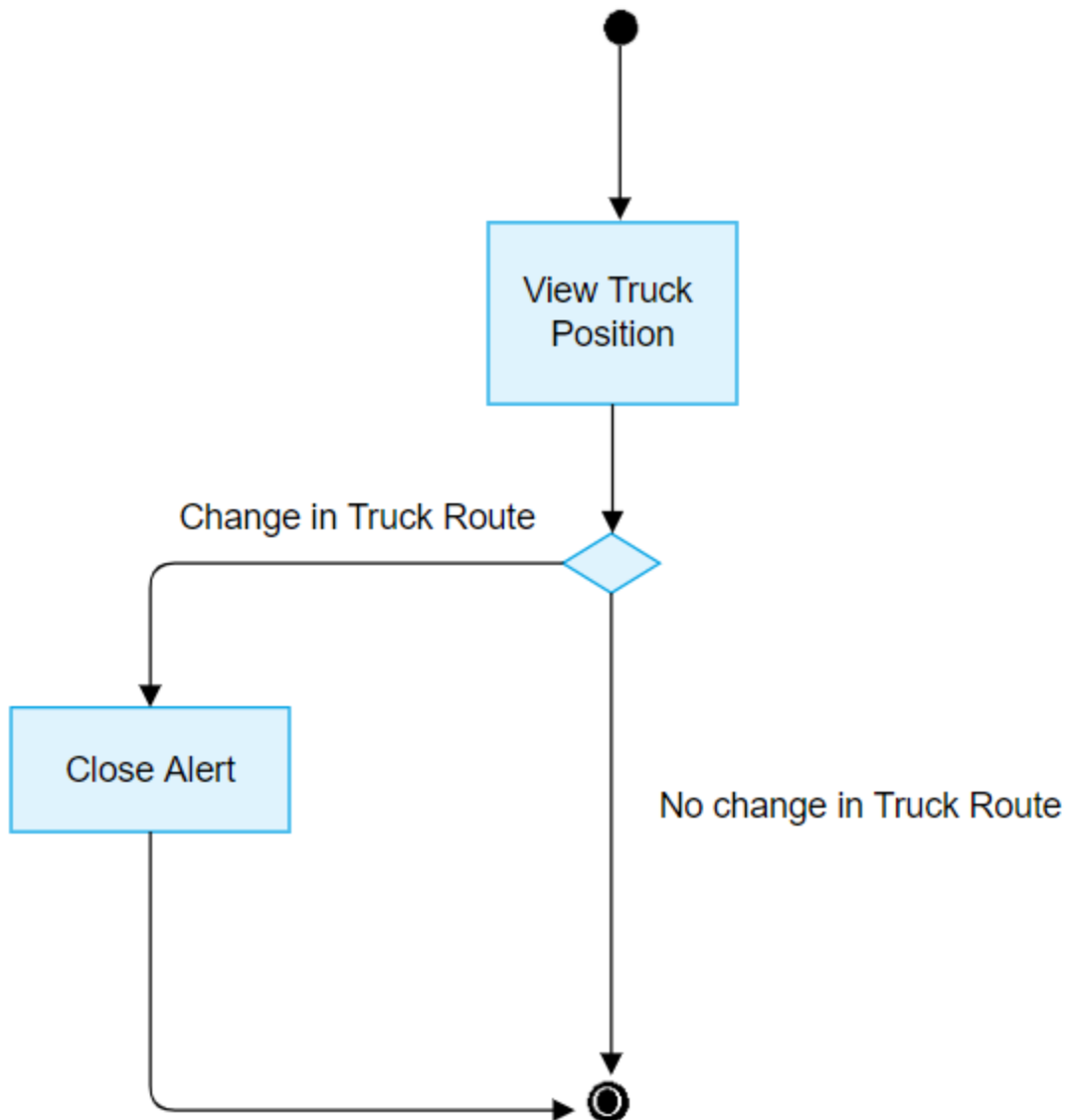
3.3.3 Sequence Diagrams

3.3.3.1 View and Edit Order Details
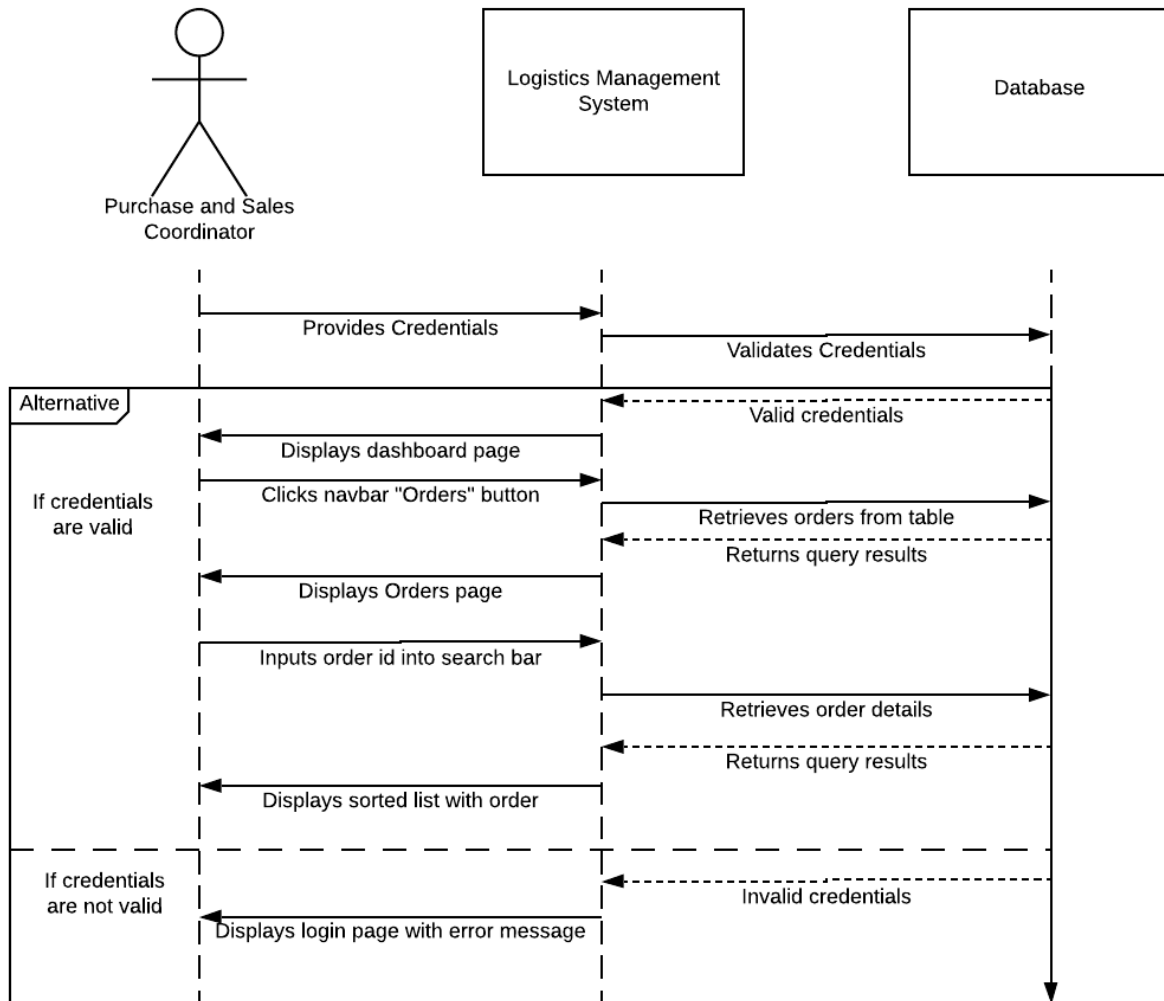
3.3.3.2 View Item Details
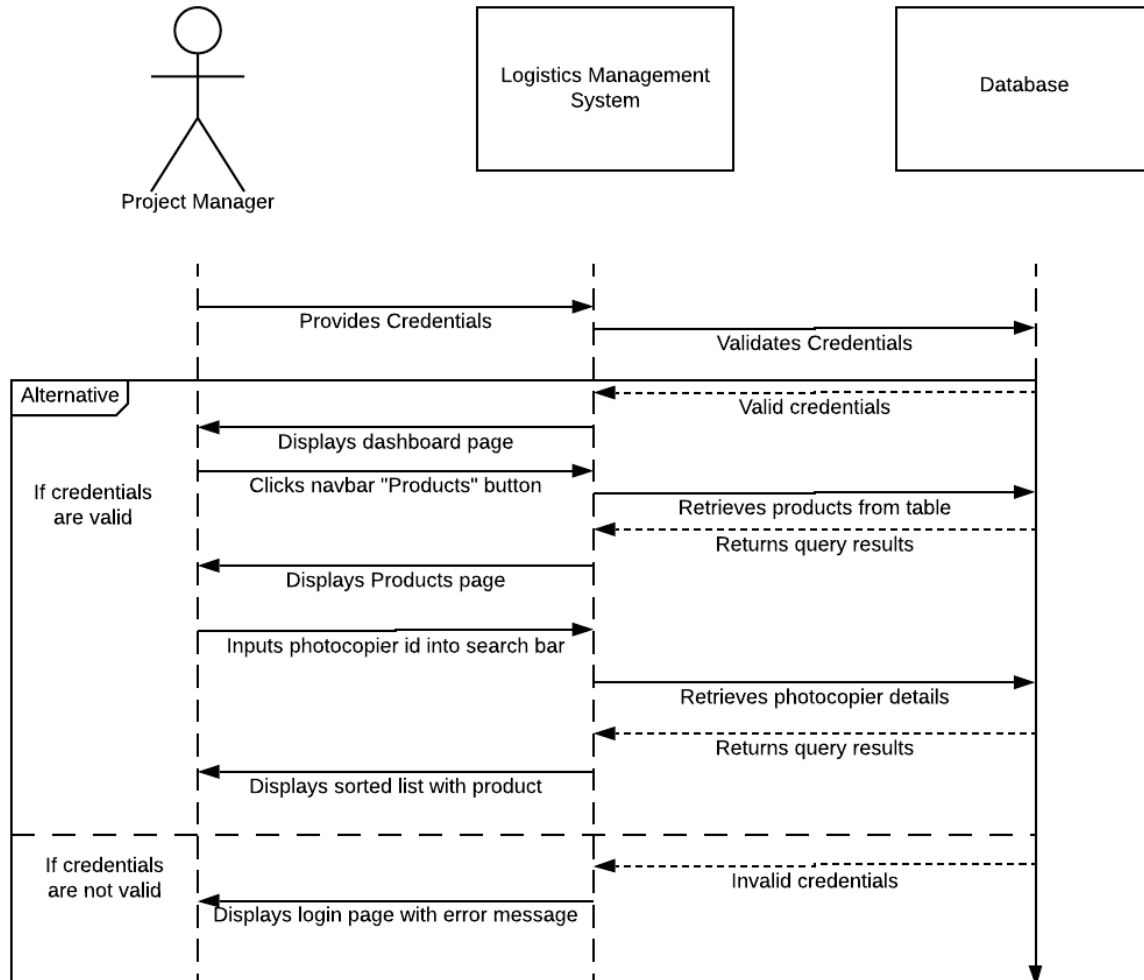
3.3.3.3 View and Export Vendor Information
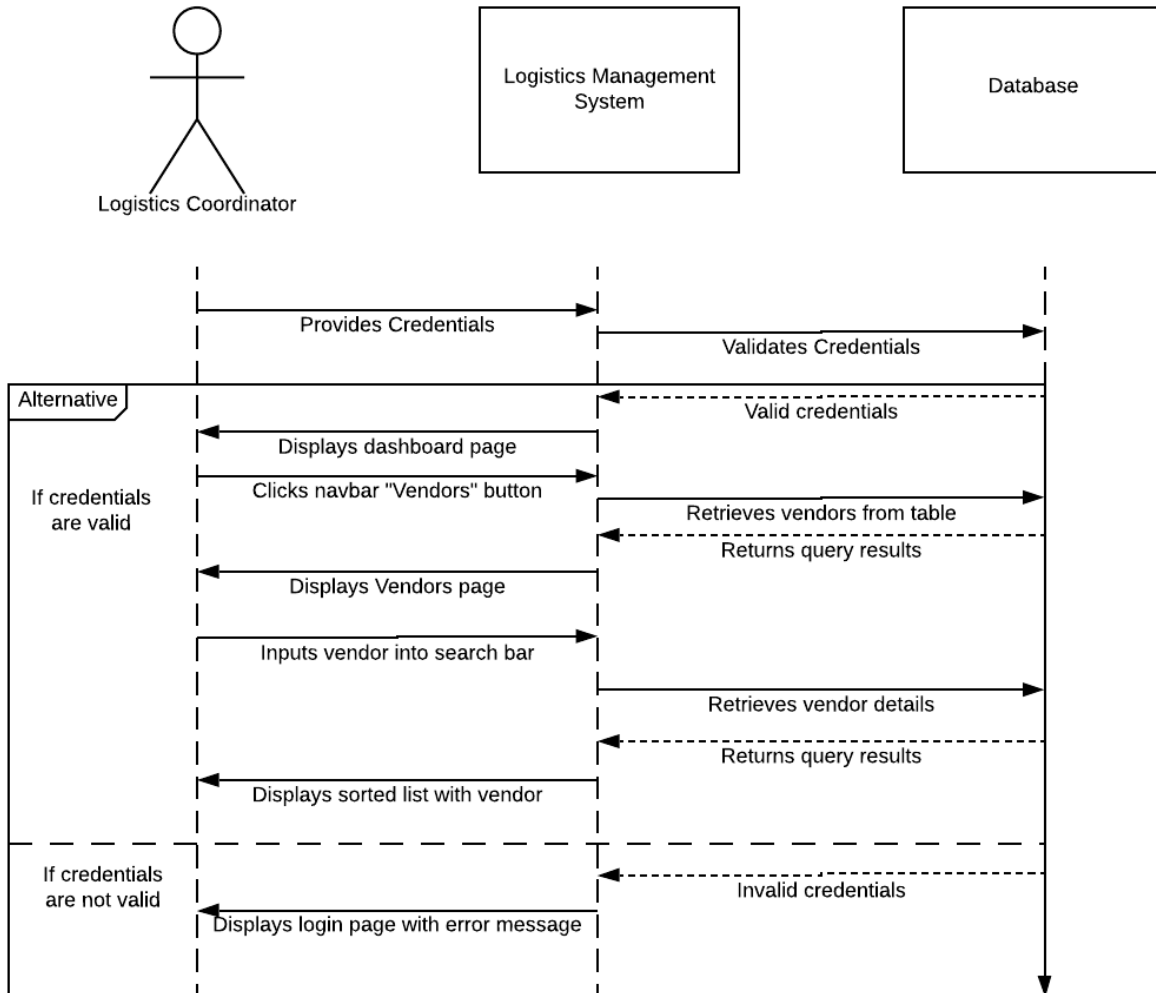
3.3.3.4 View Shipment Records
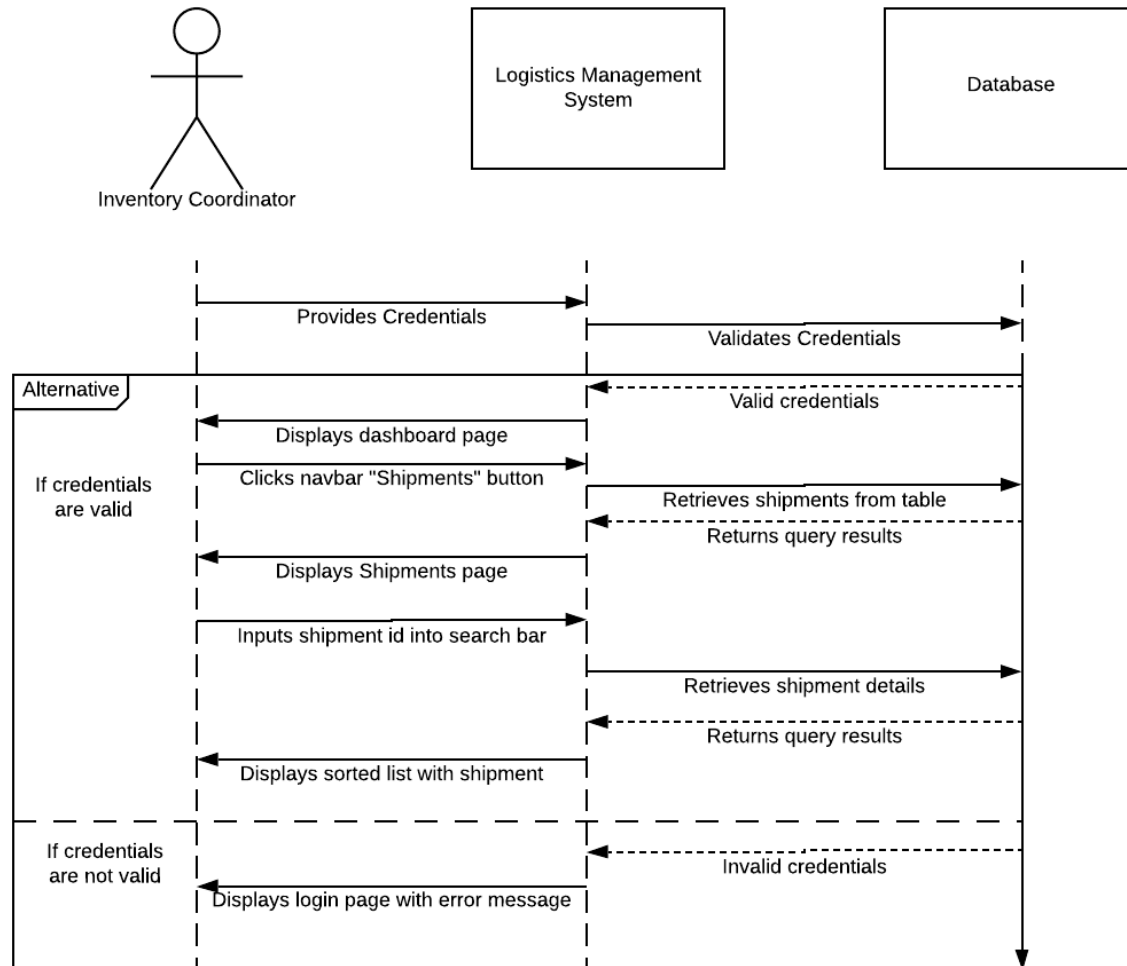
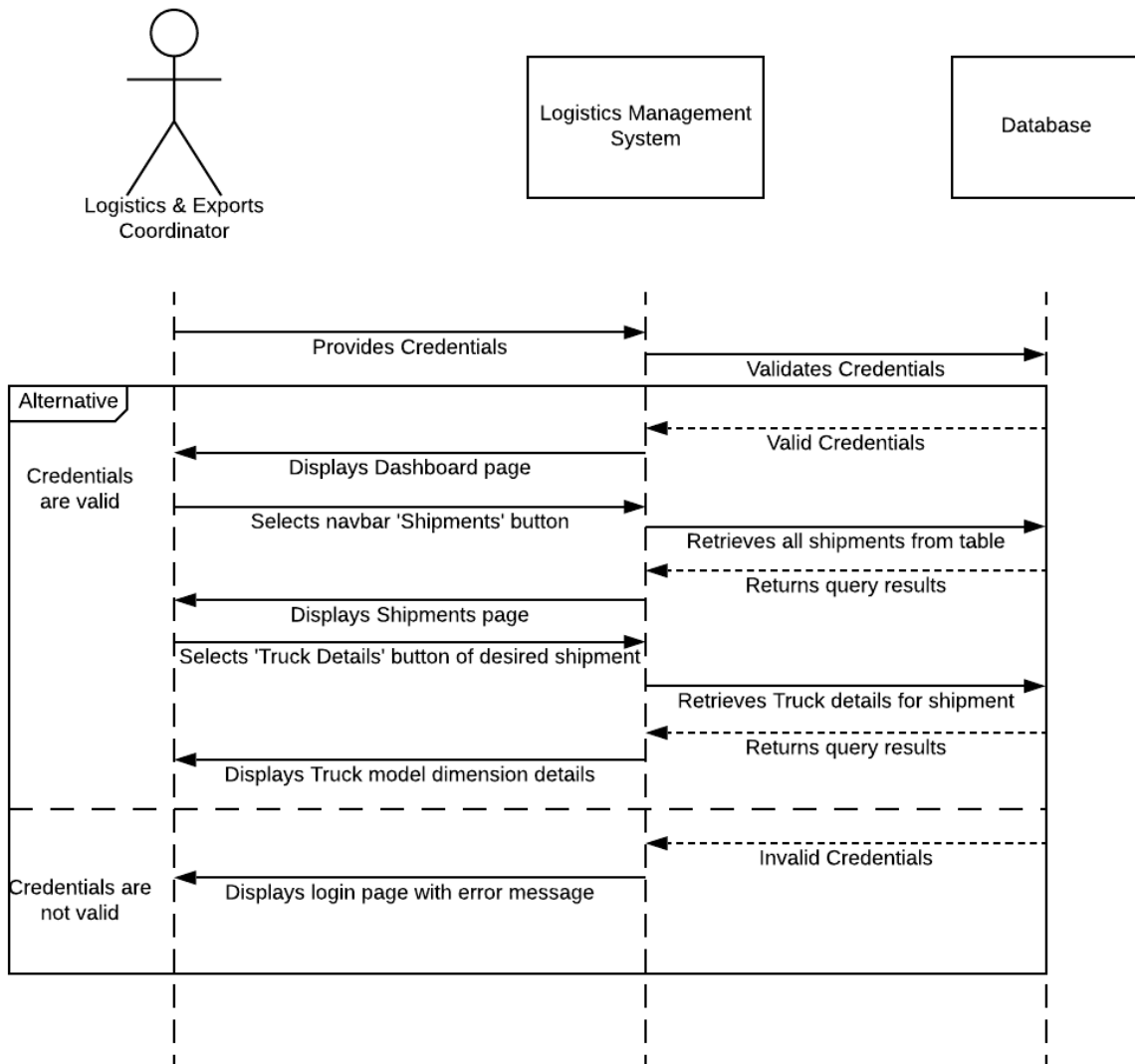### 3.3.3.5 Schedule Pickups and Deliveries
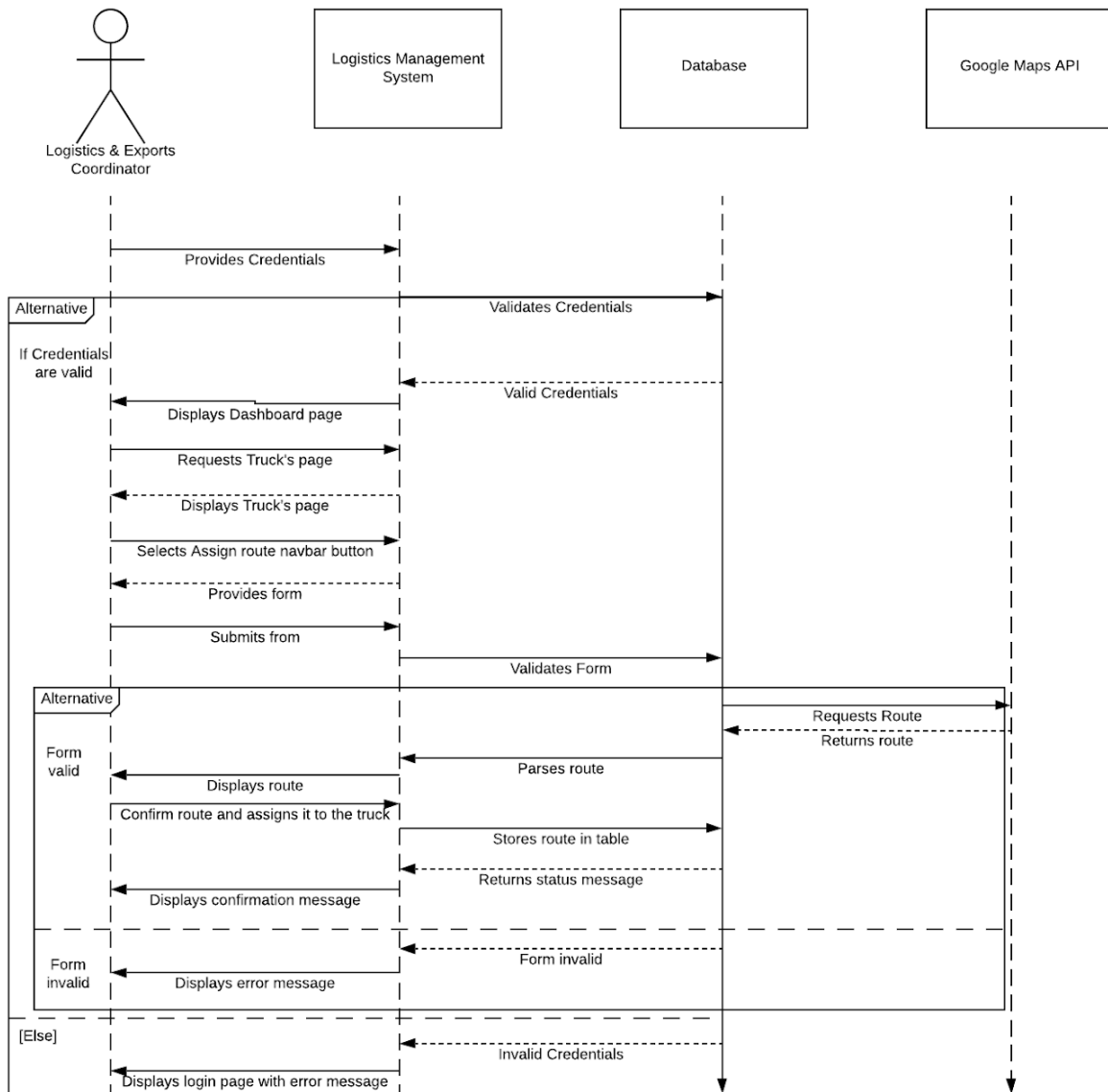
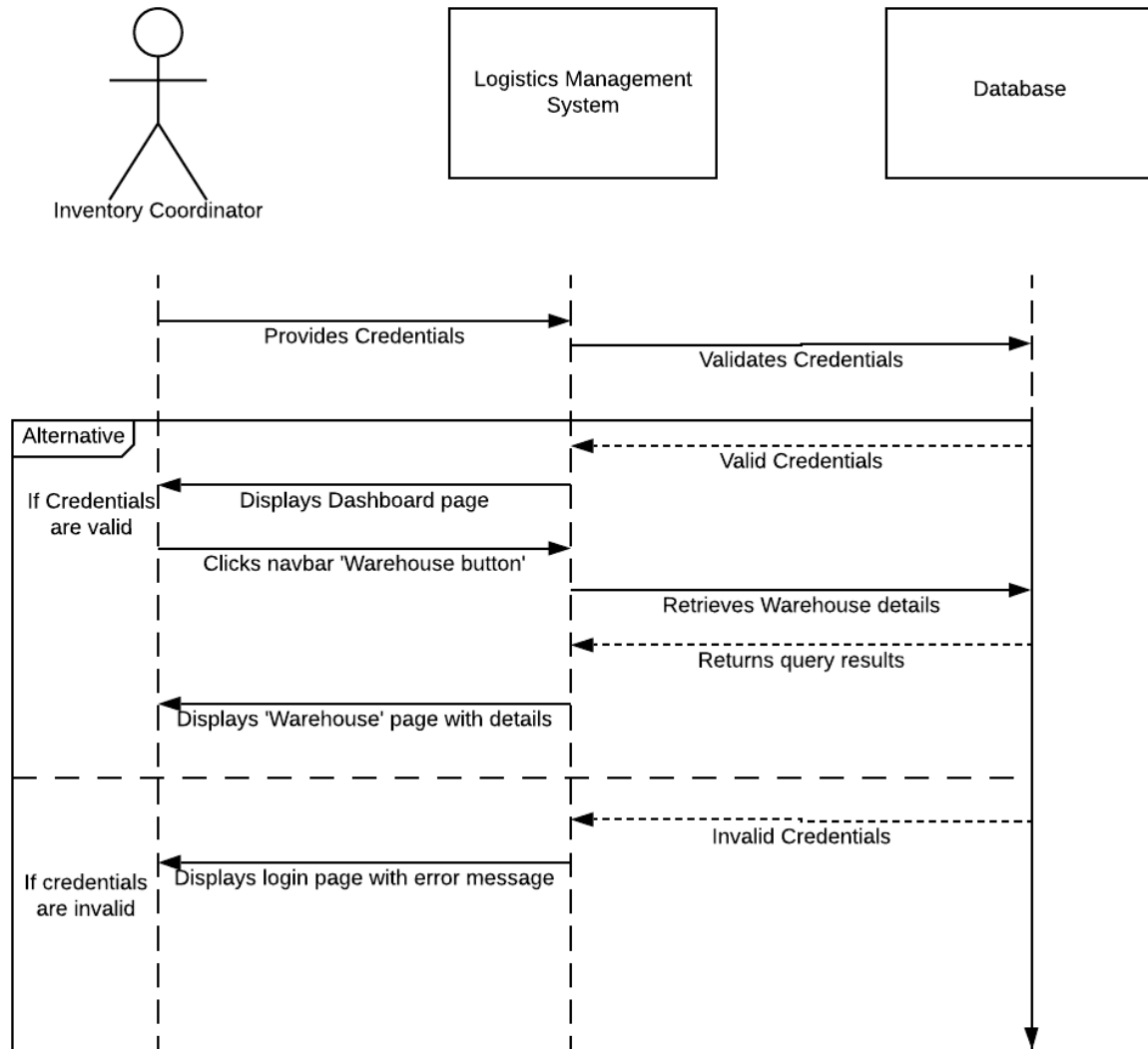### 3.3.3.6 Audit Orders for Accuracy
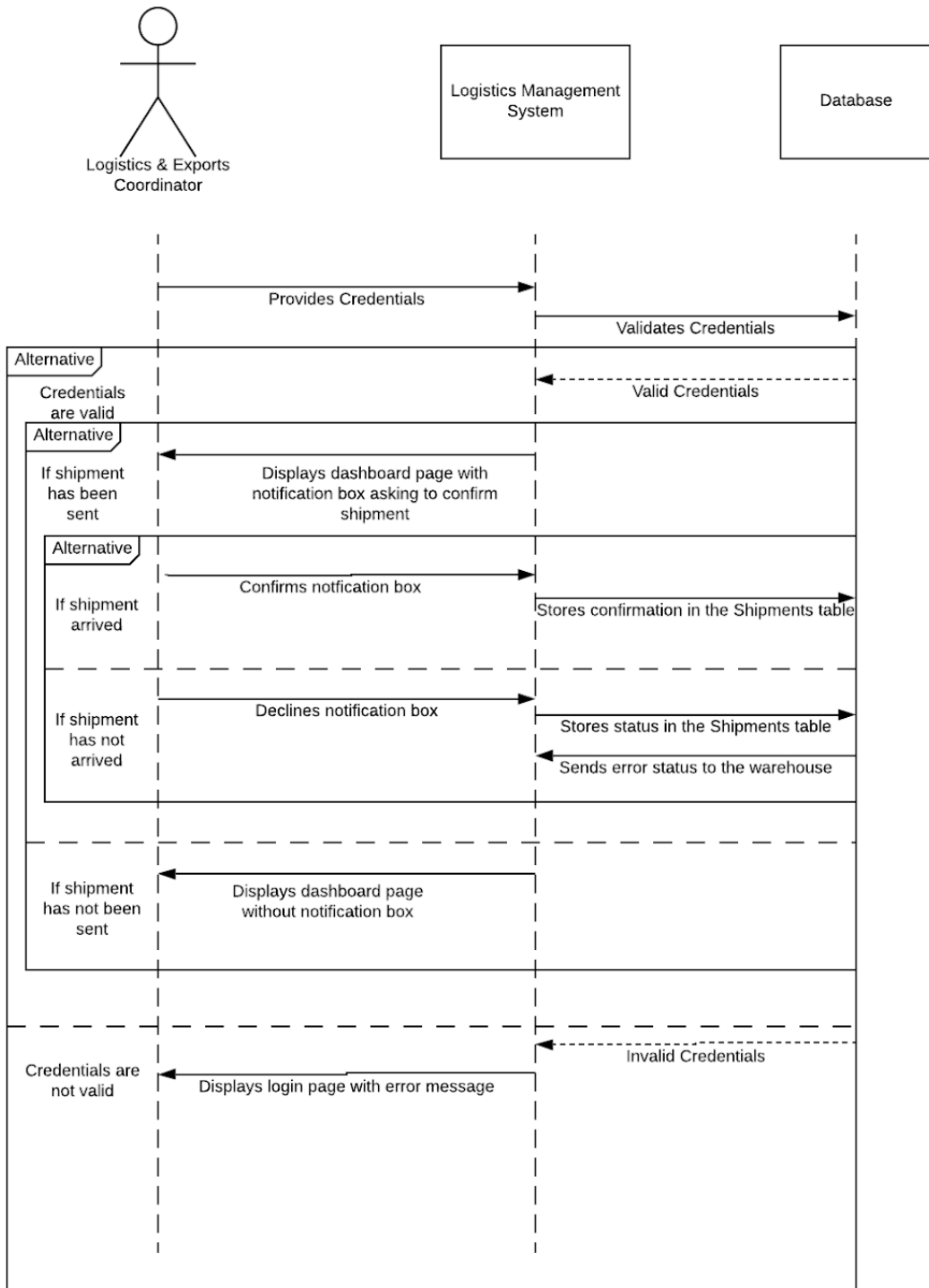
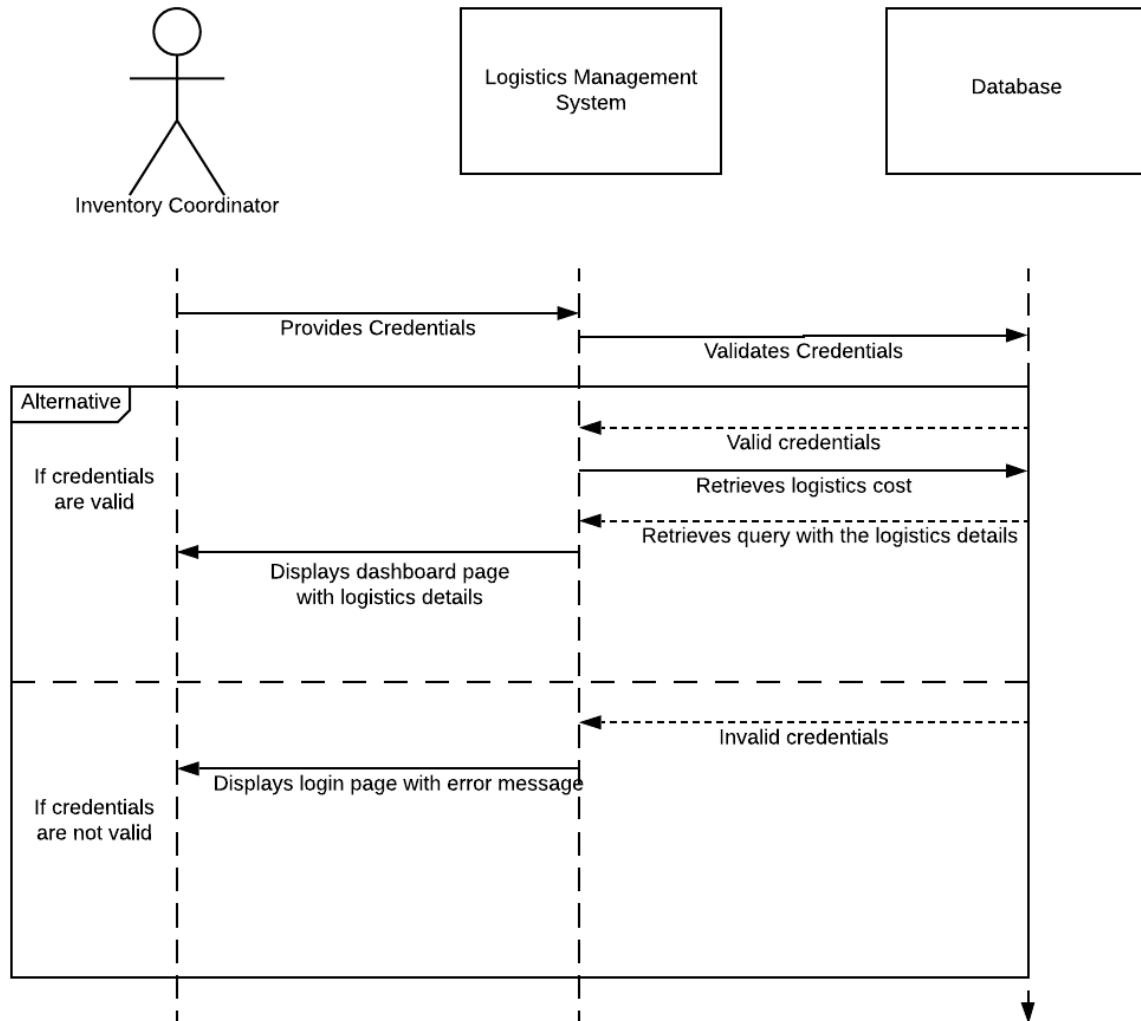### 3.3.3.7 Plan Most Efficient Route for the Truck
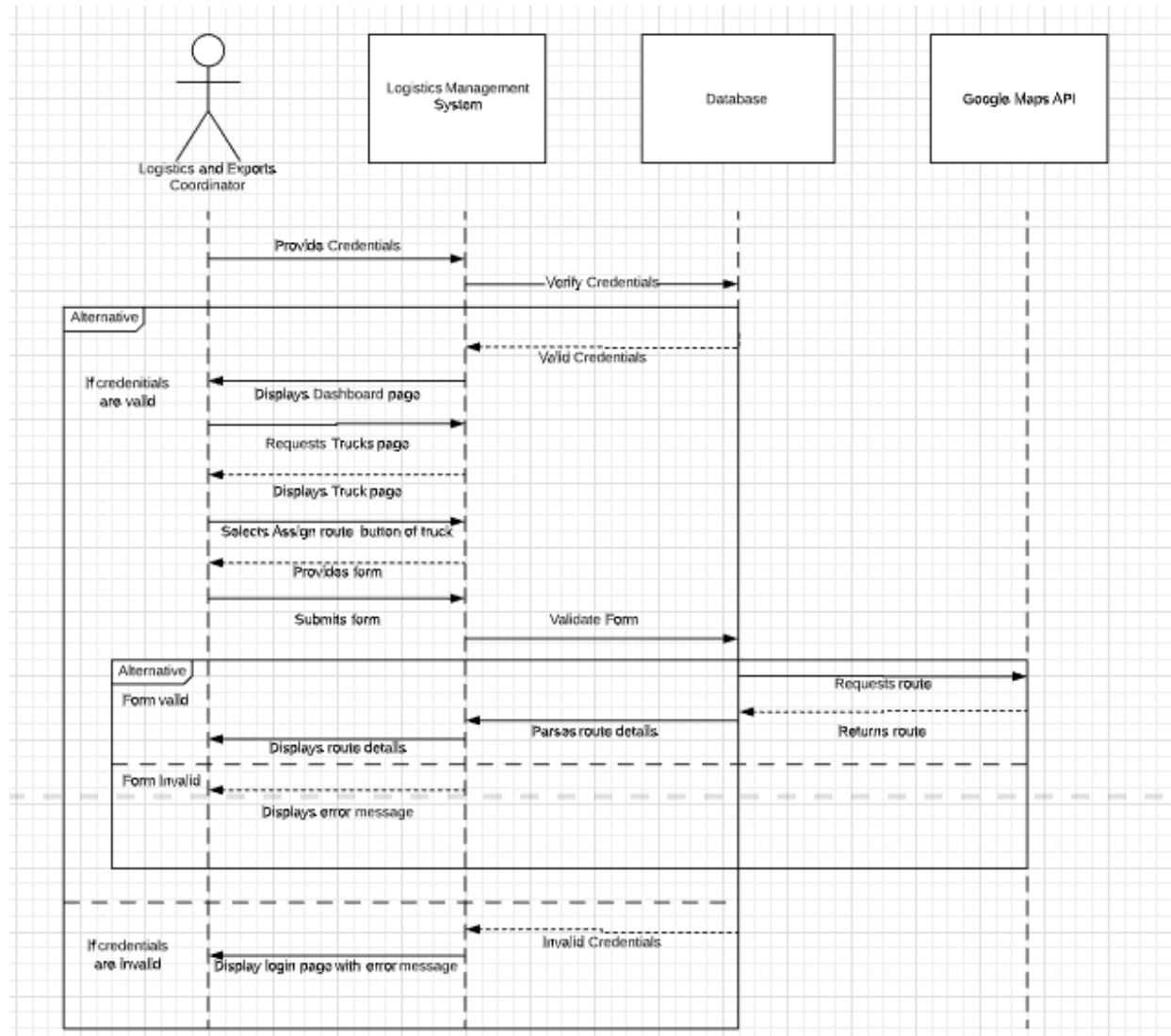
3.3.3.8 Plan Truck Container Layout

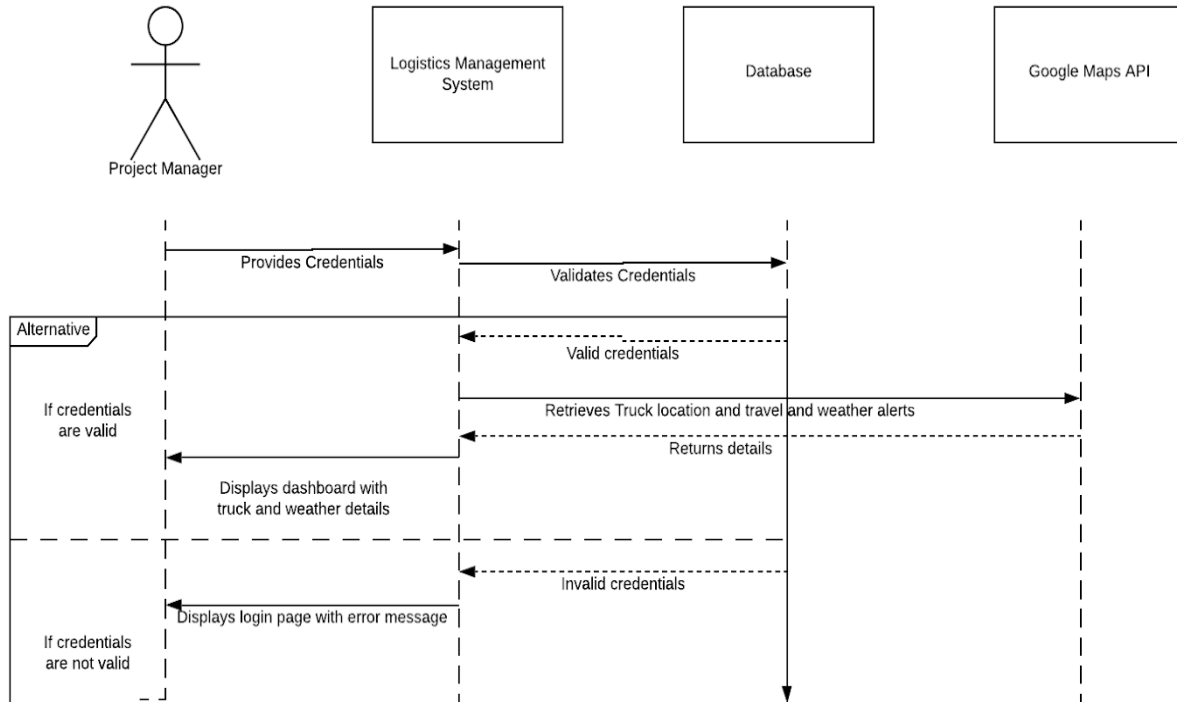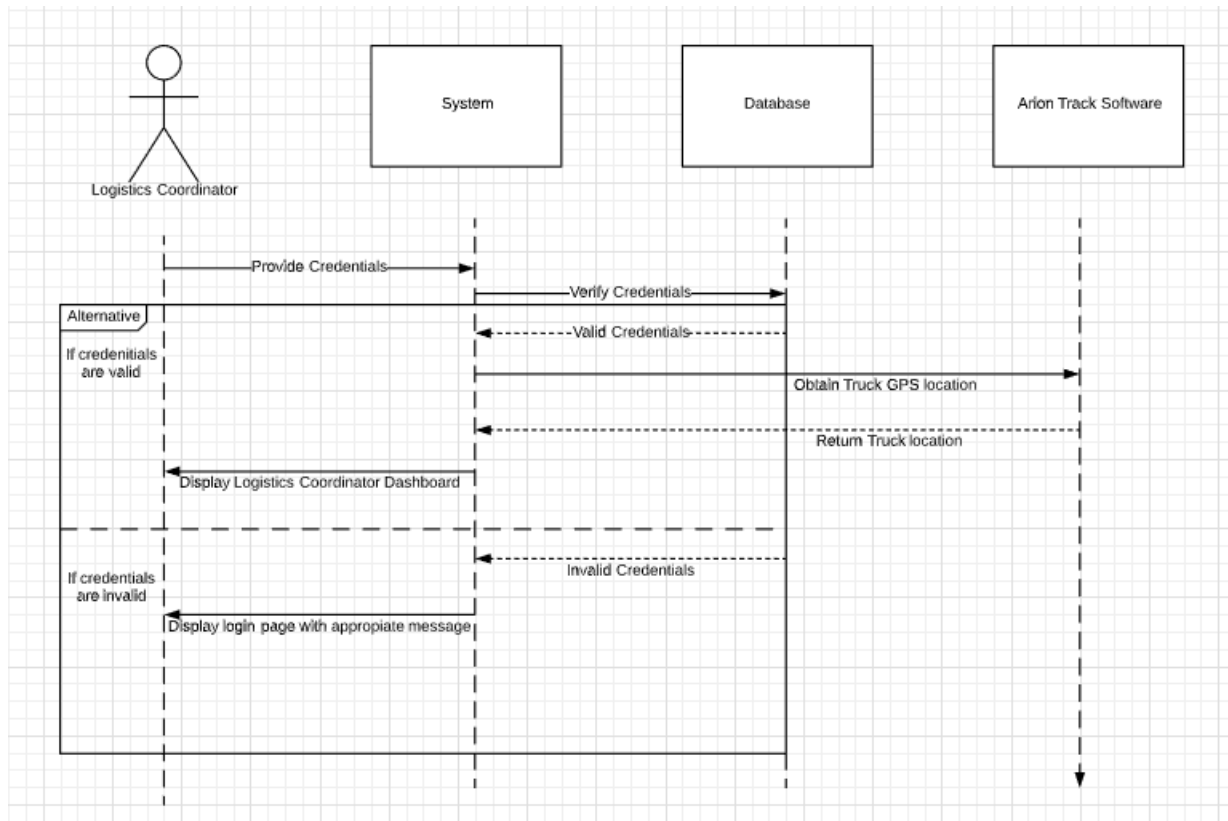### 3.3.3.9 View Available Space in Warehouse

3.3.3.10 View and Edit Logistics Cost

Inventory Coordinator

Logistics Management System

Database

Provides Credentials

Validates Credentials

Alternative

If credentials are valid

Valid credentials

Retrieves logistics cost

Retrieves query with the logistics details

Displays dashboard page with logistics details

Invalid credentials

Displays login page with error message
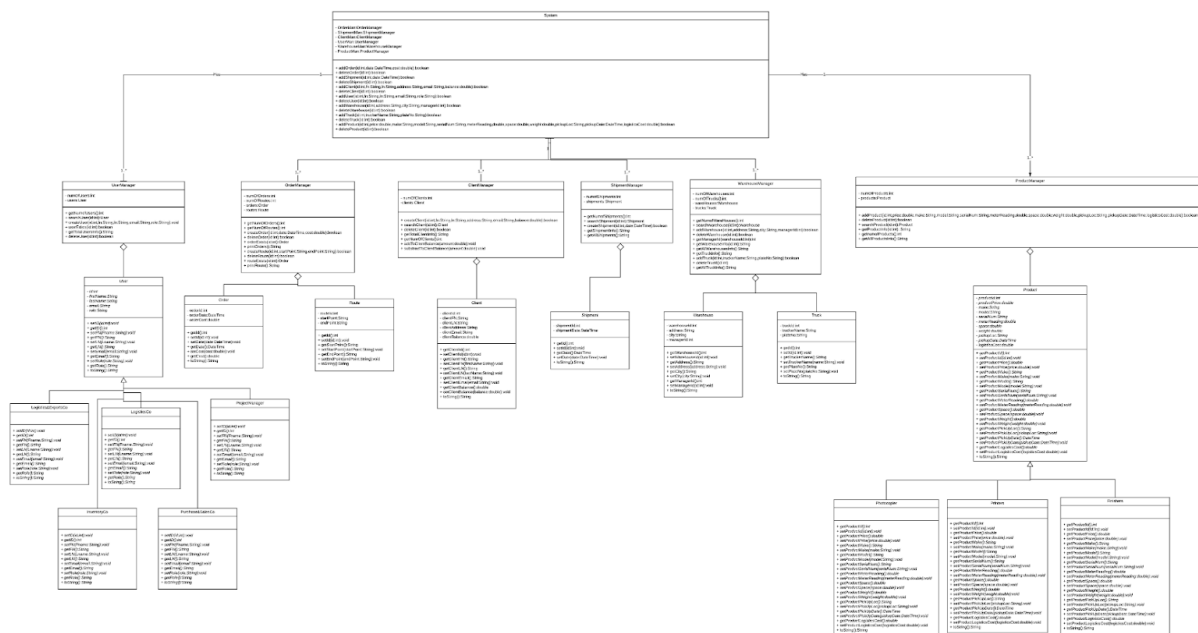
If credentials are not valid

3.3.3.11 View Updates on Truck Route

3.3.3.12 View Truck Position during Shipment Process

3.3.4 UML Class Diagram

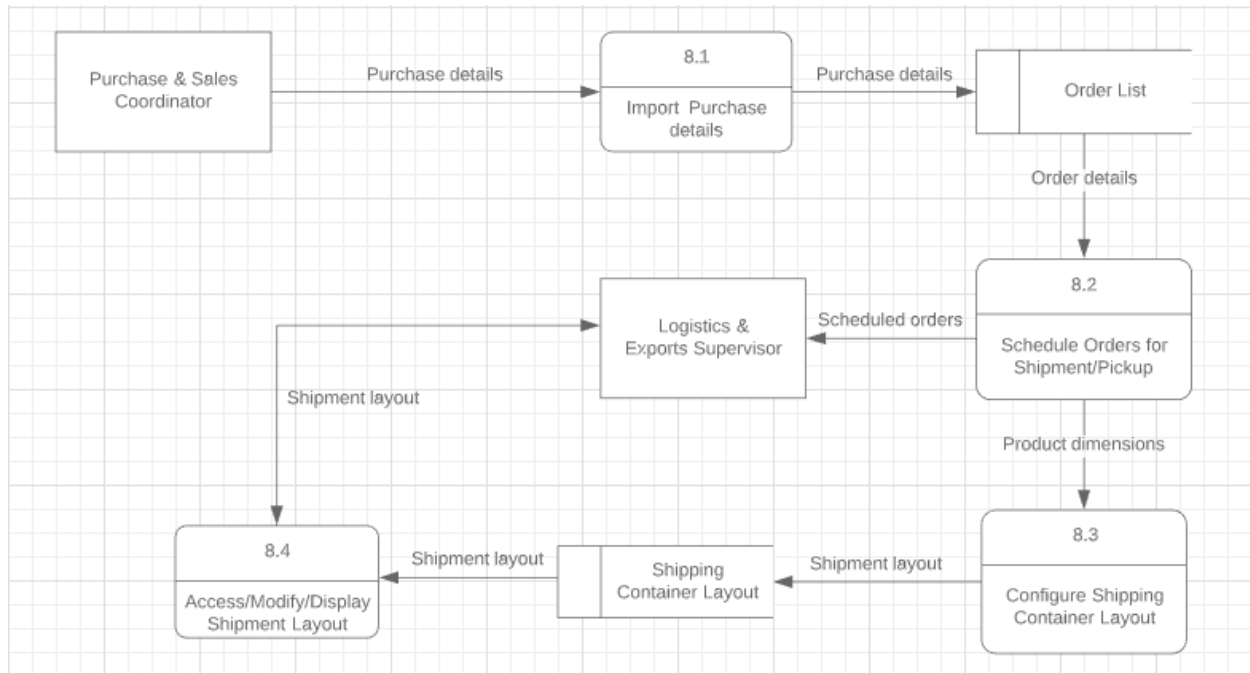*See "UMLClassDiagram.pdf"*

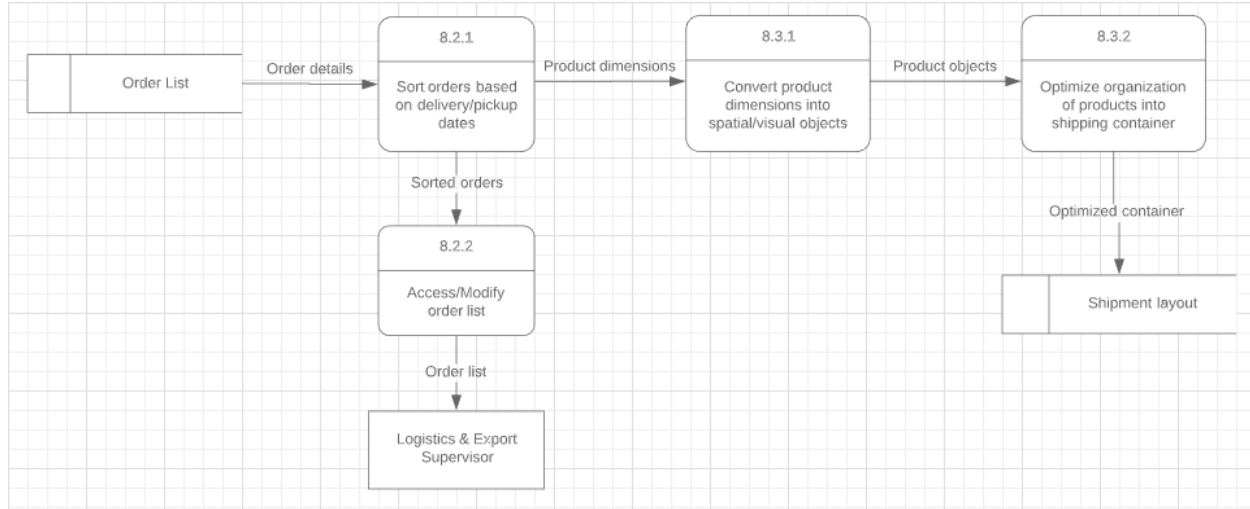# 3.4 Process Modeling

3.4.1 Data Flow Diagrams
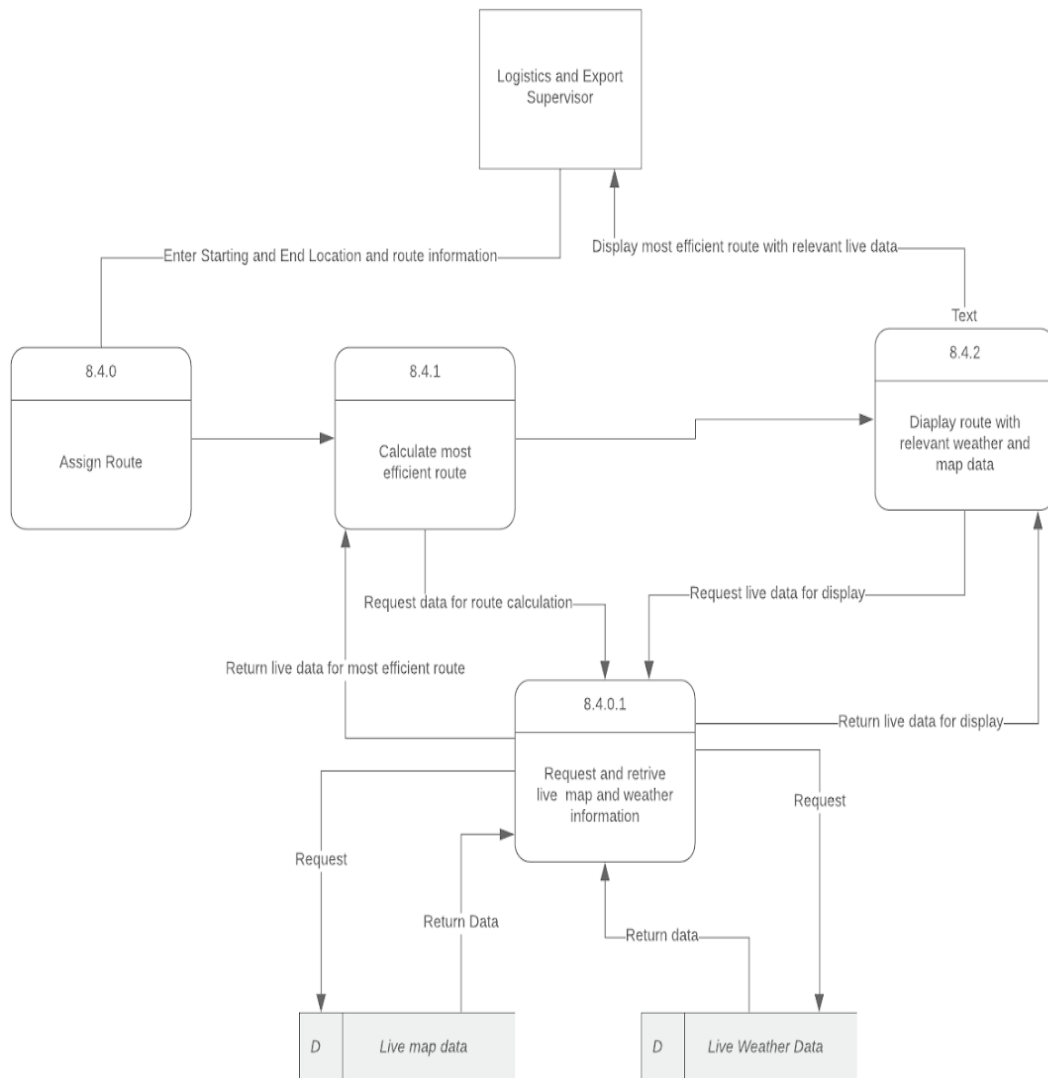
3.4.1.1 Level-0 Data Flow Diagram
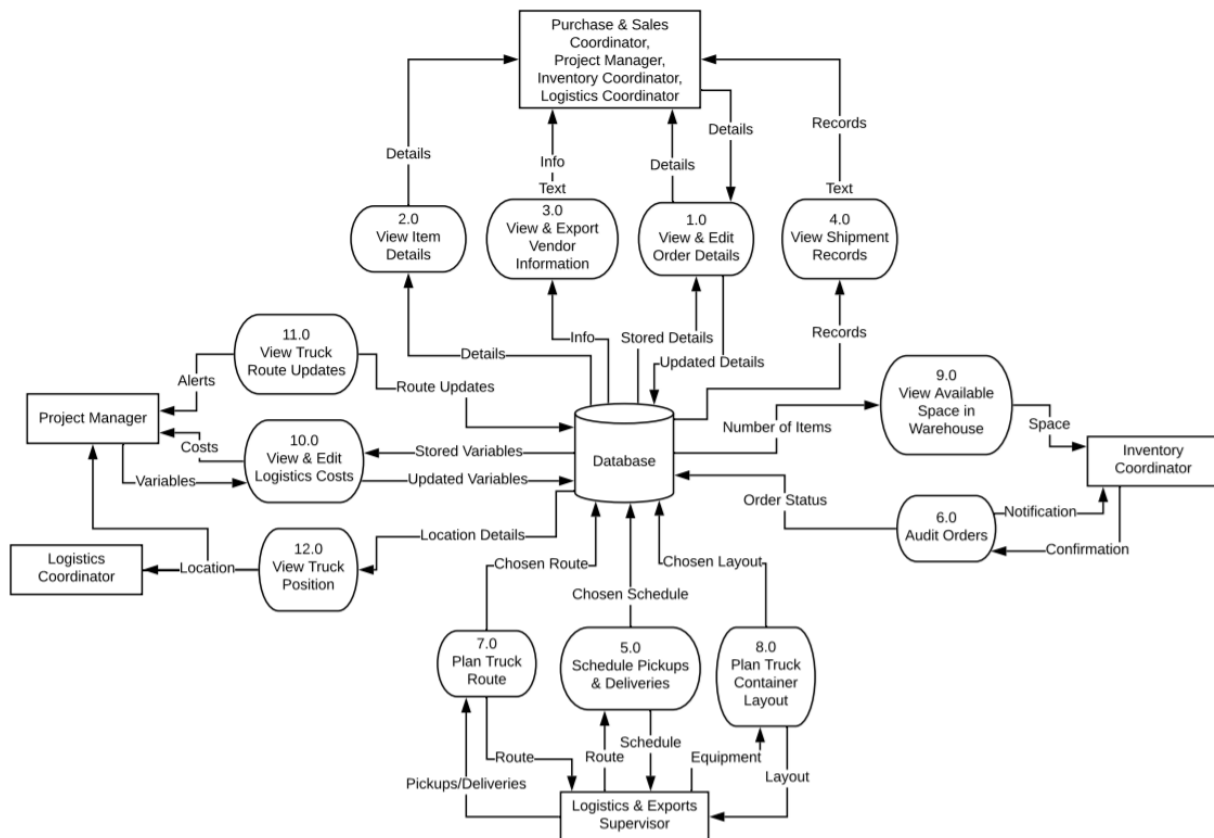
3.4.1.2 Level-1 Data Flow Diagram of Process 8.0

3.4.1.3 Level-2 Data Flow Diagram of Processes 8.2 + 8.3

3.4.1.4 Level-1 Data Flow Diagram of Process 8.4

4.0 Non-Functional Requirements

Key Non-Functional Requirements:

1. 95% uptime for live GPS location position tracking on the truck
2. Email and other notifications will be sent in less than 5 seconds of changes happening in the system
3. Will allow for up to 10 people simultaneously accessing the system without any errors (handle concurrency issues)
4. Perform inventory cross check validation once every 5 minutes with Shiva Export's current inventory management system.
5. Perform item specification cross checks once daily with the Buyer's lab system.

5.0 Logical Database Requirements

The system will use a cloud storage service to store MySql database files, CSV files, and GPX files. Most system data about warehouse inventories, user credentials, and notification data will be stored within a MySql database. This sort of a database will use .frm file types to store the table definitions, .myi files to store indexing information for quicker access to data, and the data itself will be stored in .myd file types. The system will further store periodic database backups as .LDF (transaction log) and .MDF (Data file).

One possible cloud service provider the system may use is Amazon's Relational Database Service. This service provides 100 TiB of storage across 40 different database instances. For the purposes of the application this far exceeds any possible requirements.

The system will also store historical route data as GPX files in the data base. GPX is an XML based data format that allows for effective storage of GPS coordinates across a route. The system will also store historical data of previously optimized routes and truck spaces into csv files. This data will serve useful for generating statistics showcasing the effectiveness of processes over time and may also prove useful for future data mining or machine learning efforts.

Much of data integrity will be handled through substantial error validation when data is entered. There will also be further efforts to solve concurrency challenges either using locks or the subscriber-observer pattern to ensure that team members do not enter conflicting data. Other efforts to allow for data integrity will include storing backups of databases on a weekly basis allowing for recalls on any unexpected data entry or corruption. None of the data stored in the database will be stored in Plaintext.

6.0 Other Requirements

No additional requirements.

7.0 Approval

The signatures below indicate their approval of the contents of this document.

Project Role	Name	Signature	Date
Stakeholder	Tanya Arora	tanya@copierexports.com	2019-11-11
Team Member	Saad Khan	saad.jamil.khan@gmail.com	2019-11-11
Team Member	Veronyque Lemieux	veronyque.lemieux@gmail.com	2019-11-11
Team Member	Sergio Lombana	sergiolombana101@gmail.com	2019-11-11
Team Member	Ian Miranda	ianmiranda910@gmail.com	2019-11-11
Team Member	Jeremy Thibeau	thibeau.jeremy@gmail.com	2019-11-11