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DEPARTMENT OF COMPUTER SCIENCE
CPCS-351: Software Engineering

SMART PORT

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Phase I: Project Description

1.1 Introduction

Like any city in the world that cross to the sea, it would have a port. The port is the most important thing in many countries, and it is considered the gate of the trade. People deals on the paper, but the staff come into the port so that why it's so important for people lives!

Without a port how will the food, materials, cars, and a lot of necessary resources for the human life arrive to us? especially that not all resources can be delivered by the airplanes, which means we need to use ports.

Here in our project idea, we saw that the Oxagon is a city that located above the water and it's not like any city that we can build a regular port for it; Oxagon is an industrial intelligent city that cares for human, good energy, usage of the latest technology etc.

So, our main idea for this project is to build a smart port that organize and facilitate the delivery of the imports and exports materials and shipments that go into/out the city in the most intelligent way.

1.2 Problem Description

As we said that the Oxagon is a city that laying above the water and it's a city that exports and imports the goods that the industrial city produces. So how we can organize these materials and human resources, and how we manage the track of every shipment whether it will go out or into the city.

First, we will divide the whole port into 4 tracks. For example, the first track is for the manufacturer/industrial side, second track is for food/ materials, third one is for the drugs,

and the last track is for shipments for individual people, so the whole system takes all the shipments from the ship and check-up them automatically if there are prohibits in the shipment. If the shipment includes manufacturing/ industrial staff, then the shipment will pass from the first track.

In this step, of course, many companies are waiting their shipments, so maybe the system divide to many subsystems.

Here, we will look to the code that wrote on the shipment and find out in the system which company the shipment belongs to. After that, the shipment will be arrived automatically to the right place in the port while each company will recognize the location of its shipments.

Also, we could apply a safe system to know what are the materials that enter the port while we could count how many tons that the ship can take to be in safe state.

1.3 Problem Objectives

- Our system divides the shipments by type, and that enhance the shipment's receiving process for the companies.
- Distribution of the shipments will reduce congestion that occurs when shipments are received from only one destination; all companies take its products from different places.
- Our port will distribute the shipment so that will increase the accuracy for tracking the shipment by companies if it's lost or arrive safely.

- Receive of the shipment takes less time; each destination focuses on only one filed. Hence, the shipments will be received faster than usual.
- Our port will be a safe and trusted for all the world because our system will detect for any abnormal shipment or any prohibited substances.
- The system will check if the weight of the ship doesn't reach over the maximum allowed weight, as well as make sure that every shipment goes from our smart port be in a safe state as much as possible, until reaching its destination.
- Not like any port in the world, our port specified a track for individuals to take their staff easily and faster without waiting for a company delivering.

1.4 Sources of Domain Analysis Information

The sources of domain analysis in our smart system are the individuals and companies targeted by the port to transport and ship their shipments.

To clarify, the targeted companies are the companies who want to deliver their shipments and goods to the city of Oxagon, where their trade and business is located, or they want to deliver their shipments to any city in the Kingdom of Saudi Arabia so that they take Oxagon smart port as an arrival station.

Also, the port is available for use by companies who want to deliver their shipments from one continent to another by passing through the Oxagon smart port which is located in a special and exceptional location in Neom, Saudi Arabia.

The port also will also be available to use by individuals, not just companies and governments.

1.5 Goals and Scope of the system

1.5.1 Scope of the system

Scope of the system is a system that allows smooth and flexible passage of shipments and distribute them into subsystems which make the receiving process simpler.

1.5.2 Goals of the system

Our system aims to accomplish many goals as the following:

1. Reducing working hours for workers. Hence, expenses paid will be reduced.
2. Organizing the passage of shipments will reduce the time of delivery of the shipments and thus will reduce the port responsibility in storing or accumulating goods for a long period.
3. Reducing environmental pollution in terms of reducing the use of cars based on fossil fuels in transporting goods within the port.
4. Reducing human dealings with prohibited or chemical substances, and thus maintaining the safety of port workers who are dealing with dangerous materials.

1.6 Includes and Excludes Features of the system

1.6.1 The system includes

- High-level of safety, because every shipment arrives will be checked-up in a smart way, and if the shipment contains prohibited substances, then it will be immediately disqualified.
- High-speed in the processes of exports and imports, since the system is a smart port which is a faster port than any port else.
- Reduce shipments build-up and crowding, as there are tracks for each shipment by type and field.
- The system will include consignment tracking feature from its departure to its arrival.
- Higher ability to organize all the shipments and packages in the most efficient way that makes us ensure that every shipment will pass the right track to the right customer.

1.6.2 The system excludes

- Indicators of the economy to which the port contributed to its increase.
- Profits of the port from the operations that are executed.
- Blocking many of companies and individuals from using the smart port.

1.7 System's stakeholders

The stakeholders of the system are the companies, governments, investors, and individuals

Phase 2: Business Requirements Specifications

2.1 Techniques for gathering data

In this section, we collected information about the current situation of the port to construct the smart port needs which serve our system goals. We used two techniques to collect information: User Survey and communicate with port's employee.

2.1.1 User Survey

The survey allows us to understand what consumers view of the traditional port system that is in place today and what they anticipate from the new system., [See Appendix A](#). Due to some information that was challenging to gather just through user surveys, we turned to an alternative technique.

2.2 Requirements & its types

2.2.1 Functional Requirements

R1: The system must ask staff to log in the system. (Log in)

R2: The system must allow the staff when make an order to determine the city and country of the user , where the shipment will arrive. (Make a shipment's order)

R2.1: The system must provide the feature of modifying the city and country of shipment arrival under progress before the date of shipping.

R2.2: The system must display for the staff all the available ports to deliver their shipments.R2.2.1: The system must allow the staff to determine the desired destination in the chosen city.

R3: The system must allow the staff to display his shipments history.(Shipment History)

R4: The system must charge a fee from the user for each shipping request. (Shipping fee)R4.1:

The system allows the stuff to allow the user to choose the payment method: pay before delivering or pay on delivering.

R5: The system must gain an additional fee from the user if the user desires to cancel the shipment request after the date of shipping. (Cancel order)

R6: The system must cancel the shipment automatically if the shipments unable to reach the concerned destination due to any emergency circumstance.

R7: The system must allow the staff to ask the user some questions related¹ to the shipments before completing the request of importing/exporting the shipments.

R8: The system must refuse to export or import a shipment if the shipment information differs from the information recorded in the system. (Cancel process)

R9: The system must allow the staff to track the shipment.

R9.1: The system must specify a reference number for each shipment to use this number to track the shipment. (Track shipment)

R10: The system must allow the staff to determine whether the user desire to ship directly to the concerned destination, or ship to the concerned destination via a temporary destination. (Make a shipment's order)

R10.1: The system must allow the user to use the smart port as a temporary destination.

R11: The system must display the expected arrival or departure date of the shipment to the smart port.

R12: The system must schedule the dates for shipments to be exported to other destinations. (Scheduling shipment)

R13: The system must refuse to export or import any shipment if the system detects a prohibited substance inside the shipment. (Cancel process)

R14: The system must allow the staff to communicate with the users. (Provides Services) R15:

The system must allow staff to offer services in the port (Staff permissions).

R16: The system should measure the weight of all the packages and shipments that goes to the specific ship. (Provides Services)

R17: The system must cancel any order to shipment if the ship has overweight and take the priority packages/shipments. (Cancel process)

R18: The system must allow the staff to log out. (Log out)

2.2.2 Non-Functional Requirements

R1: The system must be available for both individuals and companies. R2: The system must be available to use 24/7.

R3: The system must provide a user-friendly interface that easy to use and making operations.

R4: The system must be available in Arabic and English languages. R5: The system must protect the user's privacy.

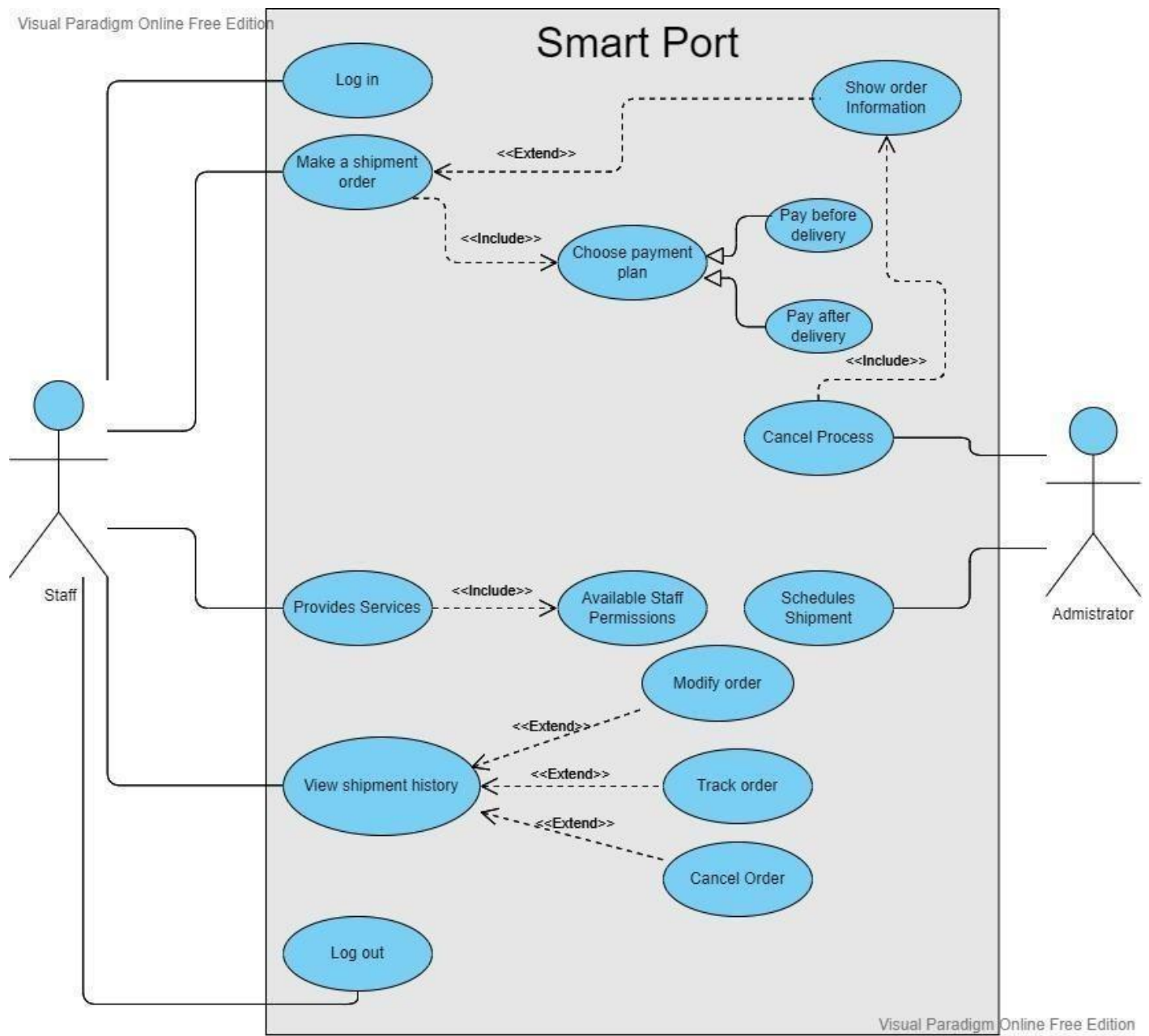
R6: The system must run on all operating systems.

R7: The system must store all the users' data in a database to be retrieved whenever the data is lost.

R8: The system must provide the feature of automatic logging-out of the system when there is no activity by the user in the system for more than 3 minutes.

R9: The system must not complete the process of log-in to the system successfully until the user enters a verification code linked to the registered email.

2.3 Use case diagram for given problems



2.4 Use case description

2.4.1 Use Case 1

Making a shipment order	
Brief Description: When users (businesses or people) want it, staff members will dispatch an order.	
Actors: Staff	
Pre-condition: <ol style="list-style-type: none">1. The staff must be logged into the system.2. The staff must create an account in the system.	
Basic flow of events: <ol style="list-style-type: none">1. The staff presses “Create new order” button.2. The system asks the staff to choose the type of the shipment.3. The system asks the staff to enter the related information of the shipments.4. The system asks the staff to determine user location by the city and country.5. The system asks the staff to determine the country of shipment’s arrival.6. The system asks the staff to determine the city of shipment’s arrival.7. The system asks the staff to choose the desired port of shipment’s arrival.	
Extension: None.	
Post-condition: <ol style="list-style-type: none">1. The staff asks the user to pay to finish his order.2. The user receives a bill of his order including the reference number.	
Special requirements: Actors must be connected to the Internet to making operations in the system.	

2.4.2 Use Case 2

Track shipments

Brief description: The system enables the staff to follow shipments from the port of export to the port of import and to determine how long the shipment will take to arrive.

Actors: Staff.

Pre-condition:

- The staff must log in to the system.
- The staff must have the shipment tracking number

Basic flow of events:

- The staff logs into the port system.
- The staff clicks on the "Track Shipments" button.
- The staff enters the shipment tracking number in the icon shown.
- After entering the shipment tracking number, click on the "Search" icon.
- In the end, all the information about the shipment will be visible to the employees, such as the location of the shipment and its arrival time, as well as how long the shipment process will take, and the staff will communicate this information to the user.

Extension:

The system fails in the following cases:

- 3a - The shipment has not been shipped.
- 3b - The staff does not have the shipment tracking number.

Post-condition:

- The staff tracks the shipment based on the user's request.

Special requirement:

- The staff must have an account in the system.
- The staff must be connected to the internet.

2.4.3 Use Case 3

Cancel Order

Brief description: The staff can be canceling the order through the system.

Actors: Staff.

Pre-condition:

- The order must be in progress..
- The staff must register in the smart port system.
- The staff must be logged into his account.

Basic flow of events:

- 1- Staff logs into his account.
- 2- The staff go to the orders and select the order he wants to cancel.
- 3- Select the check box next to each item he wants to remove from the order. To cancel the entire order, select all the items.
- 4- Select the cancel checked items when finished from step 3. 5-The staff exists from cancellation page.
- 6-The user receives confirmation message into his email address after submitting the cancellation successfully done.

Extension:

1. There is not an order in the system.

The system.

1.1 the system will appear reject message to staff that telling it no items under progress. 2.The staff can remove the item or cancel order that did not enter the charging process yet.

2.1 the system will appear reject message to staff that telling it can't cancel the order.

Post-condition:

The order cancellation successfully done by staff.

Special requirement:

- Actors must be connected to the Internet to making operations in the system.

2.4.4 Use Case 4

Provides services

Brief description: System services one of the services weighs every package or shipment that is sent to a specific ship, thus here we will discuss this service.

Actors: Admin.

Pre-condition:

- 1- The staff login to the system to write the user shipment details.
- 2- The user paid their shipments fees.
- 3- The shipment is accepted in the system and has a register number.

Basic flow of events:

1- The system by default creates a sum object for all the shipments that for example end with 13 register number, so that means that all the shipments that ends with 13 goes to the ship SAS13. 2- The object sum, adding the weights of all shipments, till it exceeds the total weight approved to handle by a ship and that's means the shipments with less priority will postponed to the next ship otherwise all the shipments will go to the ship.

Extension:

If the weight is exceeding the register number that have less priority shows an optional message to the staff if he wants to schedule the next ship or will by default schedule by the port.

Post-condition:

1- All the packages/shipments in specific ship measure so there are no ships have over weights packages/shipments for the safety of the ship.

Special requirement:

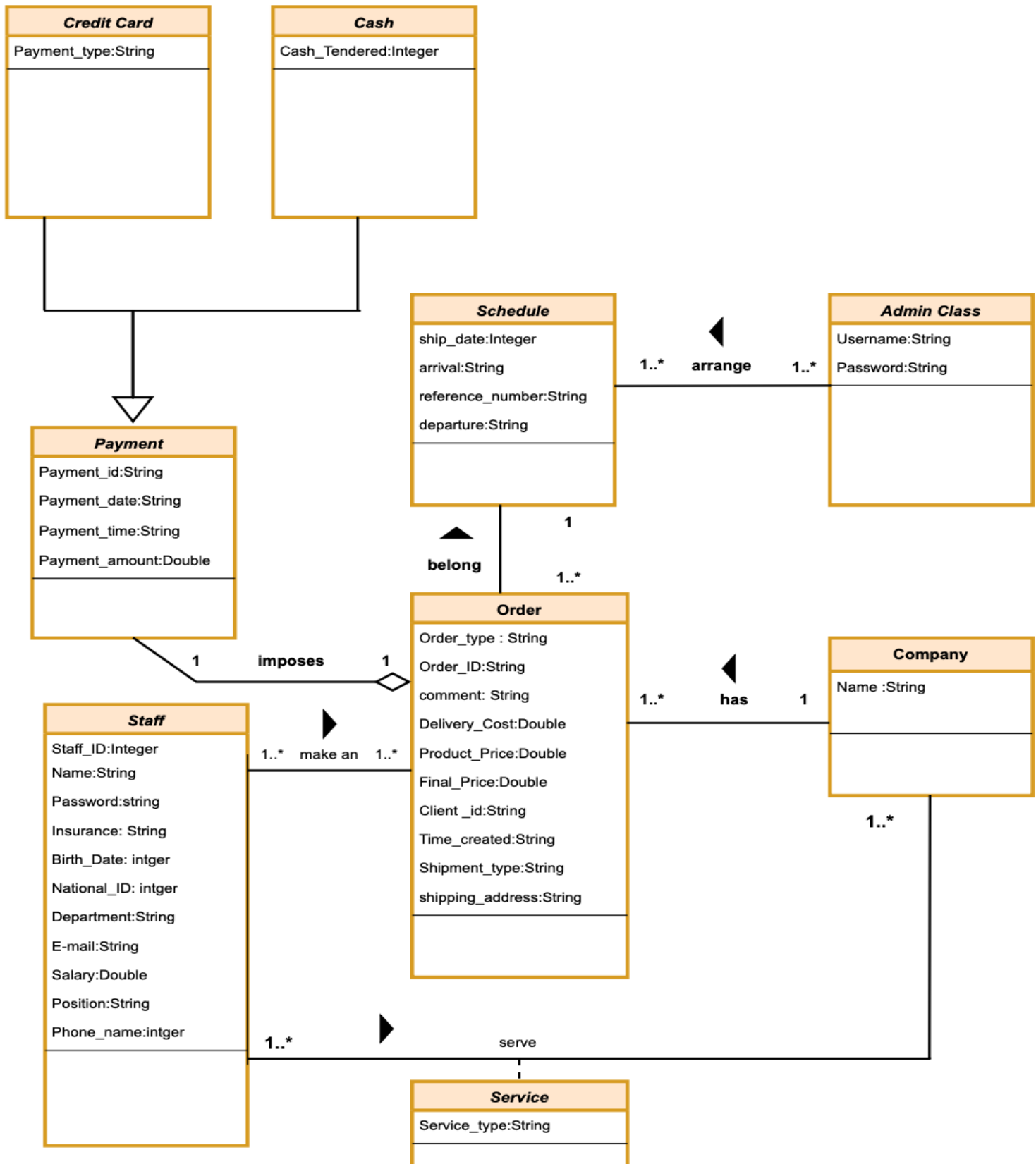
A admin that works correctly to counts the sum for the weights allowed in specific ship.

2.5 Difficulties & risk analysis in the domain

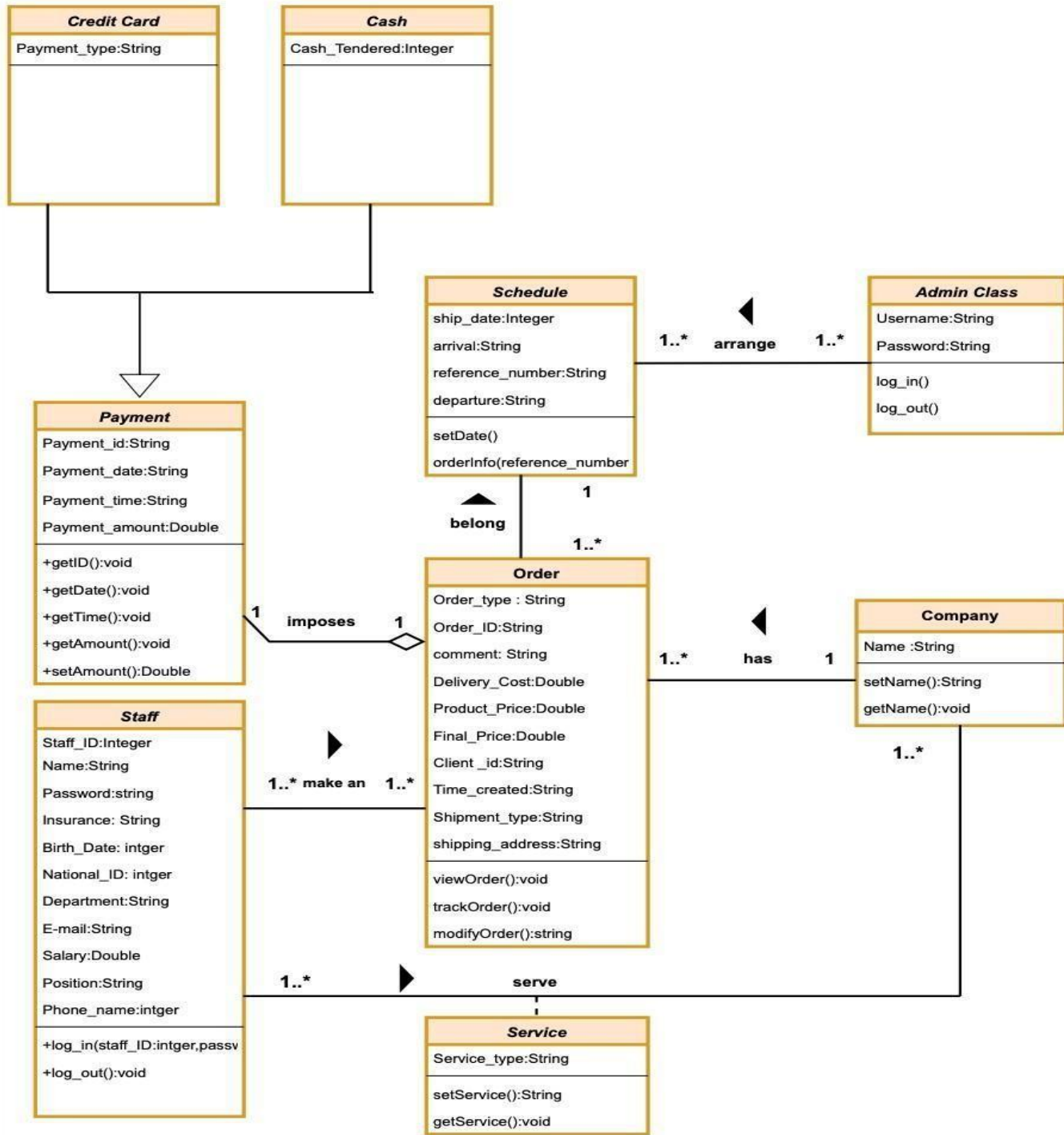
1. Difficulties to reach the people who has experience in the field.
2. Requirements able to change or enhance while processing the project.
3. Obstacles when collecting the needed information.
4. Inexperienced team might face difficulties when develop the non-functional requitements.
5. Some processes need a full knowledge in emergency situation.

Phase 3: Design and Structuring

3.1 Converting use cases to class diagram



3.2 UML class diagram



3.2.1 Association

1. A relationship between Admin class and Schedule class
 - * One schedule process can be set up by one admin.
 - * One schedule process is arranged by one admin.
2. A relationship between Order class and Company class
 - * One or more orders are with one company.
 - * One company is the owner of one or more orders.
3. A relationship between Company class and Stuff class
 - * One or more stuff serves one or more companies.
 - * One or more companies are served by one or more staff.
4. A relationship between Order class and Schedule class
 - * One or more orders belong to one Schedule.
 - * One Schedule belongs to one or more Order.
5. A relationship between Stuff class and Order class
 - * One or more staff makes one or more orders.
 - * One or more orders are made by one or more staff.

3.2.2 Composition

We don't have any relationships that are categorized as composition in our system.

3.2.3 Generalization

6. Payment class is inherited to Cash class and Credit card class.

3.2.4 Aggregation

7. Between Order class and Payment class.
 - * Payment class is a part of the Order class.
 - * If there is no order, there is no payment done for it.
 - * One order is imposed by one payment process.
 - * One payment process imposes one order.

3.3 System Architecture

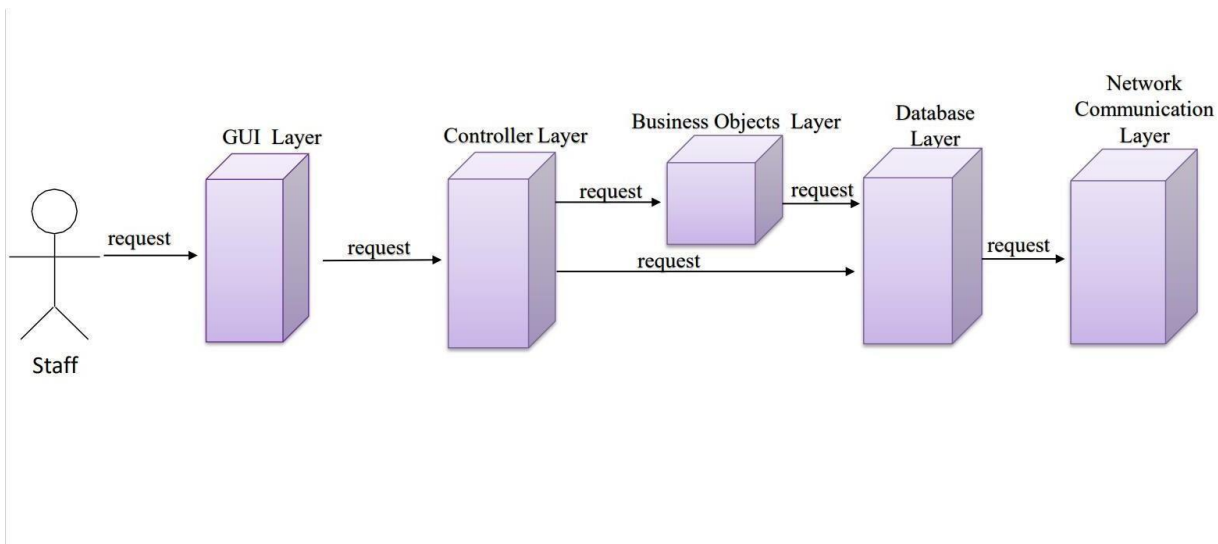
3.3.1 Type of The System

Because N-Tier architecture depends on human involvement, we opted to employ it for our system. This fits with the way our system functions, which allows for interaction between the system and the personnel.

For instance, the system responds to staff and admin requests to check the history of a shipment, place orders, and also cancel activities.

3.3.2 Architecture design

N-tier architecture is used with this interactive system

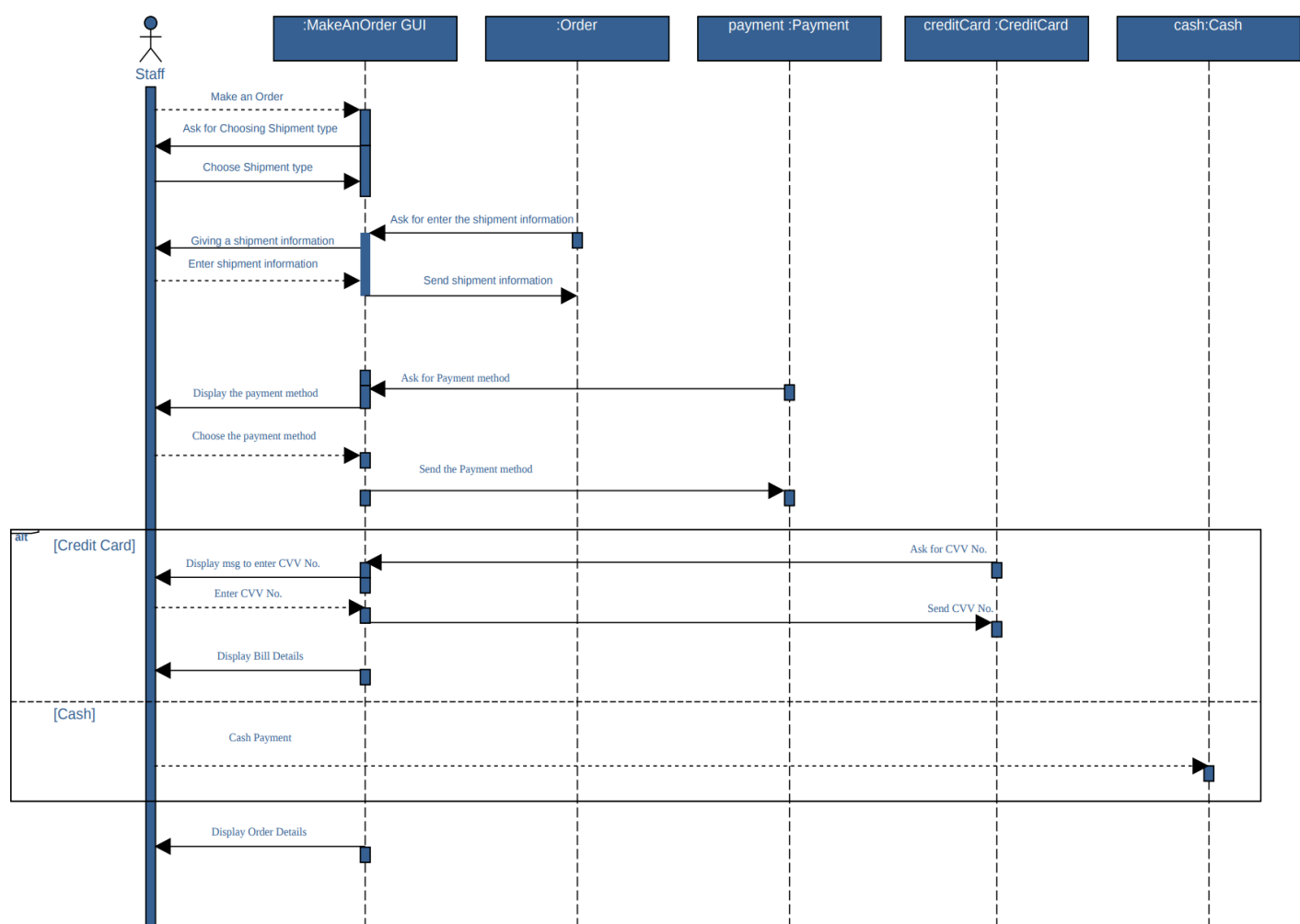


Phase 4: Modeling, Interaction & Behavior

4.1 Sequence Diagrams:

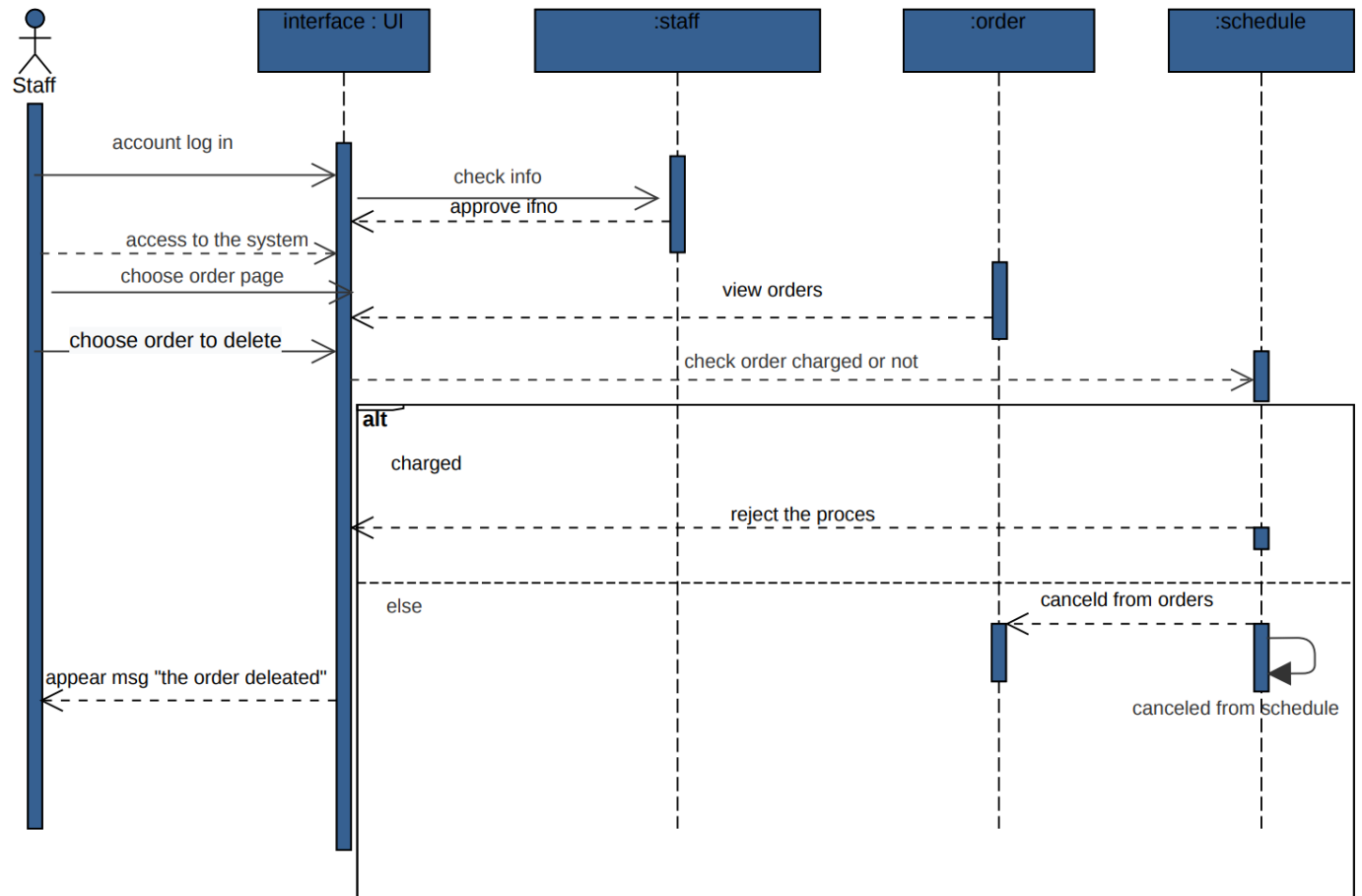
4.1.1 Sequence Diagram 1:

Use case: making a shipment order



4.1.2 Sequence Diagram 2:

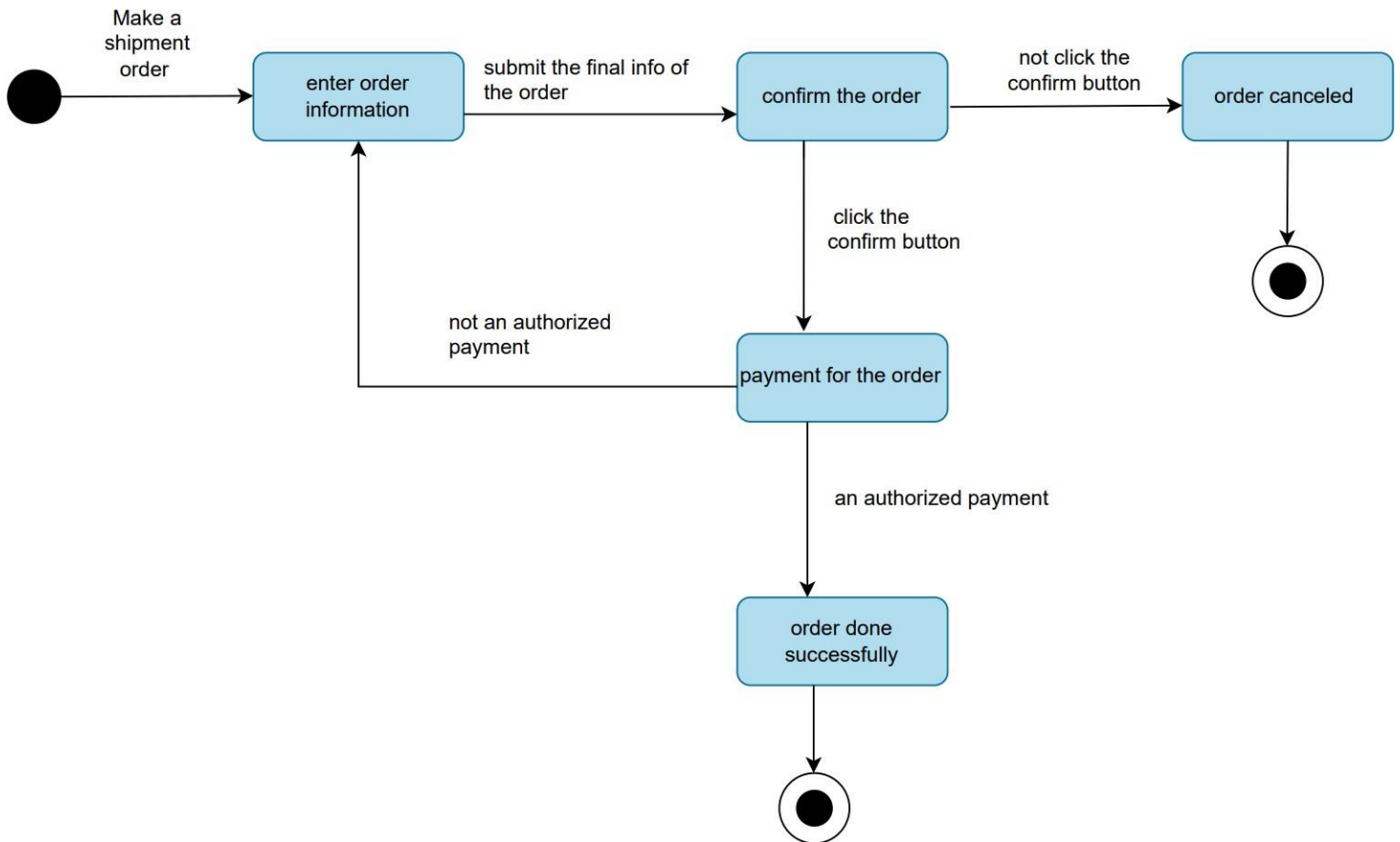
Use case: cancel order



4.2 State Diagrams:

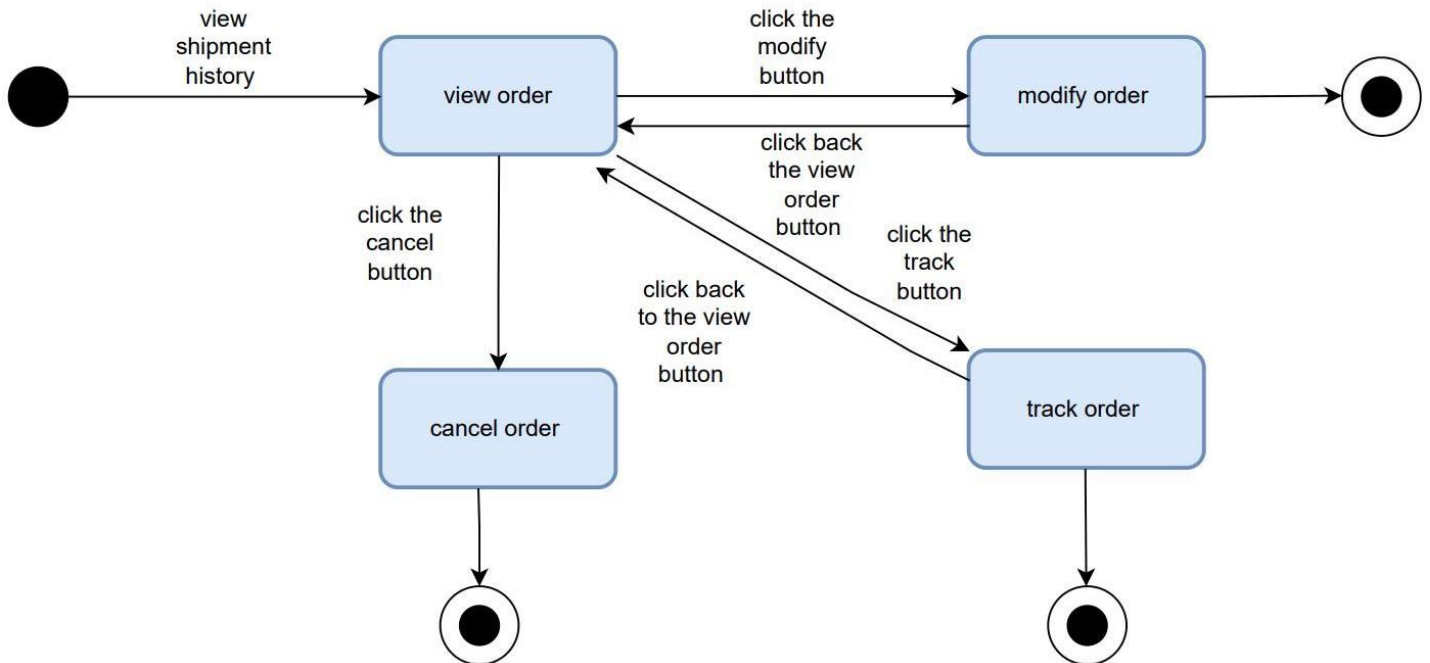
4.2.1 State Diagram 1:

Use case: Make a shipment order



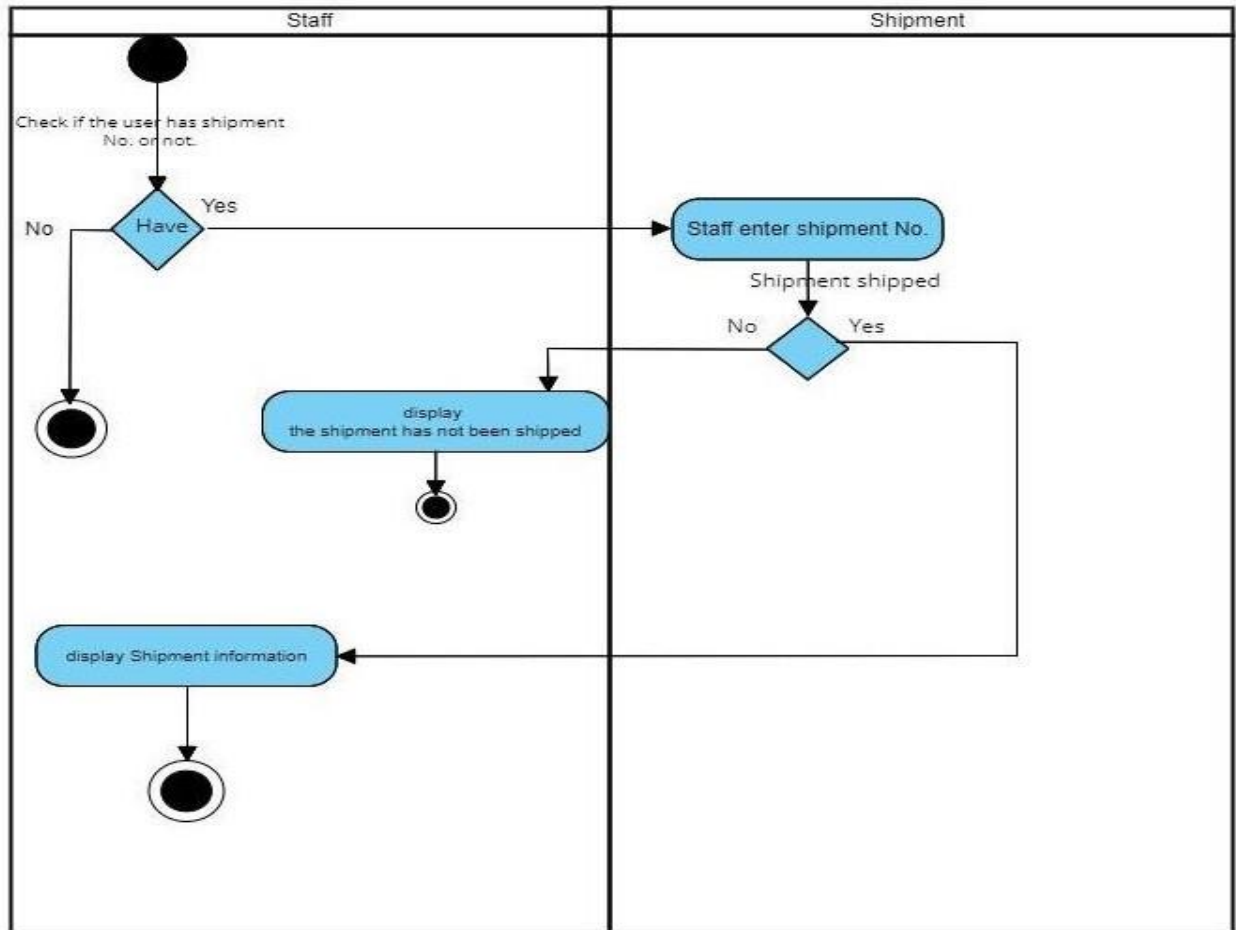
4.2.2 State Diagram 2:

Use case: View shipment history



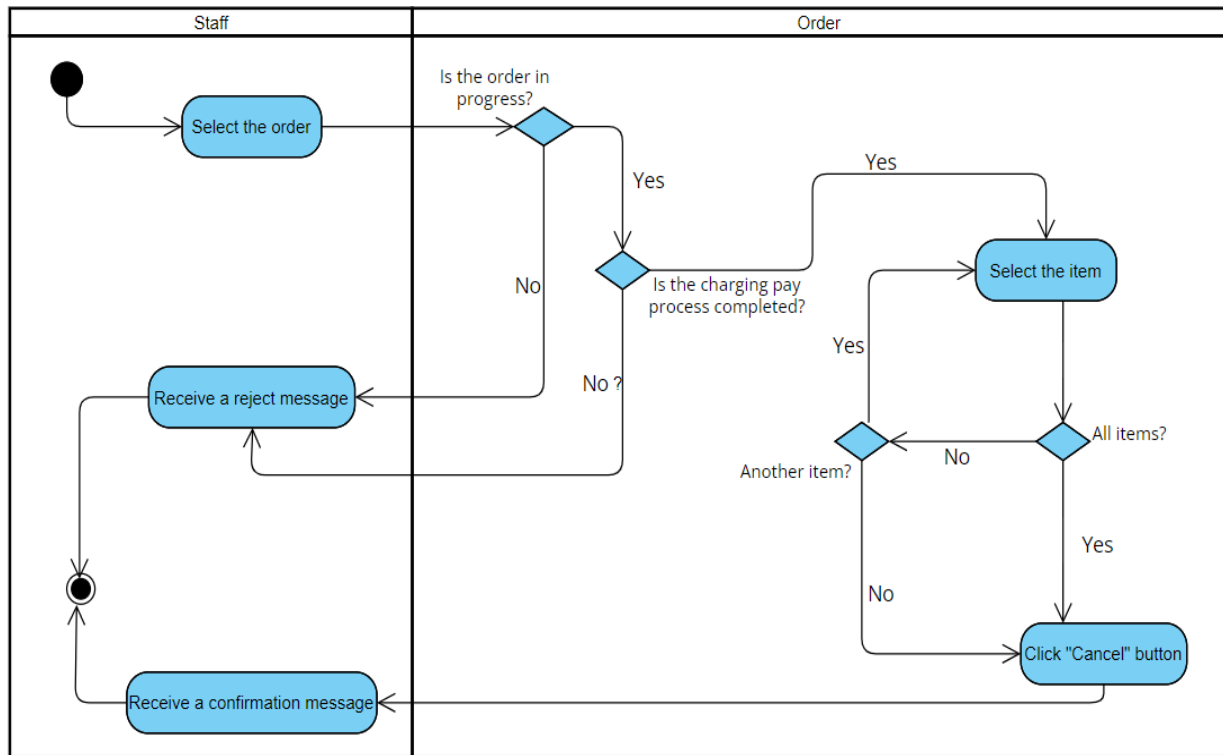
4.3 Activity Diagrams:

4.3.1 Activity Diagram1: Use case: Track shipments



4.3.2 Activity Diagrams 2:

Use case: Cancel Order



4.4 Testing

4.4.1 Objectives

Our **test** objective **has** many **goals**, the **most important** of **which** are:

- 1- To **ensure that** our system meets **our requirements** and **our users are satisfied**.
- 2- To see if **the** system needs further development.
- 3- To detect errors so **that** we can **find and fix bugs**.
- 4- To **ensure** that our **systems meet** at least **key quality standards**.
- 5- Test performance, security and **all possible test methods**.
- 6- **Make sure you can use the system** with different interfaces.
- 7- **Use tests** to avoid future errors.

4.4.2 Testing Strategy

Our goal in the testing process is to ensure that the system meets **our requirements, is working** correctly and smoothly, and **detects and corrects** any errors **we receive**. I chose the following **features for testing**:

- I will place an order for shipping.
- Shipment Tracking.
- To cancel the order.

In addition to **the** success criteria, the system **will provide** the expected **response** at the expected time.

4.4.3 Approach

The testing **methodology** used in this report is black box **testing**. In other words, the **tester inputs the input and checks if the output is required**. This method was chosen **because the emphasis is** on testing the behavior of the system **rather than implementing the tests**.

4.4.4 Test Plan 1

system:

Smartport website.

Test case name:

Track **your shipment**.

explanation:

It tests your staff's ability to **successfully** track a **shipment** from the port of import to the port **of export**.

test scenario:

Check the system response when **the** user **wants** to track **the package**.

Prerequisites:

Staff must log **into** the system. **Staff should** have **a** tracking number.

Postconditions:

Successfully track **your** shipment.

Test case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
1	Check the behavior of the system when the user wants to track his shipment and it has already been shipped .	<p>1.Log in to the system</p> <p>2.click on the "Track Shipments" button.</p> <p>3.Enter the shipment tracking No. .</p> <p>4.click on the "Search" icon.</p> <p>5.Display of all information about the shipment.</p>	<p>Username: Ahmed 1010</p> <p>Password: Ah@8671</p> <p>shipment tracking No.: S10298575</p> <p>Location of the shipment: King Abdulaziz Port in Dammam</p> <p>Expected arrival time: 13/11/2022</p>	System should display all information about the shipment.	As Expected	Pass

2	Check the behavior of the system when the user wants to track his shipment and it has not been shipped .	<p>1.Log in to the system</p> <p>2. click on the "Track Shipments" button.</p> <p>3.Enter the shipment tracking No.</p> <p>4.click on the "Search" icon.</p>	<p>Username: Mohammed 8492</p> <p>Password: Moh@1056</p> <p>shipment tracking No.: S95835610</p>	System cannot display anything for the staff and show an error message "the shipment has not been shipped".	As Expected	Pass
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4.4.5 Test Plan 2

system:

Smartport website

Test case name:

I will place an order for shipping.

explanation:

Test your staff's ordering ability.

test scenario:

See how the system responds when staff **members** want to **say something**

Shipment of orders.

Prerequisites:

Staff must log into the system.

Postconditions:

Your **order has been successfully completed.**

Test case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Pass /Fail
1	Check the behavior of the system when the staff wants to make a shipment order and it is successfully done.	1-Login into our system. 2-clicks on the “make a shipment order ” button. 3-Choose the type of the shipment. 4-Enter shipment information. 5-Determine client location by the country and city. 6-Determine the country and city of shipment’s arrival. 7- Choose Cash payment method. 8-order paid.	1. Username: Mohammed Al Zahran 2. Password: Moh20023@J 3.Shipment type: Glass. 4. Shipment Information: Al Rifai,KSA ,Jeddah, client, ID:1212353221, Comment: breakable. Final Price:1200. 5- Shipment’s arrival: KSA,Jeddah,Al Hamadani a Street	The system should display a bill of his order including a reference number.	As Expected	Pass

2	Check the behavior of the system when the staff wants to make a shipment order and it fails.	<p>1-Login into our system.</p> <p>2-clicks on the “make a shipment order ” button.</p> <p>3-Choose thetype of the shipment.</p> <p>4-Enter shipment information.</p> <p>5-Determine client locationby the country and city.</p> <p>6-Determine the country and cityof shipment’ s arrival.</p> <p>7- Choose aCredit Card payment method.</p>	<p>1. Username: Ali Alghamdi.</p> <p>2. Password: Ali43563@R</p> <p>3.Shipment type: Clothes.</p> <p>4.Shipment Information :Shein, KSA, Riyadh, client, ID:1411129299</p> <p>Comment: Nothing. Final Price:600.</p> <p>5- Shipment’s arrival: KSA,Riyadh,Khalidiya street.</p>	The system rejects the order and displays the message “The card does not have enough money”.	As Expected	Pass
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4.4.6 Test Plan 3

system:

Smartport website.

Test case name:

To cancel the order.

explanation:

Tests **if staff can cancel orders.**

test scenario:

Check the system response when the staff wants to cancel **the** order.

Prerequisites:

Staff must **log into** the system. **Shipment is** in progress and **payment is required.**

Postconditions:

The cancellation process **completes** successfully.

Test case ID	Test Scenario	Test Steps	Test Data	Expected Result	Actual Result	Pass/Fail
1	Check the behavior of the system when the staff will cancel an order that is still in progress.	1. Log in to the system 2. Click on the "Select the Order" button. 3. Select the item/s. 4. Click on the "Cancel" icon. 5. A confirmation message will be received.	1. Username: saleha hmed 2. Password: Sa12345leh\$2 3. Order Number: 419008021 4. Selected items: #290021, #40019231, #2217361	The system must apply the process successfully and a confirmation message of applying the process will appear.	As Expected	Pass

2	Check the behavior of the system when the staff will cancel an order that is not in progress.	<p>1. Log in to the system</p> <p>2. Click on the "Select the Order" button.</p> <p>3. A reject message will be received.</p>	<p>1. User name: khalid1996</p> <p>2. Password: \$khalid123khalid\$@@</p> <p>3. Order Number: 9110274531</p>	The system displays a rejection message informing that the process is unable to be done.	As Expected	Pass
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4.5 Test Design Technique

4.5.1 Equivalence Partitioning Example: Payment Date (1-31)

Invalid Partition	Valid Partition	Invalid Partition
<ul style="list-style-type: none"> • 0 • -1 • -2 • -3 • ... 	<ul style="list-style-type: none"> • 1 • 2 • 3 • 4 • ... • 31 	<ul style="list-style-type: none"> • 32 • 33 • 34 • 35 • ...

4.5.2 Boundary Value Analysis Example: Payment Date (1-31)

Invalid Partition-Valid Partition (Lower Boundary)		Invalid Partition-Valid Partition (Upper Boundary)	
• 0	• 1	• 32	• 31

4.5.3 Decision Table Testing Example: Username & Password

Username	F	T	F	T
Password	F	F	T	T
Expected Result	Error: Please EnterUsername	Error: Please EnterPassword	Error: Please Enter Username	Log in processed

4.6 Conclusion

To brief our idea, we said that our project helps the port to facilitate the fast classification of the shipments by
to its track, don't forget that our system has four tracks on the port which reduce the time of delivery and it
will increase the safety of the port and to the port staff also.
types a

So, our recommended solution was to create a Smart port system that has the main features that
we said before.
Of course, there are many features, but we just mention the essential.

We really faced many challenges in our project especially about how to collect information and,
what made it much harder is how to implement this idea because we found ourselves in a black
hole but fortunately with the effort of the team, hardworking and a bunch of meetings. We do it!