



*Onion Express*

# **System Analysis Document**

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# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
1.1	Purpose . . . . .	3
1.2	Definitions . . . . .	3
1.3	System Overview . . . . .	3
<b>2</b>	<b>Requirements</b>	<b>5</b>
2.1	Use Case Modelling . . . . .	5
2.1.1	Global Use Cases . . . . .	5
2.1.2	Specification of Use Cases . . . . .	6
2.2	Supplementary Specification . . . . .	31
2.2.1	Security . . . . .	31
2.2.2	Performance . . . . .	32
2.2.3	Data Storage and Computing . . . . .	33
2.2.4	Track the Package . . . . .	33
2.2.5	Maintenance . . . . .	34
2.2.6	Others . . . . .	34
<b>3</b>	<b>Analysis</b>	<b>35</b>
3.1	Architectural Analysis . . . . .	35
3.1.1	System Structure . . . . .	35
3.2	Analysis Model . . . . .	37
3.2.1	Global Class Diagram . . . . .	37
3.2.2	Use Case Realization . . . . .	38
<b>4</b>	<b>User Interface</b>	<b>50</b>
4.1	Mobile Devices(iOS) . . . . .	50
4.1.1	Log in Page . . . . .	50
4.1.2	Main Page . . . . .	51
4.1.3	Search Page . . . . .	52
4.1.4	Order Page . . . . .	53
4.1.5	Account Page . . . . .	54
4.2	Website . . . . .	54
<b>5</b>	<b>Glossary of Terms</b>	<b>57</b>
<b>6</b>	<b>Contributions</b>	<b>62</b>

# 1 Introduction

Onion Express® is a system built for logistic companies, which provides them with a solution to logistics tracking, goods packing, goods distribution, after-sales management, data storage, information processing, etc.

## 1.1 Purpose

These days as B2C business is increasing rapidly, the growth of logistics business is also remarkable. The enormous market demand brings logistics companies opportunities as well as the challenge. Facing such kind of condition, this project is aimed at improving the efficiency of field personnel and customer satisfaction of a logistics company by building a cross-platform system.

## 1.2 Definitions

As Jobs has ever said, “People don’t know what I really want at all, until your products are in their eyes”. This project is specially designed for an independent logistics companies like UPS. The business scope is limited within China. To be more precise, the express is only available in Jiangsu, Zhejiang and Shanghai at the beginning. Temporarily private orders are not covered in the business scope, which means the express company corporates with e-commercial companies only with the cash-on-delivery express or normal express. The system focuses on logistics service without regard to O2O, bulk cargo or self-support e-business. Timing express might be expanded in future.

## 1.3 System Overview

The actors in the system are classified as *Postman*, *E-business*, *Customer service*, *Customer* and *Agent*. *Customer* and *Agent* are generalized as Receiver. The *Postman* has access to this system only on mobile devices while *Customer* has access both on browsers as well as mobile devices. *E-business* offers orders periodically. *Customer service* helps to deal with tasks cannot be done only by the system.

Web application and iOS application provide different functions for different users to enhance user experience and have some humanization design(e.g. using different colors to mark tasks as reception or delivery in postman’s app). Besides basic functions, the system also

provides some advanced functions, like printing invoices. Different offline payment methods are supported. And the customer's telephone number is hidden to protect his/her privacy. The postman is equipped with a multifunctional special device, when the customer receives his/her package, he/she can use this device to pay by card and can also press thumb on it to sign digitally, besides, the device helps collect postman's GPS location accurately.

The system considers all the 8 scenarios, including sending the package, paying for the product, signing the package and so on. To integrate the system, two scenarios are added. One is creating the orders, at the beginning of the entire flow. Another is dealing the order manually, to reduce errors caused by the system and handle other unanticipated situations. That can improve the stability of the system and in consideration of the relatively small scale of users in the early stage, robot customer service is not necessary. It can be taken into consideration when the business is expanding to a certain stage.

This project also designs several user interface mock-ups on the website and on mobile devices. Core functions are exhibited in these mock-ups, for example, the dispatch list interface.

Nonfunctional requirements and further explanations on security, performance, data storage and computing, tracking the package, maintenance and others are detailed in supplementary Specification.

# 2 Requirements

## 2.1 Use Case Modelling

### 2.1.1 Global Use Cases

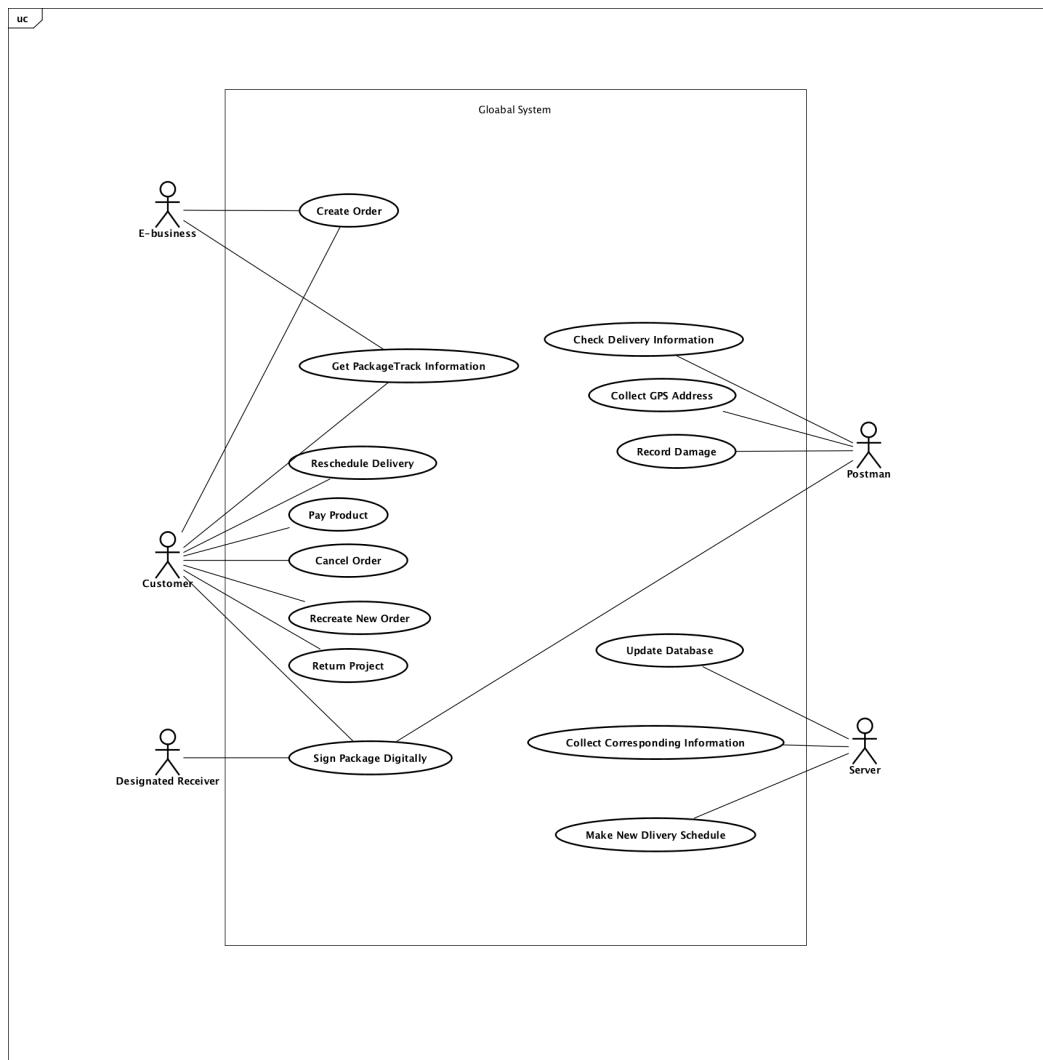


Figure 2.1: Global Use Cases Diagram

## 2.1.2 Specigication of Use Cases

### Scenario One

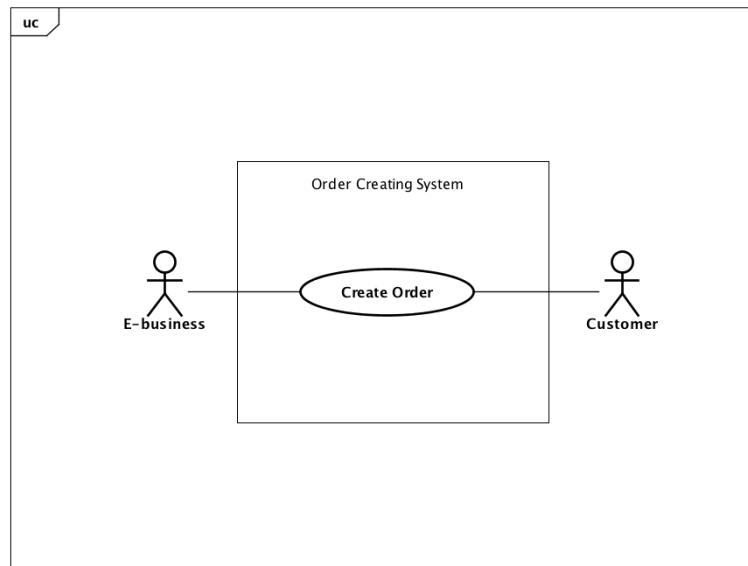


Figure 2.2: Scenario One Use Case Diagram

Use Case Name	Create Order
Related Requirements	Scenario One
Goal in Context	The customer or E-business requests to create order.
Preconditions	The customer buys products from E-business or wants to send packages.
Successful End Condition	Server creates order according to the information provided by E-business & Customer.
Failed End Condition	Server refuses to create an order.
Primary Actors	E-business and Customer
Secondary Actors	None
Trigger	E-business & Customer sends the related information to Server.
Main Flow	<p>Step 1 : Customer &amp; E-business Registers Information to Server.</p> <p>Step 2 : Customer &amp; E-business Sends Information to Server.</p> <p>Step 3 : Server checks whether the information is completed.</p> <p>Step 4 : Server creates orders automatically according to the information above.</p> <p>Step 5 : E-business &amp; customer transfers products to Logistics company and pays for the delivery. If the customer doesn't pay before, Logistics company will pay for products for the customer in advance.</p> <p>Step 6 : Logistics company transports packages to different regional distribution centers.</p>
Extensions	The request of creating order is rejected.

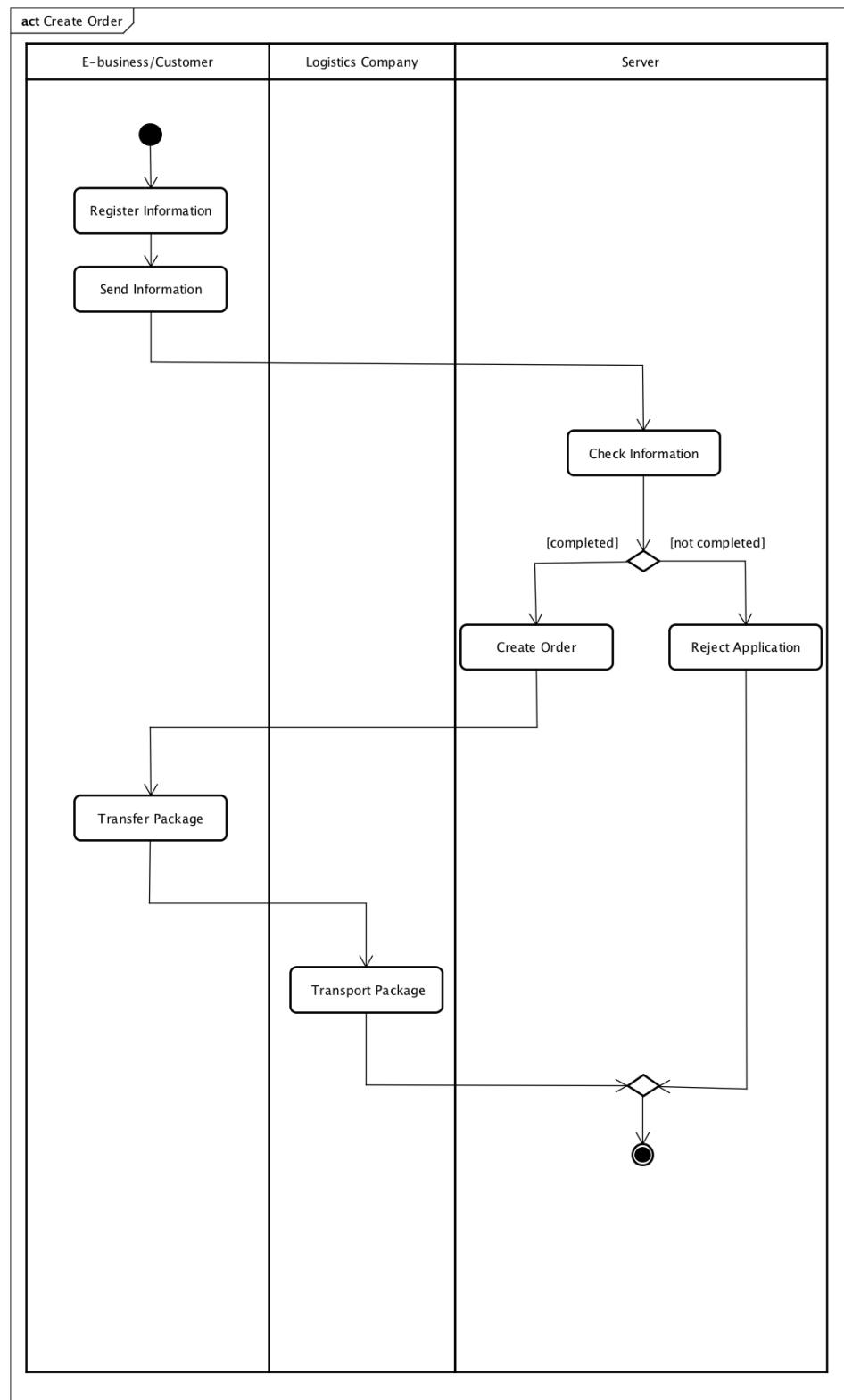


Figure 2.3: Scenario One Activity Diagram

## Scenario Two

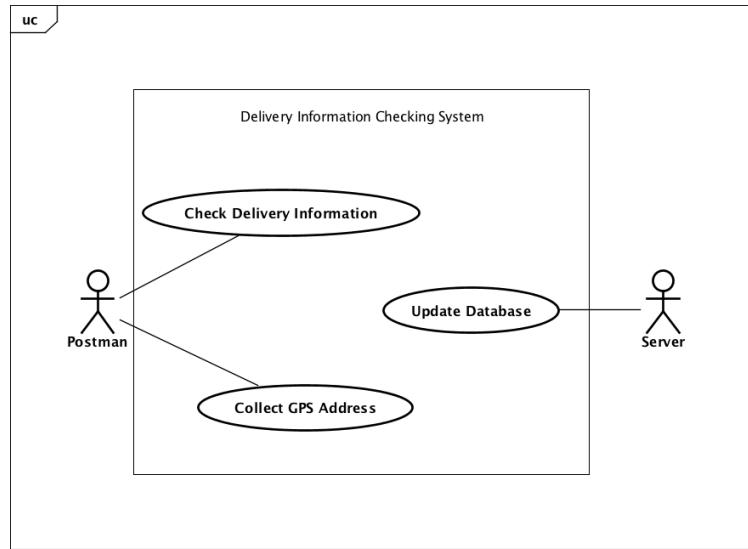


Figure 2.4: Scenario Two Use Case Diagram

Use Case Name	Collect GPS Address
Related Requirements	Scenario One
Goal in Context	Postmen collect the GPS address of the customer.
Preconditions	Postmen have delivered packages to the destination.
Successful End Condition	Server Updates database successfully.
Failed End Condition	None
Primary Actors	Postman
Secondary Actors	Server
Trigger	The GPS address of the customer is not in the database.
Main Flow	Step 1 : Postmen inspect that whether the GPS address of the customer is in the database. Step 2 : If the GPS address of the customer is not in the database, postmen will collect the GPS address. Include : Update database.
Extensions	None

Use Case Name	Check Delivery Information
Related Requirements	Scenario Two
Goal in Context	Postmen accept delivery task assigned by the system.
Preconditions	Orders have been created and packages have been transported to the regional distribution centers.
Successful End Condition	Postmen check delivery information and send packages to the customer.
Failed End Condition	None
Primary Actors	Postman
Secondary Actors	None
Trigger	Postmen accept an delivery task.
Main Flow	<p>Step 1 : Logistics Company assigns task to Postman.</p> <p>Step 2 : Postmen accept delivery task.</p> <p>Step 3 : Postmen log in the system.</p> <p>Step 4 : Postmen check delivery information including tracking number, destination, personal information about receivers, QR code for payment (if the customer choose to pay on-site) and so on.</p> <p>Step 5 : Postmen go to the regional distribution center and get the package.</p> <p>Step 6 : Postmen deliver it to the destination.</p> <p>Step 7 : Postmen inform customers to take packages. At the same time, Postmen will Inspect Address, if the GPS address of the customer is not in the database, they will collect the GPS address.</p>
Extensions	None

Use Case Name	Update Database
Goal in Context	Server Updates database.
Preconditions	Postmen collected the GPS address of the customer and sended to server.
Successful End Condition	Server Updates database successfully.
Failed End Condition	Server fails to update database.
Primary Actors	Server
Secondary Actors	None
Trigger	The GPS address of the customer is not in the database.
Main Flow	Step 1 : Server Updates database.
Extensions	None

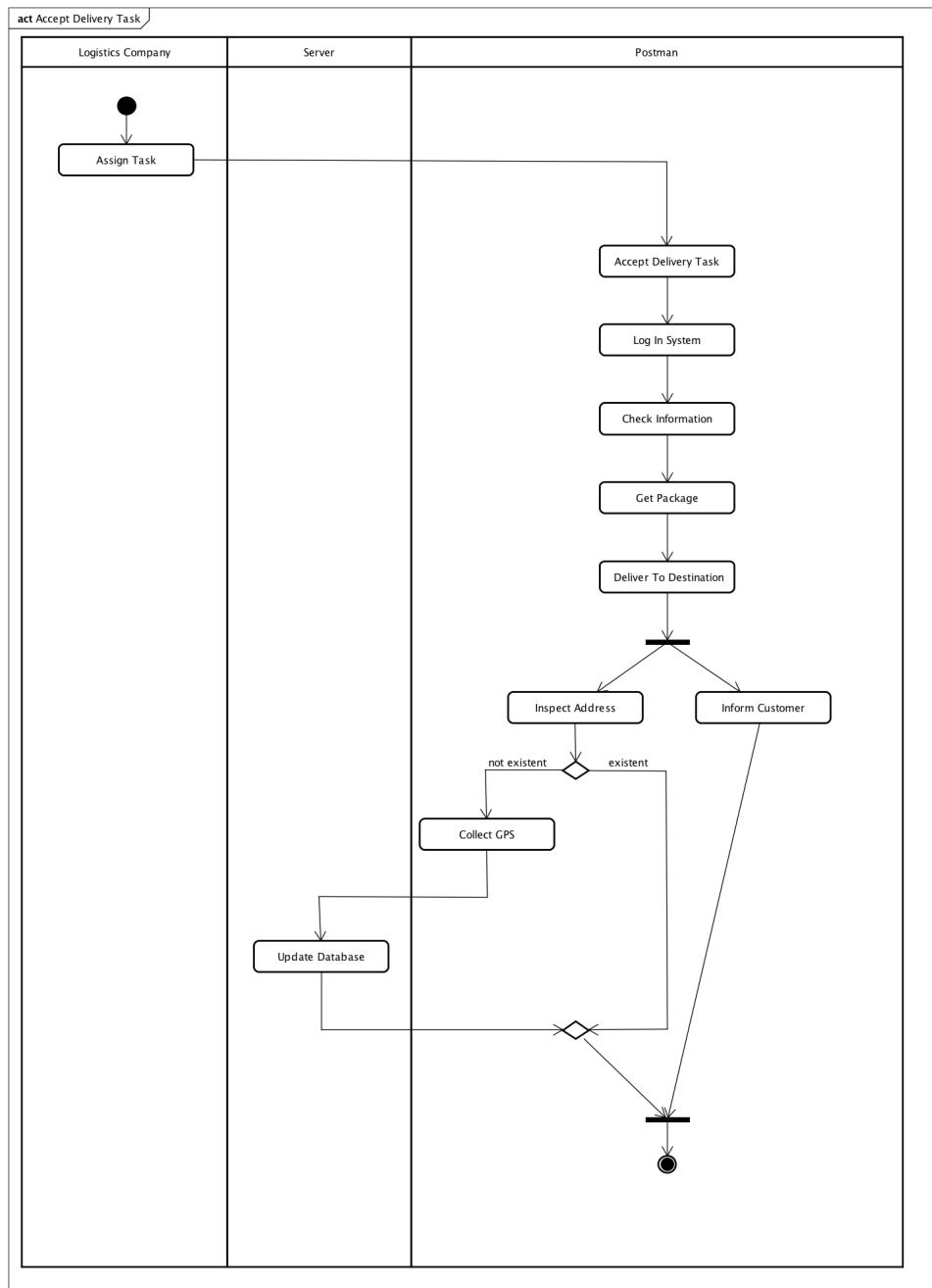


Figure 2.5: Scenario Two Activity Diagram

### Scenario Three

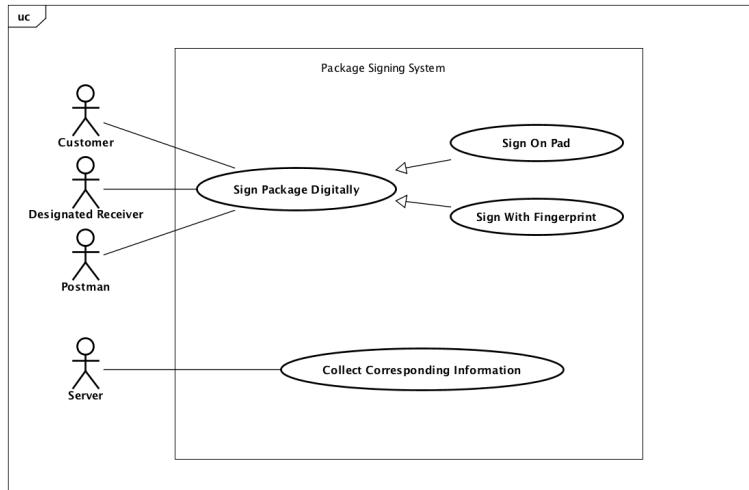


Figure 2.6: Scenario Three Use Case Diagram

Use Case Name	Collect Corresponding Information
Related Requirements	Scenario Two & Three
Goal in Context	Collect information and archive related data.
Preconditions	Signing package is finished successfully.
Successful End Condition	The order is marked as complete; Relevant information is gathered.
Failed End Condition	The order is unfinished; Inspect system exception.
Primary Actors	Server
Secondary Actors	None
Trigger	System sends server a message that informs the package delivery is done.
Main Flow	<p>Step 1 : Information including the data of received products, customer acceptance and some other transaction details are collected by the server. All necessary related data is archived to database.</p> <p>Step 2 : Server requests to mark this order as complete.</p>
Extensions	<p>Step 1.1 : Error appears upon the procedure of data collection.</p> <p>Step 1.2 : Data collection is undone.</p>

Use Case Name	Sign on Pad
Related Requirements	Scenario Two & Three
Goal in Context	A customer or the receiver designated by him/her requests to sign his/her name (or other proofs of identity) on Pad.
Preconditions	The package has delivered to the customer-specified location on time.
Successful End Condition	The customer receives the package; Package delivery success.
Failed End Condition	The customer fails to get the package; Package should be returned or reschedule delivery.
Primary Actors	Customer, Package receiving representative.
Secondary Actors	Postman
Trigger	Postman requests customer to sign on pad with the agreement of customer.
Included Cases	Confirm Reception, Collect Corresponding Information
Main Flow	<p>Step 1 : Customer checks if the parcel is delivered right and in good condition in person.</p> <p>Step 2 : Customer signs on pad.</p> <p>Step 3 : Postman confirms the package is received by customer or his/her representative.</p> <p>Step 4 : All corresponding information including the data of the received product and customer acceptance will be transferred back to the server; The order will be marked as complete.</p> <p>Include : Collect Corresponding Information</p>
Extensions	<p>Step 1.1 : The customer is not convenient to sign the package and asks someone to receive for him/her.</p> <p>Step 2.1 : The representative of customer request to sign the package.</p> <p>Step 2.2 : A confirming message is send to customer and he/she should ensure the package is received by the person he/she designated.</p> <p>Include : Confirm Reception</p> <p>Step 2.3 : The representative signs on pad.</p>

Use Case Name	Sign Package Digitally
Related Requirements	Scenario Two & Three
Goal in Context	A customer requests to sign the package.
Preconditions	The package has delivered to the customer-specified location on time.
Successful End Condition	The customer receives the package; Package delivery success.
Failed End Condition	The customer fails to get the package; Package should be returned or reschedule delivery.
Primary Actors	Customer, Package receiving representative.
Secondary Actors	Postman
Trigger	Postman sends customer the request of signing the package.
Included Cases	Confirm Reception, Collect Corresponding Information
Main Flow	<p>Step 1 : Customer checks if the parcel is delivered right and in good condition in person.</p> <p>Step 2 : Customer signs the package digitally.</p> <p>Step 3 : Postman confirms the package is received by customer or his/her representative.</p> <p>Step 4 : All corresponding information including the data of the received product and customer acceptance will be transferred back to the server; The order will be marked as complete.</p> <p>Inlude : Collect Corresponding Information</p>
Extensions	<p>Step 1.1 : The customer is not convenient to sign the package and asks someone to receive for him/her.</p> <p>Step 2.1 : The representative of customer request to sign the package.</p> <p>Step 2.2 : Step 2.2 : A confirming message is send to customer and he/she should ensure the package is received by the person he/she designated.</p> <p>Inlude : Confirm Reception</p> <p>Step 2.3 : The representative signs the package digitally.</p>

Use Case Name	Sign with Fingerprint
Related Requirements	Scenario Two & Three
Goal in Context	A customer or the receiver designated by him/her requests to sign his/her name (or other proofs of identity) on Pad.
Preconditions	The package has delivered to the customer-specified location on time.
Successful End Condition	The customer receives the package; Package delivery success.
Failed End Condition	The customer fails to get the package; Package should be returned or reschedule delivery.
Primary Actors	Customer, Package receiving representative.
Secondary Actors	Postman
Trigger	Postman requests customer to sign via fingerprint with the agreement of customer.
Included Cases	Confirm Reception, Collect Corresponding Information
Main Flow	<p>Step 1 : Customer checks if the parcel is delivered right and in good condition in person.</p> <p>Step 2 : Customer signs with fingerprint.</p> <p>Step 3 : Postman confirms the package is received by customer or his/her representative.</p> <p>Step 4 : All corresponding information including the data of the received product and customer acceptance will be transferred back to the server; The order will be marked as complete.</p> <p>Include : Collect Corresponding Information</p>
Extensions	<p>Step 1.1 : The customer is not convenient to sign the package and asks someone to receive for him/her.</p> <p>Step 2.1 : The representative of customer request to sign the package.</p> <p>Step 2.2 : A confirming message is send to customer and he/she should ensure the package is received by the person he/she designated.</p> <p>Include : Confirm Reception</p> <p>Step 2.3 : The representative signs with fingerprint.</p>

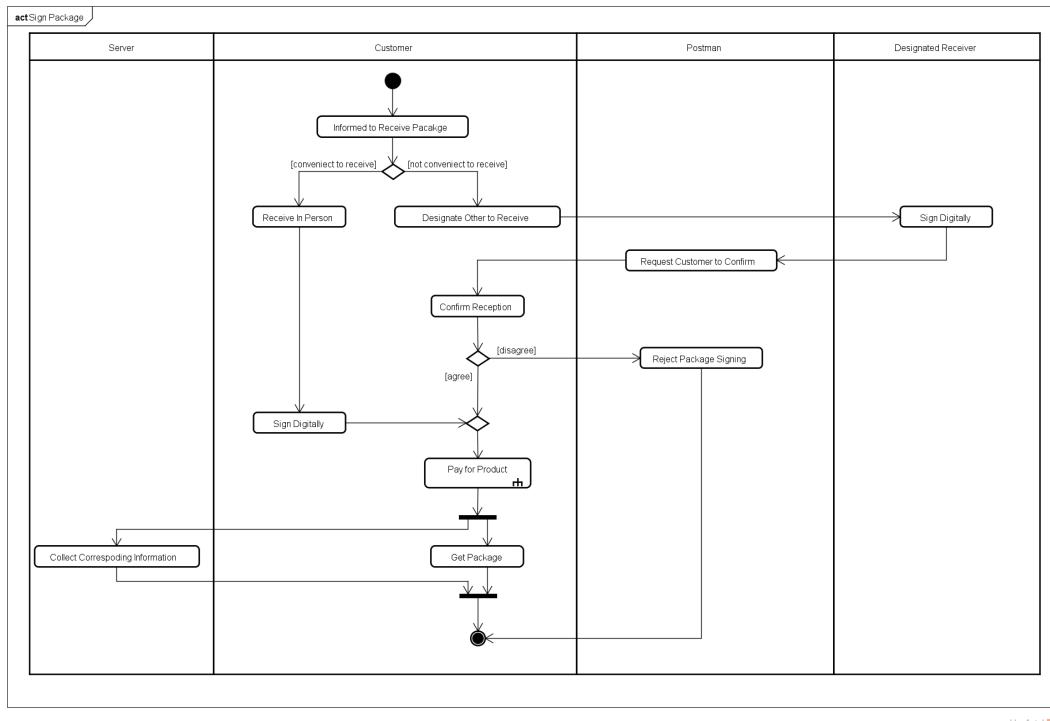


Figure 2.7: Scenario Three Activity Diagram

## Scenario Four

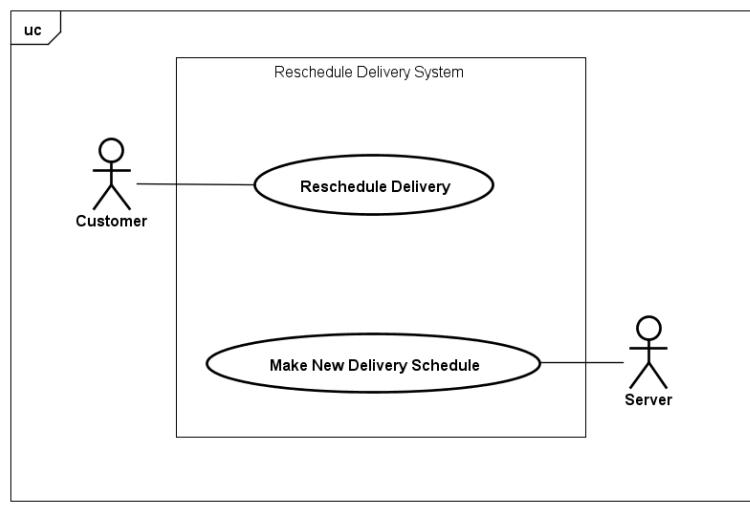
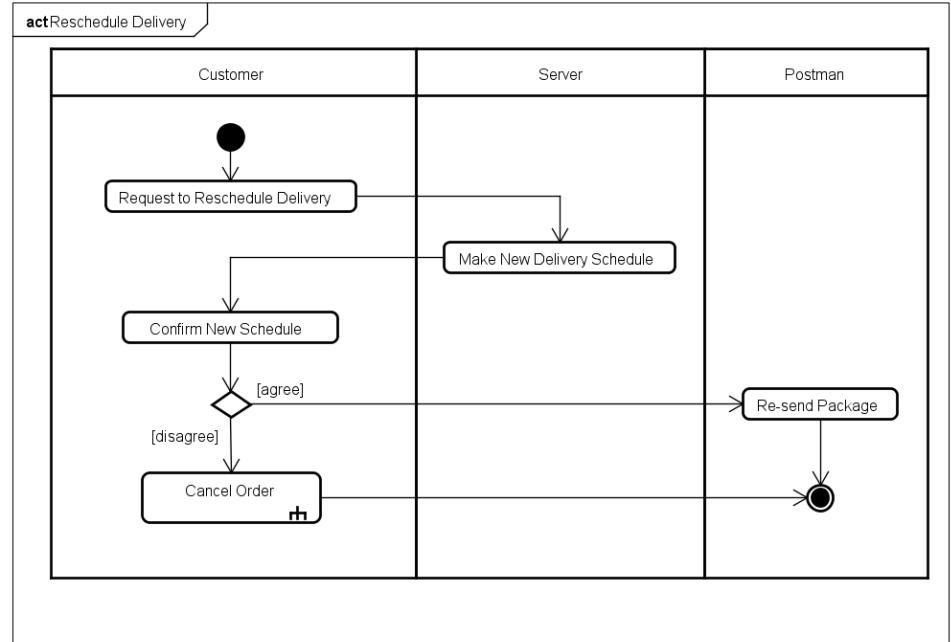


Figure 2.8: Scenario Four Use Case Diagram

Use Case Name	Make New Delivery Schedule
Related Requirements	Scenario Four
Goal in Context	Rearrange package delivery.
Preconditions	No one receives the package.
Successful End Condition	A new delivery schedule is made; Parcel would be sent again.
Failed End Condition	Delivery reschedule failed.
Primary Actors	Server
Secondary Actors	Customer, Postman
Trigger	Server make a request of reschedule package delivery.
Main Flow	<p>Step 1 : Server puts forward a new schedule.</p> <p>Step 2 : Server sends the new plan to customer to see if customer is available then.</p> <p>Step 3 : Customer replies yes.</p> <p>Step 4 : Postman sends the package again according to new schedule that specified by customer.</p>
Extensions	<p>Step 3.1 : Customer replies no.</p> <p>Step 3.2 : Made new delivery schedule again, or cancel the order.</p>

Use Case Name	Reschedule Delivery
Related Requirements	Scenario Four
Goal in Context	Rearrange package delivery.
Preconditions	Customer does not receive the package.
Successful End Condition	A new delivery schedule is made; Parcel would be sent again.
Failed End Condition	Delivery reschedule failed.
Primary Actors	Customer
Secondary Actors	Server
Trigger	Customer requests to reschedule package delivery.
Main Flow	<p>Step 1 : Customer requests the server to reschedule package delivery, sends a new time that he/she is available (and a new location if he/she needs).</p> <p>Step 2 : Server makes a new delivery plan.</p> <p>Include : Made New Delivery Schedule</p> <p>Step 3 : Customer agrees.</p> <p>Step 4 : New Schedule would be executed.</p>
Extensions	<p>Step 3.1 : Customer is not satisfied with the new schedule.</p> <p>Step 3.2 : Made new delivery schedule again, or cancel the order.</p>



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Figure 2.9: Scenario Four Activity Diagram

## Scenario Five

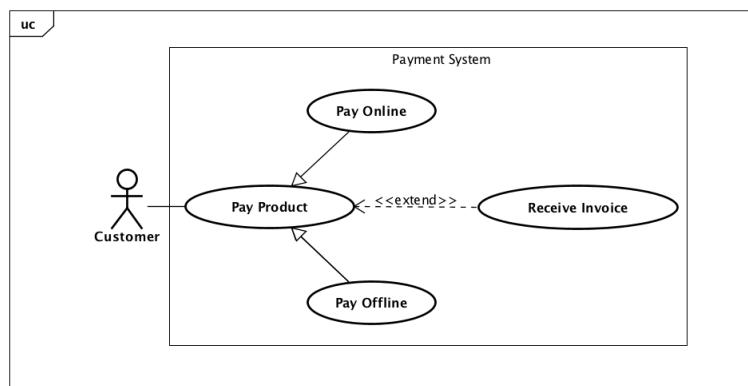


Figure 2.10: Scenario Five Use Case Diagram

Use Case Name	Pay Online
Related Requirements	Scenario Five
Goal in Context	The customer wants to pay for the product online after he/she has placed the order.
Preconditions	The customer has placed the order, and paying online is provided.
Successful End Condition	The payment is completed.
Failed End Condition	The order has been canceled.
Primary Actors	Customer
Secondary Actors	None
Trigger	The customer places the order.
Main Flow	<p>Step 1 : Customer logs in the Third-party Trade system.</p> <p>Step 2 : Customer checks the amount in the system.</p> <p>Step 3 : Customer enters the password to pay.</p> <p>Step 4 : Customer finishes the payment.</p> <p>Step 5 : E-business receives the payment.</p>
Extensions	None

Use Case Name	Pay for Product
Related Requirements	Scenario Five
Goal in Context	The customer needs to pay for the product after he/she has placed the product or received the product.
Preconditions	The customer has placed the order.
Successful End Condition	The payment is completed.
Failed End Condition	The order has been canceled or the customer has not received the product for some reasons.
Primary Actors	Customer
Secondary Actors	None
Trigger	The customer places the order or receives the product.
Main Flow	<p>Step 1 : Customer chooses one acceptable way to pay for the product.</p> <p>Step 2 : Customer checks the amount.</p> <p>Step 3 : Customer finishes the payment.</p> <p>Step 4 : E-business receives the payment.</p>
Extensions	Step3.1 : Customer asks for a invoice about the product.

Use Case Name	Pay Offline
Related Requirements	Scenario Five
Goal in Context	The customer wants to pay for the product offline after he/she has received the product.
Preconditions	The customer has received the product, and paying offline is provided.
Successful End Condition	The payment is completed.
Failed End Condition	The customer has not received the product for some reasons.
Primary Actors	Customer
Secondary Actors	Postman
Trigger	The customer receives the product.
Main Flow	<p>Step 1 : Postman checks the amount with the customer.</p> <p>Step 2 : Customer chooses one way to pay, by cash or by credit card.</p> <p>Step 3 : Customer finishes the payment.</p> <p>Step 4 : Postman records the information about the payment.</p> <p>Step 5 : The logistics company transfers the money to E-business.</p>
Extensions	<p>Step 2.1 : Customer chooses to pay by cash.        Customers pays for the product by cash.        Postman checks the amounts of money and confirms the payment in the app.</p> <p>Step 2.2 : Customer Chooses to pay by credit card.        Postman provide the POS device for the customer.        Customer gives the postman his/her Visa card or Union-Pay card.        Postman swipes the card and enters the amount of money.        Customer enters the password.        The bank system adds money to the logistics company's account.</p> <p>Step 4.1 : Postman submits the money to the logistics company.</p>

Use Case Name	Provide Invoice
Related Requirements	Scenario Five
Goal in Context	E-business provides the invoice about the product for the customer.
Preconditions	The customer has completed the payment and asks for the invoice.
Successful End Condition	The Invoice has been sent to the customer.
Failed End Condition	E-business rejects the request.
Primary Actors	E-business
Secondary Actors	Customer
Trigger	Customer asks for the invoice about the product.
Main Flow	<p>Step 1 : Customer choose one way to receive the invoice, digital invoice sent by e-mail or a paper invoice sent by post.</p> <p>Step 2 : E-business sends the invoice to the customer.</p> <p>Step 3 : Customer receives the invoice and confirm whether the infomation is onsistent.</p>
Extensions	<p>Step 1.1 : Customer chooses to receive a digital invoice sent by e-mail.            Customer fills in the e-mail address in the app.</p> <p>Step 1.2 : Customer chooses to receive a paper invoice sent by post.            Customer fills in the mailing address in the app.</p>

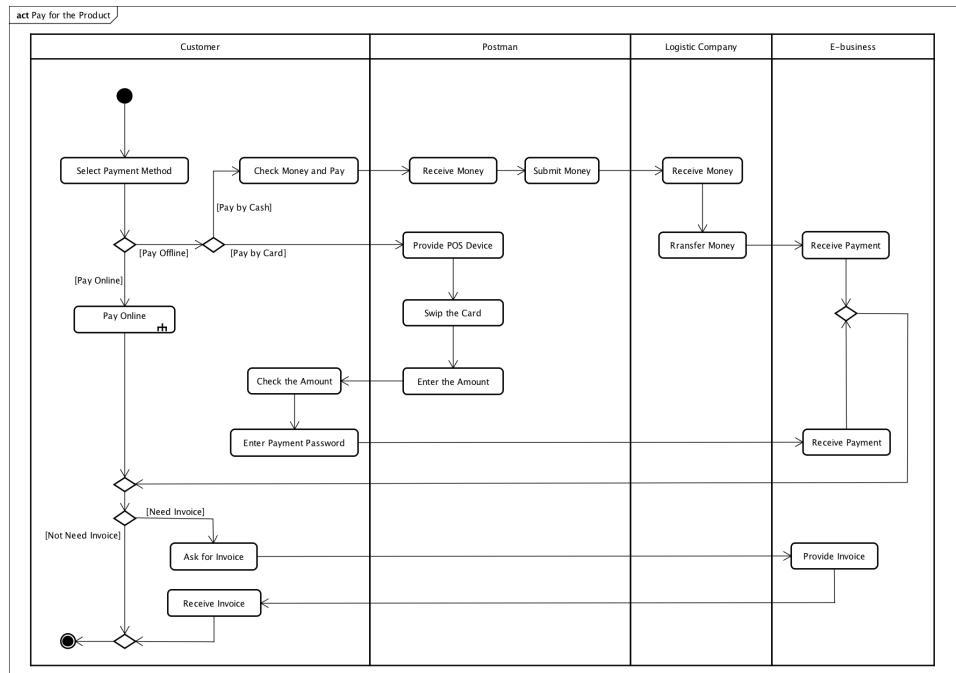


Figure 2.11: Scenario Five Activity Diagram: Pay The Product

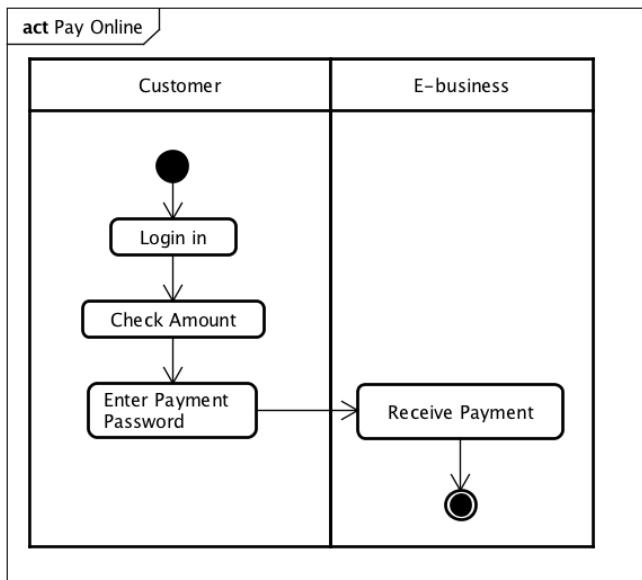


Figure 2.12: Scenario Five Activity Diagram: Pay Online

## Scenario Six

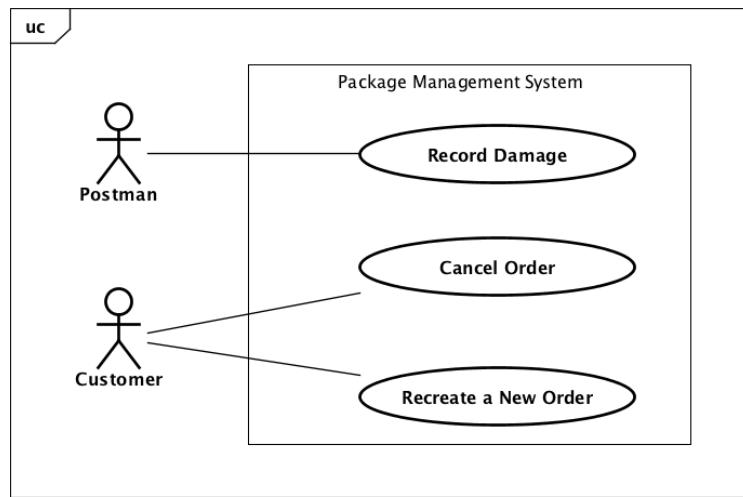


Figure 2.13: Scenario Six Use Case Diagram

Use Case Name	Record Damage
Related Requirements	Scenario Six
Goal in Context	Postman records the information of the damaged or lost package.
Preconditions	The package was damaged or lost.
Successful End Condition	Postman records the information successfully.
Failed End Condition	The information of the package was lost as well.
Primary Actors	Postman
Secondary Actors	None
Trigger	The package was damaged or lost.
Main Flow	Step 1 : Postman records the information of the package. Step 2 : The logistics company receives the corresponding information. Step 3 : The logistics company sends a message to the customer, explaining the situation and making an apology to the customer.
Extensions	None

Use Case Name	Cancel Order
Related Requirements	Scenario Six
Goal in Context	The customer wants to cancel the order for some reasons.
Preconditions	The customer has placed the order. The package has not been shipped or the package was damaged or lost during process of delivery.
Successful End Condition	The logistics company passes the request.
Failed End Condition	The request is rejected.
Primary Actors	Customer
Secondary Actors	None
Trigger	The customer makes the request of canceling the order.
Main Flow	Step 1 : Customer logins the logistics system. Step 2 : Customer selects the button "cancel the order". Step 3 : Customer explains the reason. Step 4 : The logistics company receives the request and passes the request.
Extensions	None

Use Case Name	Recreate a New Order
Related Requirements	Scenario Six
Goal in Context	The customer wants to recreate a new order without any extra fees because the old package was damaged or lost.
Preconditions	The old package was damaged or lost and the customer has received the message from the logistics company.
Successful End Condition	The new order is placed successfully.
Failed End Condition	The new order is non-compliant and rejected.
Primary Actors	Customer
Secondary Actors	None
Trigger	The customer makes the request of recreating a new order.
Main Flow	Step 1 : Customer receives the message about the information of the damaged or lost package. Step 2 : Customer logins the logistics system. Step 3 : Customer chooses to deliver a new package. Step 4 : Customer fills in the basic information and recreates a new order without any extra fees. Step 5 : The logistics company receives the new order and passes the request.
Extensions	None

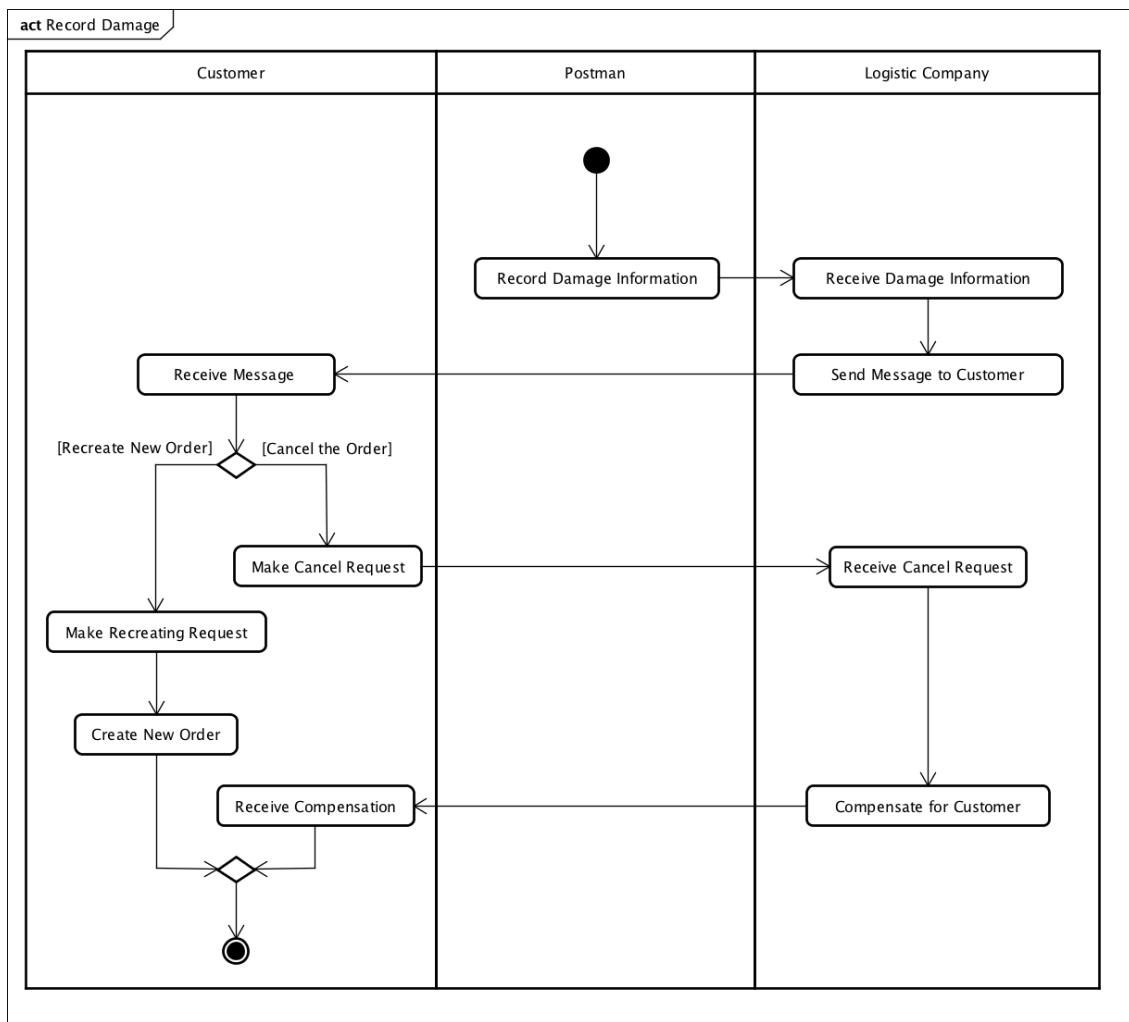


Figure 2.14: Scenario Six Activity Diagram

## Scenario Seven

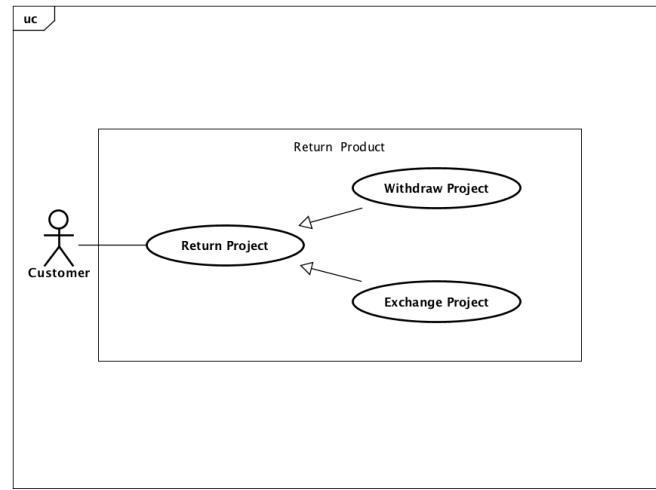


Figure 2.15: Scenario Seven Use Case Diagram

Use Case Name	Withdraw Product
Related Requirements	Scenario Seven
Goal in Context	A customer returns the product and the payment is reimbursed.
Preconditions	The customer wants to withdraw the product or she unsatisfied with after receiving within a month.
Successful End Condition	The order is completed and the payment is reimbursed to the customer.
Failed End Condition	The order is not completed and the payment is not reimbursed to the customer.
Primary Actors	Customer
Secondary Actors	None
Trigger	The customer choose to withdraw the product.
Main Flow	Step 1 : Customer makes the returning request. Step 2 : Server checks the returning request. Step 3 : The package is delivered. Step 4 : The E-business receives and checks the pack. Step 5 : The E-business agrees the returning. Step 6 : Server make the new delivery schedule.
Extensions	Step 2.1 : The database does not verify the details. Step 3.1 : The package fails to be delivered. Step 5.1 : The E-business doesn't agree the withdrawing.

Use Case Name	Exchange Product
Related Requirements	Scenario Seven
Goal in Context	A customer returns the product and the delivery schedule is made again upon mutual agreement.
Preconditions	The customer wants to exchange the product the or she unsatisfied with after receiving within a month.
Successful End Condition	The delivery schedule is made again upon mutual agreement.
Failed End Condition	The delivery schedule fails to be made again upon mutual agreement.
Primary Actors	Customer
Secondary Actors	None
Trigger	The customer choose to exchange the product.
Main Flow	<p>Step 1 : Customer makes the returning request.</p> <p>Step 2 : Server checks the returning request.</p> <p>Step 3 : The package is delivered.</p> <p>Step 4 : The E-business receives and checks the pack.</p> <p>Step 5 : The E-business agrees the returning.</p> <p>Step 6 : Server make the new delivery schedule.</p>
Extensions	<p>Step 2.1 : The database does not verify the details.</p> <p>Step 3.1 : The package fails to be delivered.</p> <p>Step 5.1 : The E-business doesn't agree the exchange.</p>

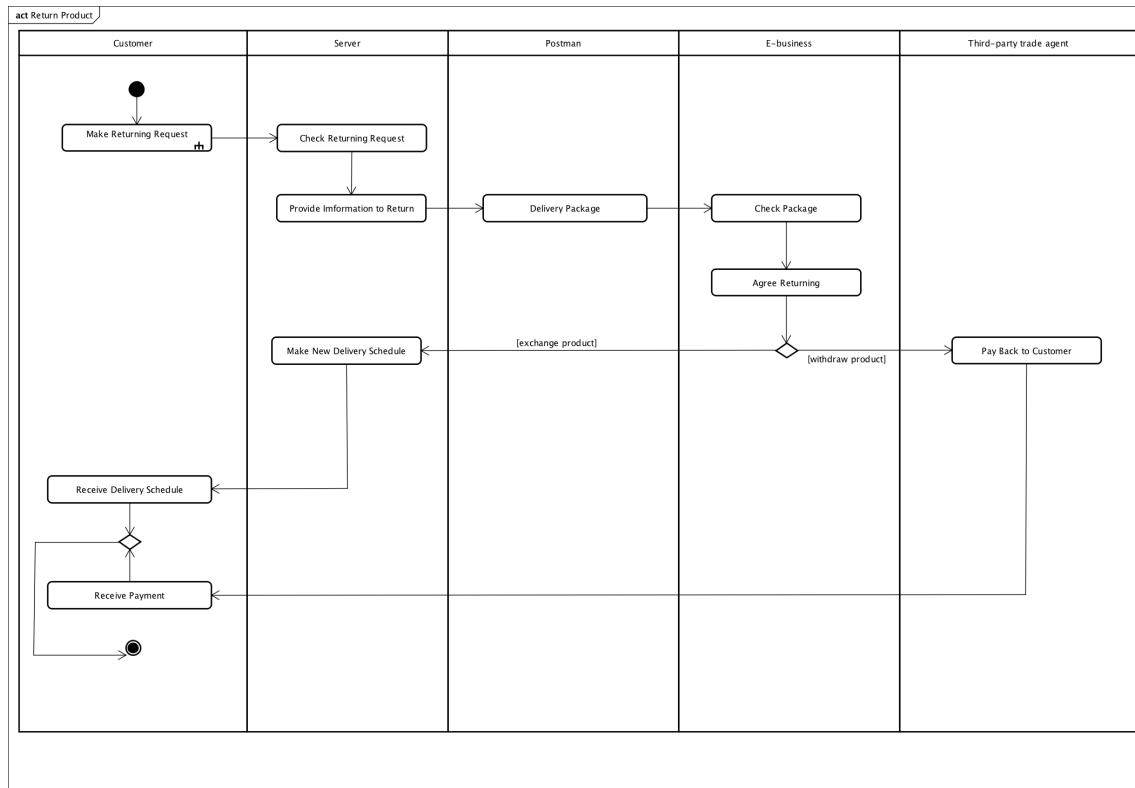


Figure 2.16: Scenario Seven Activity Diagram: Return Product

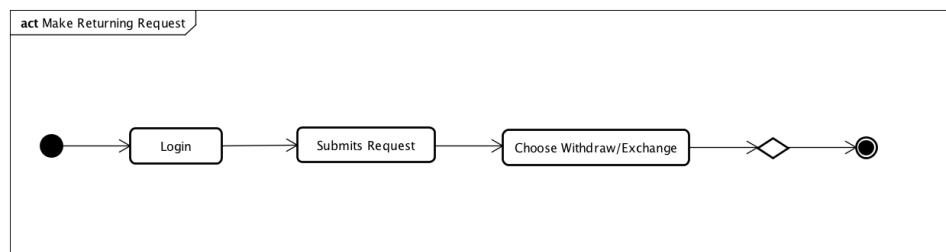


Figure 2.17: Scenario Seven Activity Diagram: Make Returning Request

## Scenario Eight

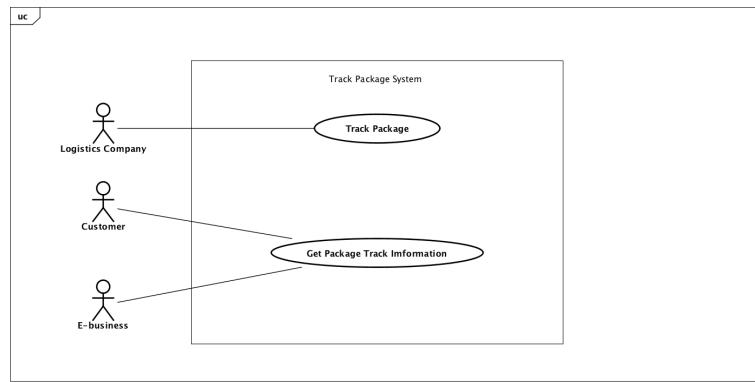


Figure 2.18: Scenario Seven Use Case Diagram

Use Case Name	Track Package
Related Requirements	Scenario Eight
Goal in Context	The logistics tracks all the packages, collecting the location at fixed period and inserting new addresses of destinations into the database.
Preconditions	The customer or the e-business company deliver the package.
Successful End Condition	The logistics tracks all the packages and feeds back to the customer or the E-business.
Failed End Condition	The logistics fails track all the packages and feed back to the customer or the E-business.
Primary Actors	Logistics
Secondary Actors	None
Trigger	Postman receives the package from the customer.
Main Flow	<p>Step 1 : Postman receives and expresses the package to the logistics.</p> <p>Step 2 : Logistics delivers the package to the express station.</p> <p>Step 3 : The express station scans the bar code.</p> <p>Step 4 : Server records the express station information of the package.</p> <p>Step 5 : Logistics delivers the package to the next express station.</p>
Extensions	Step 3.1 : The express station fails to scan the bar code and gets a new bar code.

Use Case Name	Get Package Track Information
Related Requirements	Scenario Eight
Goal in Context	The customer or the e-business can get track information of the package delivered.
Preconditions	<p>1. The returning request is admitted.</p> <p>2. The customer or E-business delivers the returning product.</p> <p>3. The package has not been transferred to the receiver.</p> <p>4. The customer or the E-business has obtained the tracking number.</p> <p>5. The logistics tracks all the packages, collecting the GPS location at fixed period and inserting new GPS addresses of destinations into the database automatically.</p>
Successful End Condition	The customer or the e-business successfully tracks the package he or she delivered.
Failed End Condition	The customer or the e-business successfully failed to track the package he or she delivered.
Primary Actors	Customer, E-business
Secondary Actors	None
Trigger	The customer or the E-business logins the system.
Main Flow	<p>Step 1 : The customer or the E-business logins the system.</p> <p>Step 2 : The customer or the E-business inputs the tracking number.</p> <p>Step 3 : The customer or the E-business get package track information.</p>
Extensions	Step 1.1 : The customer or the E-business failed to login the system with the wrong account and password.

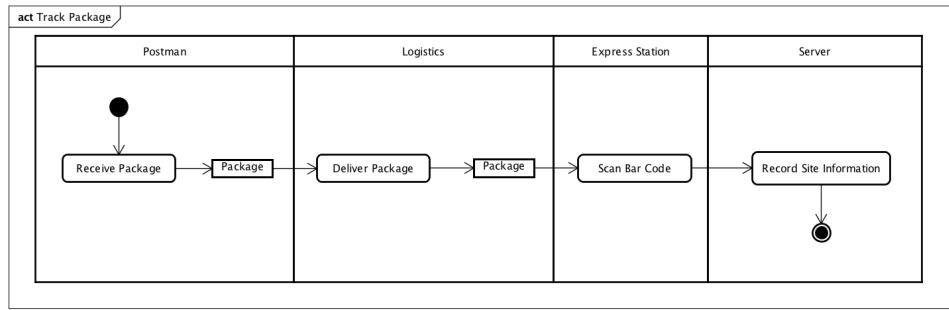


Figure 2.19: Scenario Seven Activity Diagram: Track Package

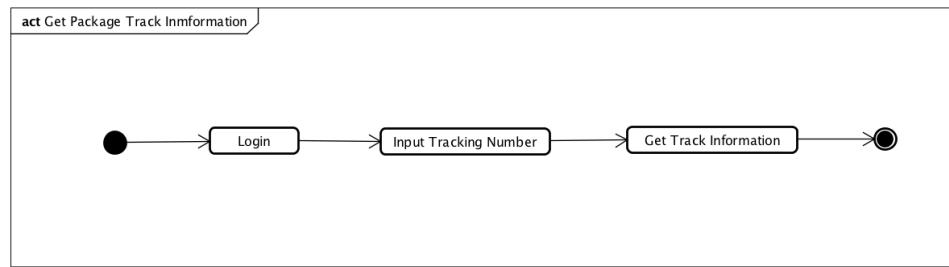


Figure 2.20: Scenario Seven Activity Diagram: Get Package Track Information

## 2.2 Supplementary Specification

### 2.2.1 Security

The system should avoid the database being attacked and data being taken advantage of by the wicked.

#### Access and Data Integrity

1. The authorization of access to the system of postmen, customers and customer servers should be classified and announced clearly. With certain authorization, different users have limited access to data and operation.
2. The server should use anti-virus software.
3. Firewalls and network protection are necessary, and they should be updated in time.
4. The atomic processes in the database will ensure the accuracy of the database.

## **Encryption**

1. The session should not be transmitted in DNS.
2. All texts and messages should be encrypted with Encryption Algorithm such as RSA, 3DES or IDEA.
3. Two keys are used to identify a certain user. One public key is used for encryption and another private key is used for decryption. The key is a completely random mix of letters.
4. The session will record the activity of the customer, and if the customer has no operation for 5 minutes, he or she will log out the system automatically.
5. After customers log out the system, all the private information(cookies) will be cleaned.

## **Digital Certificates**

1. We use digital certificates as a replacement of user names and passwords, for example, SSL Certificates. It will be used automatically with the permission of users.
2. The IP address or location where users log in the system will be recorded and when the account is used beyond their regular locations, the user will get alarmed.

## **Digital Signatures**

1. Users should log in the system with a password. Our system will test its complexity. If it is too simple, the system will remind the users to complicate it. That involves cryptography.
2. We use a message digest to ensure the integrality of the data.
3. If necessary, we can extend our fingerprint system to login system.

### **2.2.2 Performance**

1. The information of the package, including the real-time position, Order-ID, the postman etc., should be checked by customers in 3 seconds with at most 0.1% error rate.
2. The payment should be confirmed in 2 seconds by the system from the moment when the third party trade agent sends the message or the postmen report the payment.
3. The order created by customers should be processed in 15 minutes.
4. The orders obtained from e-business should be processed every hour(about 5,000 orders).

5. Information of the delivery such as the phone number, the address, the receiver and others should be updated and checked by postman in 1 min.
6. This system allows the e-business to create batch orders which can be sent at regular time.
7. The estimate of delivery time should be accurate with the max uncertainty in 2 days.
8. The expectation should be sent to custom service in 2 min from the time a postman reports it.
9. This system's unavailable time should be controlled in 20 minutes in a year.
10. To offer the best user experience, a content delivery network should be used by this system.

### **2.2.3 Data Storage and Computing**

1. To store a huge amount of data, distributed database should be used. And it should use Homogeneous Distributed Databases Management System.
2. Considering that there may be an enormous number of visitors and inquiries at the same time, the system must implement cloud computing service.
3. The system can support as many as 1500 times of visits per second.
4. There must be a copy of the database, including device entity, software, data and even employees, in order to prevent some unpredictable disasters.
5. If the database is destroyed, the copy should be enabled in 3 hours.
6. The data can be in English, Chinese, Japanese, French and Korean.

### **2.2.4 Track the Package**

1. In order to track the package, the GIS system should be applied, with the help of the GPS system. The system gets geographic information from a third party system, and get the position of postmen who deliver the package through the system of postmen. And this system should match both kinds of the information and show it to users of the system.
2. The system for postmen should upload the position of the postman automatically every 2 hours, through 3G, 4G or WLAN network.
3. If the locations of postmen are missing for 4 hours, the system should inform the custom servers, and custom servers will contact with postmen.

## **2.2.5 Maintenance**

1. The distributed database should be maintained by the employees of our own company including the employees of the standby database every day when the visiting traffic is not heavy.
2. The software for custom service, customer and postmen and the system itself should be maintained by our employees.
3. The geographic information source should be multiple, in case that one of the sources is unavailable.
4. The engineers from the company offered DBMS will maintain our system every year.
5. An integrated scheme to deal accidents, for example, the crash of database, is necessary.

## **2.2.6 Others**

1. The architectures of the postman app and the customer app are B/S and C/S, but that of custom service is C/S for safety.
2. Our system can be used in iOS and Android on mobile devices and in a normal browser on PC(Windows/macOS/Unix).
3. Anticipated development time is two months.

# 3 Analysis

## 3.1 Architectural Analysis

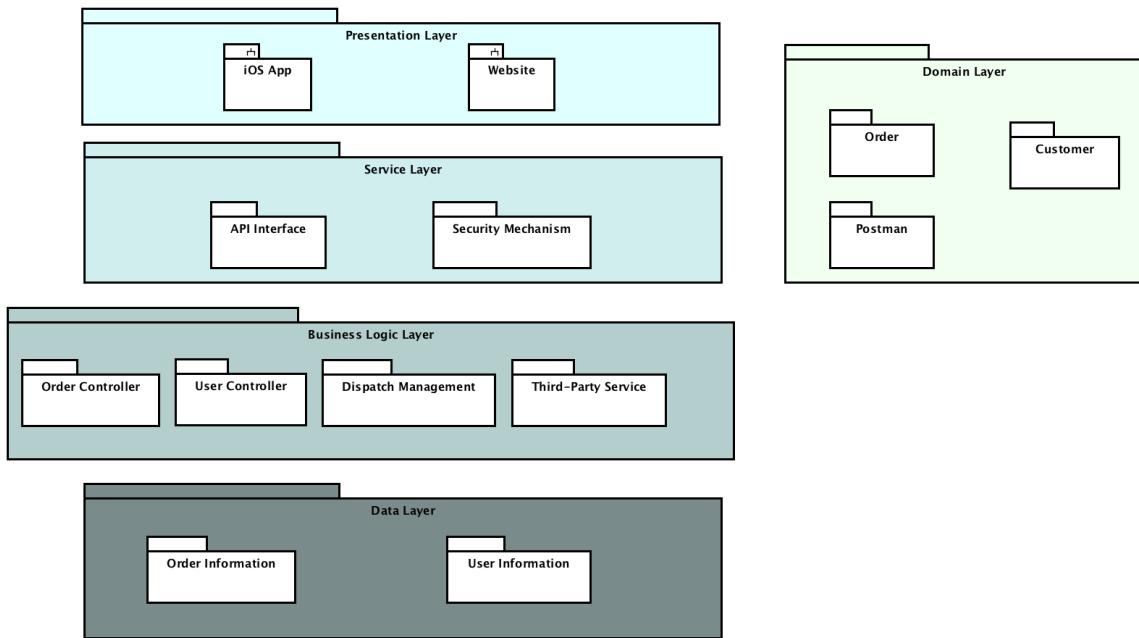


Figure 3.1: Package Diagram

### 3.1.1 System Structure

The architecture has 5 layers, which are extended from the 4-tier architecture. We have taken extensibility, code reusability into consideration. 5 layers are as follows.

#### Presentation Layer

The first layer is Presentation Layer. This layer provides a user interface to translate the logistics information to user friendly representation. It contains Web front-end and iOS app, serving as user's entry of the system. It transfers the information the transport layer and call the API, provided by the transport layer. The layer in out system consists of two subsystems, iOS app and Website. As for the platforms consideration, the website will take

advantage of Bootstrap framework, using the language of HTML, CSS and JavaScript. The iOS app will use the Cocoa Touch, Media, Core Services and Core OS in the development.

### **Service Layer**

The second layer is Service Layer. This layer works as a coordinator of our system. It provides some Application Programming Interface(API) to the Presentation Layer, including Web API, iOS API and external API. The external API provides interfaces to some third-party services, such as Alipay API provides the services for pay via Alipay Account. This layer plays a role of delivering the request from Presentation Layer to Busniess Logic Layer. We have designed protocols and different frameworks to implement those API, including Spring Web and UIKit.

### **Business Logic Layer**

The third layer is Business Logic Layer. This layer contains several controllers including Order Controller, User Controller, Dispatch Management and Third-Party Service. In our system, these controllers will process the data and make package the update UI operation. This layer is one of the part of MVC(Model-View-Controller) framework.

### **Data Layer**

The fourth layer is Data Layer. This layer define the data model of our system, including data access and data maintenance. It contains Order Information and User Information which is entity in our database system. In this layer, we will take advantage of different database and handle different type efficiently(e.g. structural and non-structural data). We will use Oracle DBMS and SQL language. For the data access, we will choose the Hibernate and NHibernate framework.

### **Domain Layer**

The last layer is Domain Layer. The Domain Layer contains 3 packages including Order, Customer, Postman. This layer contains the concrete information stored in our system. It provides services for the Business Logic Layer by helping it get concrete information. We sperate these information into this independent layer, so that there will be less data redundancy and the efficiency of reading or writing will be improved. This layer is also related with the Data Layer, It needs the service and support of the Data Layer.

## 3.2 Analysis Model

### 3.2.1 Global Class Diagram

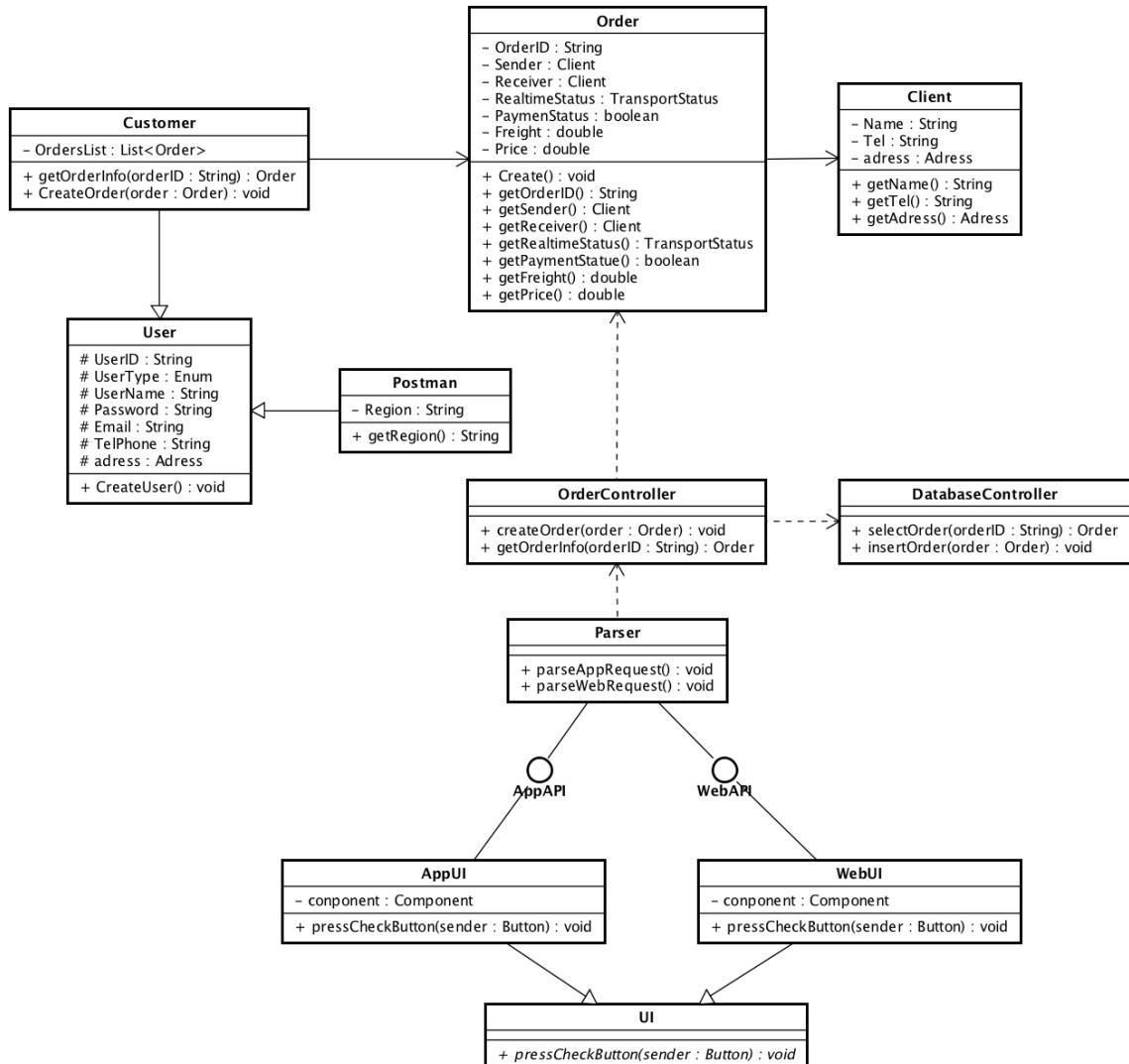


Figure 3.2: Global Class Diagram

The first part is the domain layer, which contains the User Class, Order Class and Client Class. Thus, Customer and Postman is the subclass of User and implement the method. The User Class records the basic information of a user. User ID is the primary key of Use and User Type is an enum consisting of [Customer, Postman, Superuser]. The user can login the system by email or ID or telephone number and password. In the newly created class, it's instance stores the detailed information of the order, including user's name, phone

number, and address. This class is designed as a self-define data type and can be used to compare the information of users stored in our system.

The class Customer has a corresponding order list and the attributes to sign the package. The Postman has the attribute ‘region’ to identify the areas where he is in charge of. We define the public API of User to provide services for the controller.

The class Order record the basic information of an order. The Order ID is the primary key of Order. Since the sender or the receiver may not register an account in the system, the Order class records the name, Tel number and address of sender and receiver. The class Order is designed for containing information about our orders and all the basic services will be offered by the controller, such as [createOrder(), getOrderInfo()]. When the user tracks the package, System will return the real-time address of the order.

The second part is the controller classes. All the requests from UI are sent to the Parser. The Parser provides Order Controller APIs to web UI and app UI. It will parse the request and delivery the request to corresponding controller. The DatabaseController collects the necessary information to record in the database and handles the request and returns the result to UI. For example, when the user tracks the package by using the app UI, the app UI will call the app API and sends the request to Parser then to the OrderController.

The third part is the boundary classes containing the UI class. The AppUI provides a lot of functions for users, which is the same with the WebUI.

### 3.2.2 Use Case Realization

#### Scenario One

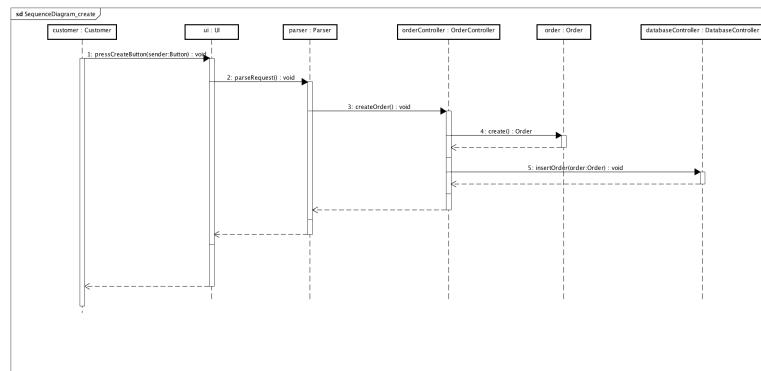


Figure 3.3: Scenario One Sequence Diagram: Create

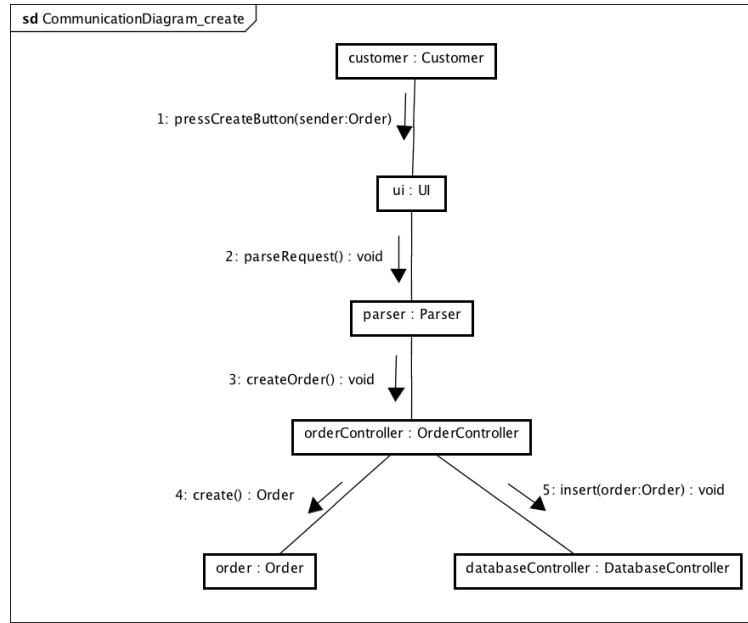


Figure 3.4: Scenario One Communication Diagram: Create

As seen in the communication diagram or sequence diagram, the customer can create order in our order management system. The customer will create order by pressing the corresponding buttons on user interface. After getting the request, user interface will send the request to the parser. Then, the parer send messages to the order controller to create order. The order controller, as seen from its name, will send the creating messages to the class order and control its creation of order, then new order will be created and inserted to database by database controller.

## Scenario Two

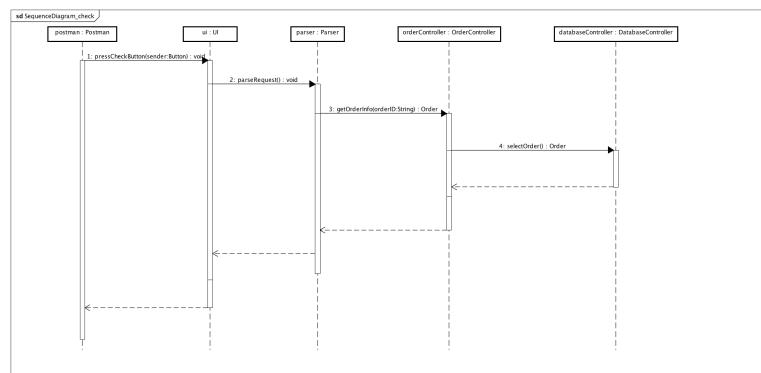


Figure 3.5: Scenario Two Sequence Diagram: Check

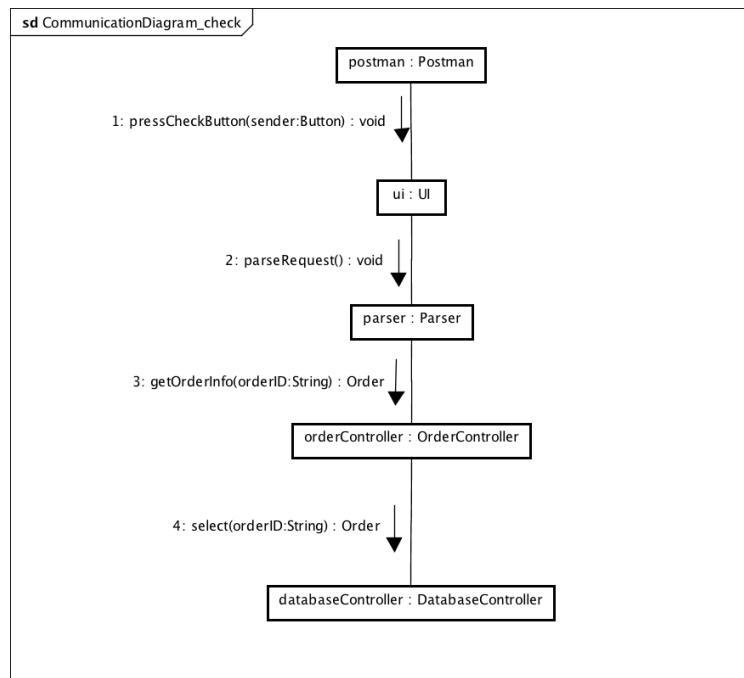


Figure 3.6: Scenario Two Communication Diagram: Check

As seen in the communication diagram or sequence diagram, postman can check order information in our order management system. Postman will check order information by pressing the corresponding buttons on user interface. After getting the request, the user interface will send the request to parser by calling the API. The parser will analyze the request and send messages to the order controller. Then the order controller will call database controller to select corresponding order information from database.

## Scenario Three & Four

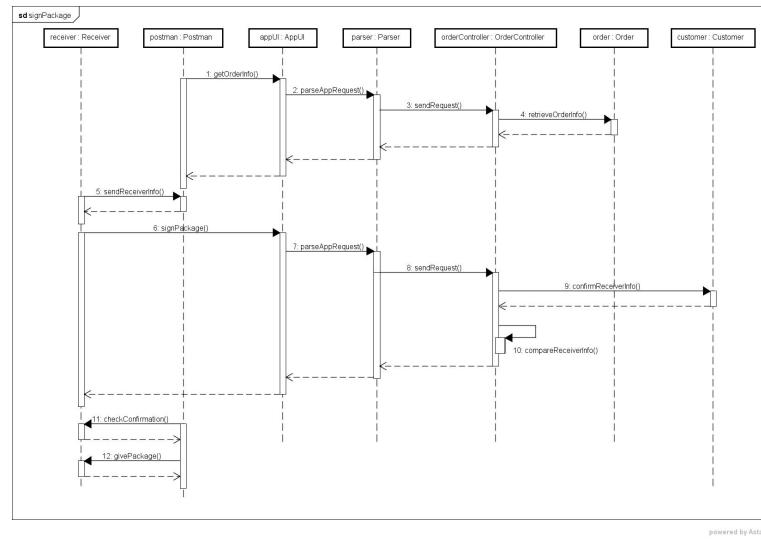


Figure 3.7: Scenario Three & Four Sequence Diagram: Sign Package

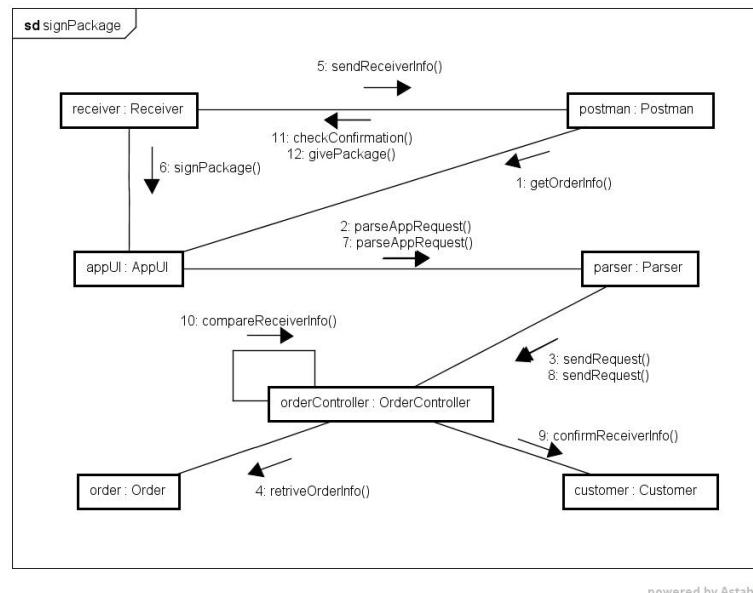


Figure 3.8: Scenario Three & Four Communication Diagram: Sign Package

The process of signing package is shown as the sequence diagram below. First of all, the postman needs to know information of the customer. As a result, a request of retrieving the order information will be sent by postman. The parser here is to analysis requests from UI

and transmit to the controller. Information, including customer's name and phone number, will be returned to the postman. After that, the receiver is supposed to inform the postman her information. In order to verify if she is the designated person or customer herself, a confirmation of customer is required. If so, the receiver will have access to sign the package; otherwise, the demand of signing the package should be rejected.

## Scenario Five

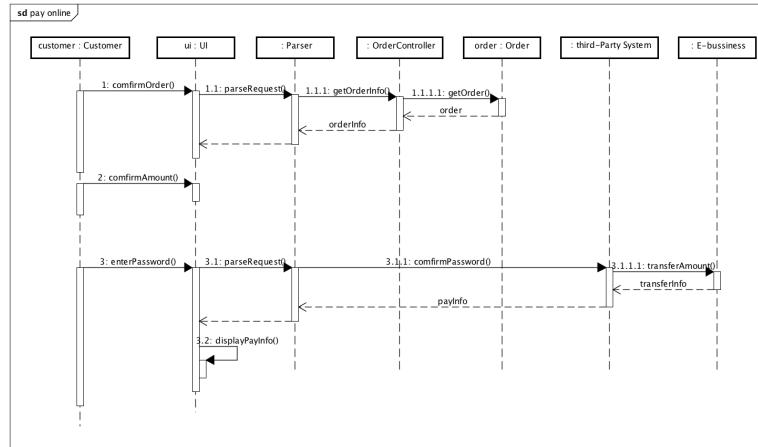


Figure 3.9: Scenario Five Sequence Diagram: Pay Online

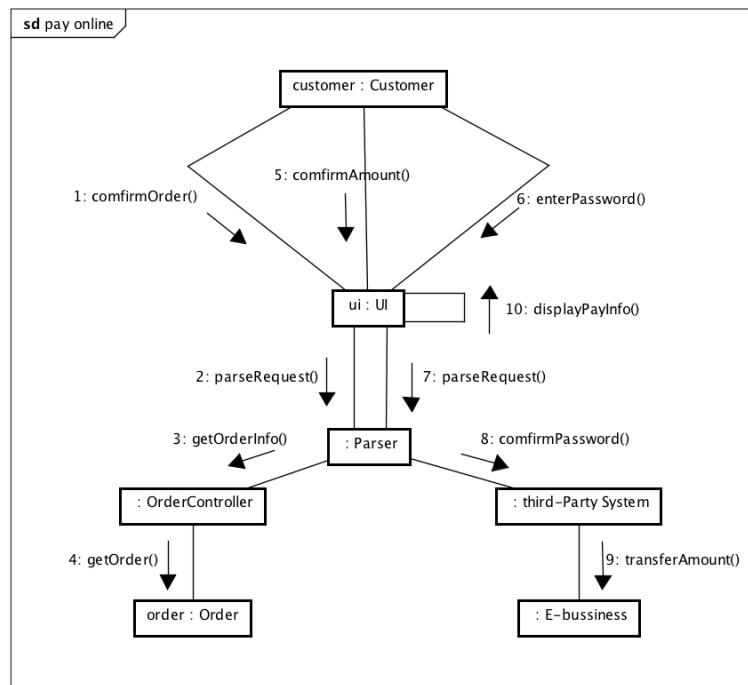


Figure 3.10: Scenario Five Communication Diagram: Pay Online

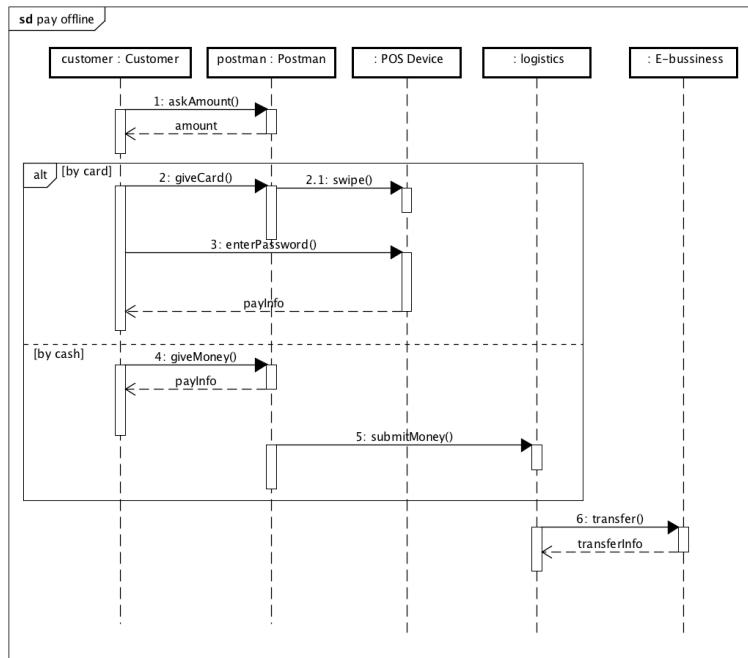


Figure 3.11: Scenario Five Sequence Diagram: Pay Offline

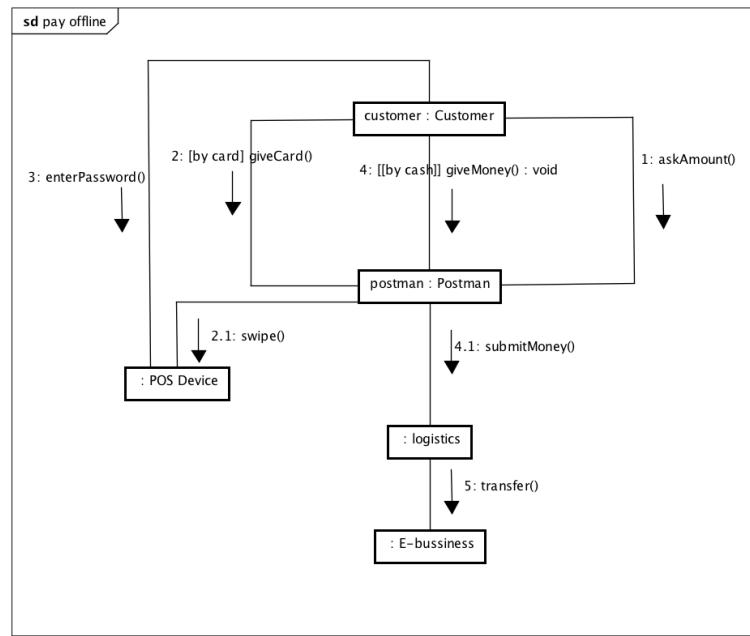


Figure 3.12: Scenario Five Communication Diagram: Pay Offline

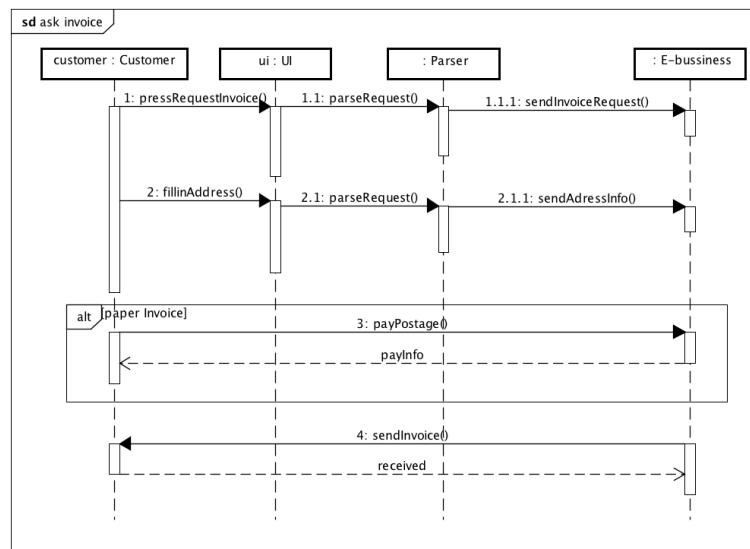


Figure 3.13: Scenario Five Sequence Diagram: Ask Invoice

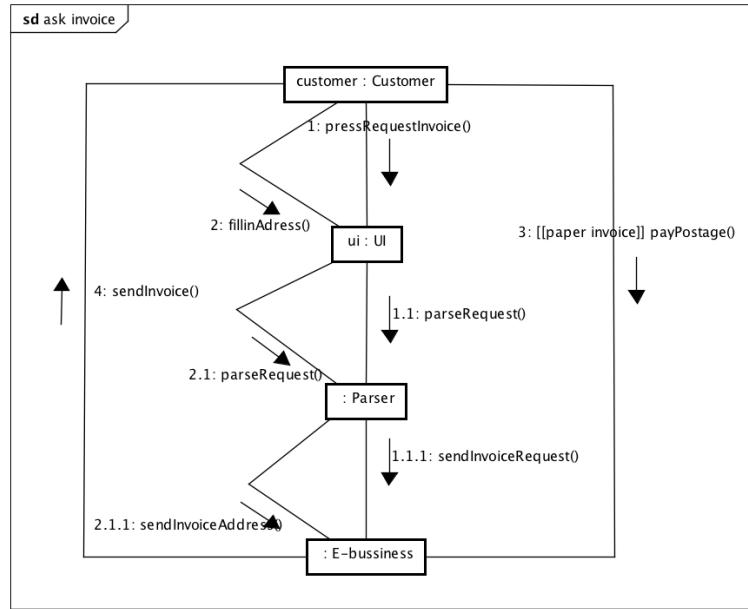


Figure 3.14: Scenario Five Communication Diagram: Ask Invoice

After the customer creates an order, he or she should choose one way to pay for the product, pay online or pay offline. If the customer chooses to pay online, he or she should enter the payment password after confirmed the order. And the Parser will parse the request and send the password to the third-Party System. Then the third-Party System will response the payment information(success or failed) and the ui will display the payment information. On the other hand, if the customer chooses to pay offline, he or she needs to pay after received the product. The customers pays for the product by cash or by card after checked the amount with the postman. Then the postman submits the money to the logistic company. After the third-Party System or logistic company received the amount, it will transfer money to the E-business.

After paid the product, the customer has the opportunity to ask the E-business for an invoice. He or she fills in the address in the app, and then the Parser will parse the request and send the address to the E-business. If the customer wants a paper invoice, he or she needs to pay an extra postage for the invoice. After that, the E-business will send the invoice to the customer.

## Scenario Six

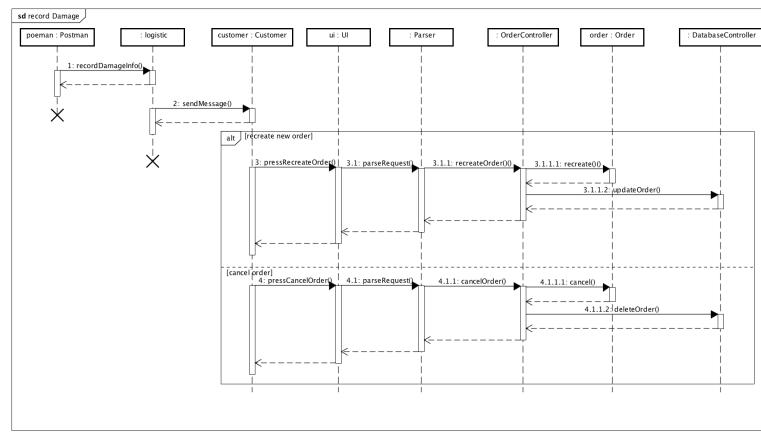


Figure 3.15: Scenario Six Sequence Diagram: Record Damage

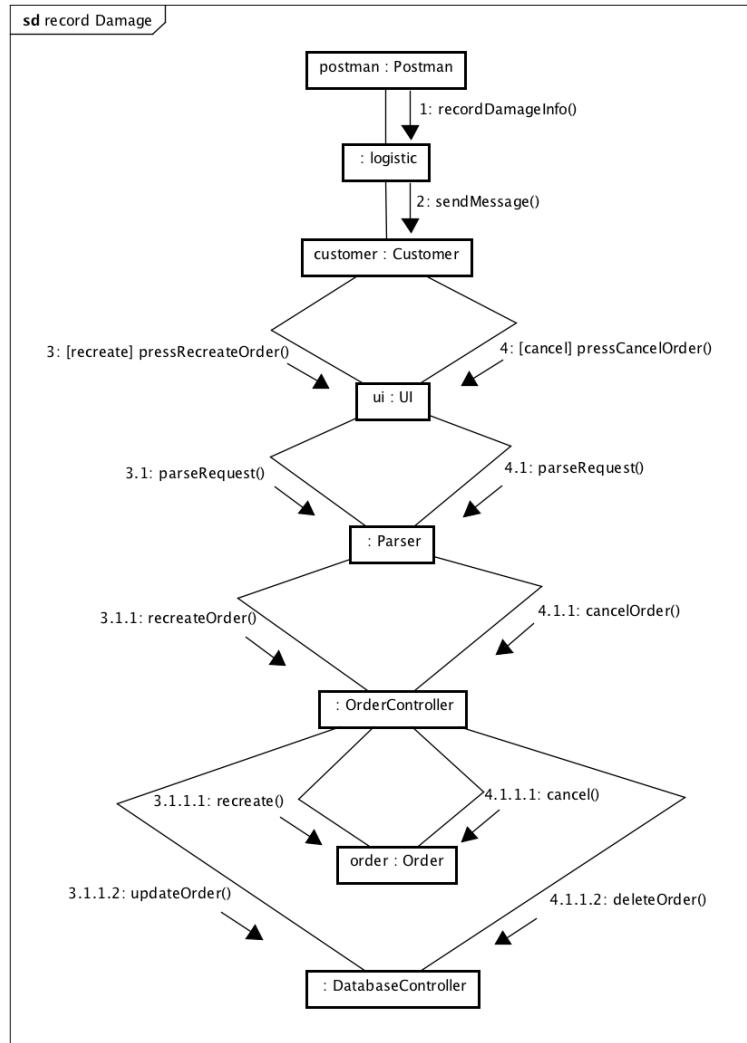


Figure 3.16: Scenario Six Communication Diagram: Record Damage

If the package is damaged or lost, the postman records the damages and sends the damages information to the logistic company. Then the logistic company will send an apology message to the customer. After received the message, the customer can choose to recreate a new order or cancel the order. He or she needs to press the recreate or cancel button in the app, and then the Parser will parse the request and send a signal to the OrderController. After received the signal, the OrderController will execute a function to update or delete the order information in the database.

## Scenario Seven

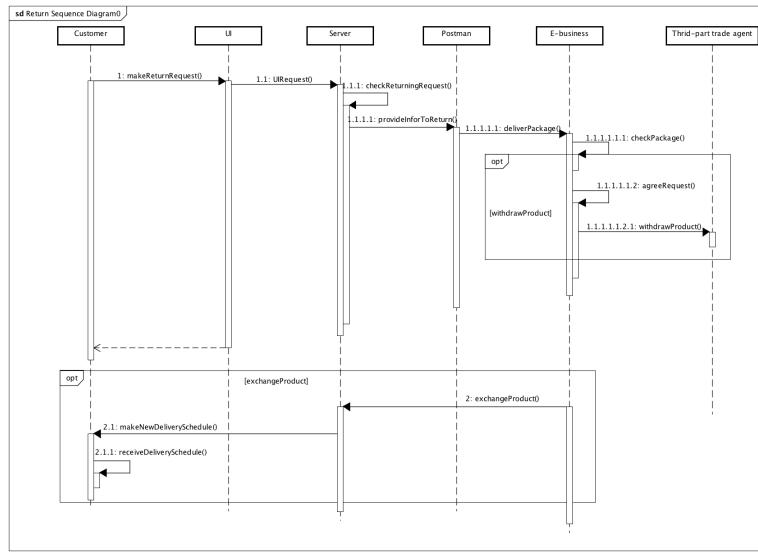


Figure 3.17: Scenario Seven Sequence Diagram: Return

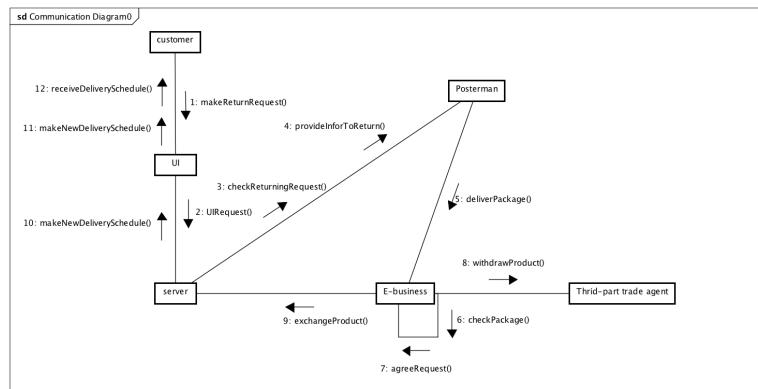


Figure 3.18: Scenario Seven Communication Diagram: Return

If the customer is unsatisfied with the product, he/she can return the product. Customers need to apply for returning through both App UI and Web UI. Then Parser will recognizes that request and assigns it to OrderController so Order Domain will return a label containing the address to send it back and the postage.

If the customer chooses to cancel the order, after a similar process, the order will be completed. Else if he/she chooses to withdraw the order, the original order will be recorded through **withdrawProduct()** and then be completed.

## Scenario Eight

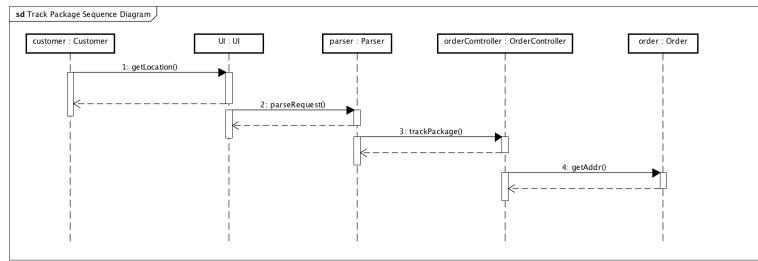


Figure 3.19: Scenario Eight Sequence Diagram: Track

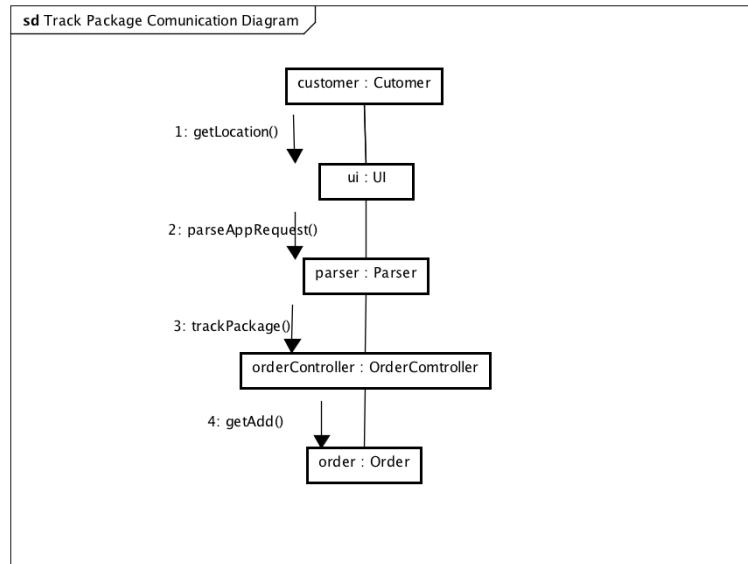


Figure 3.20: Scenario Eight Communication Diagram: Track

Customers and Customer Service have the right to track the product. Customer will invoke the function on UI. Messages will be sent to Parser in URL link. After parsing the link, Parser invokes the trackPackage function of OrderController. OrderController will then get the location by invoking the function of order entity. After getting the real time address, the system will return this information to the UI who invokes the function.

# 4 User Interface

## 4.1 Mobile Devices(iOS)

### 4.1.1 Log in Page

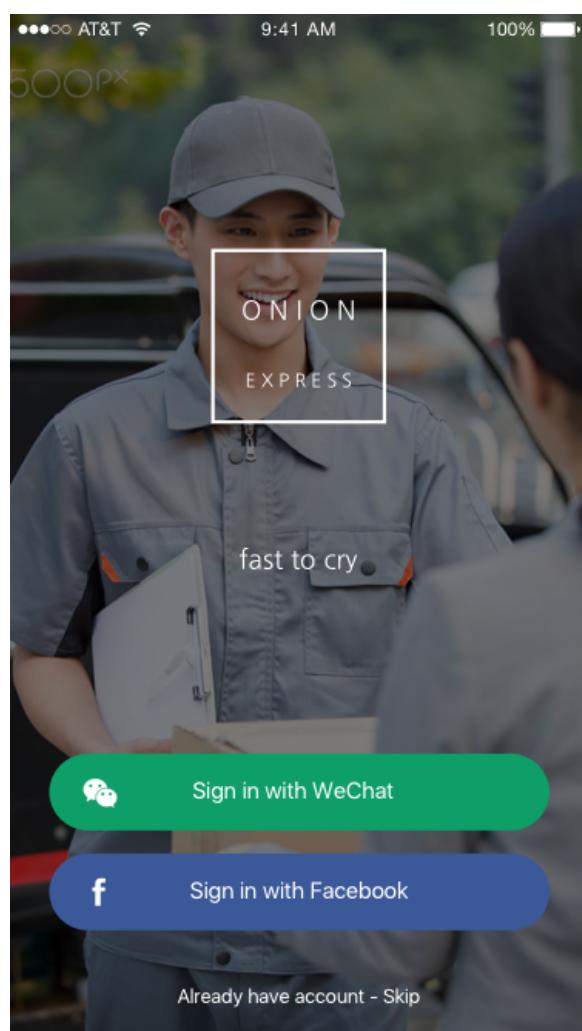


Figure 4.1: Log in

This is the login page of our app, for convenience, users can log in via WeChat or

Facebook, which is the popular socail account around the world. Through the account, we will record user's infomation in the server, and can sync data to provide a better user experience.

#### 4.1.2 Main Page

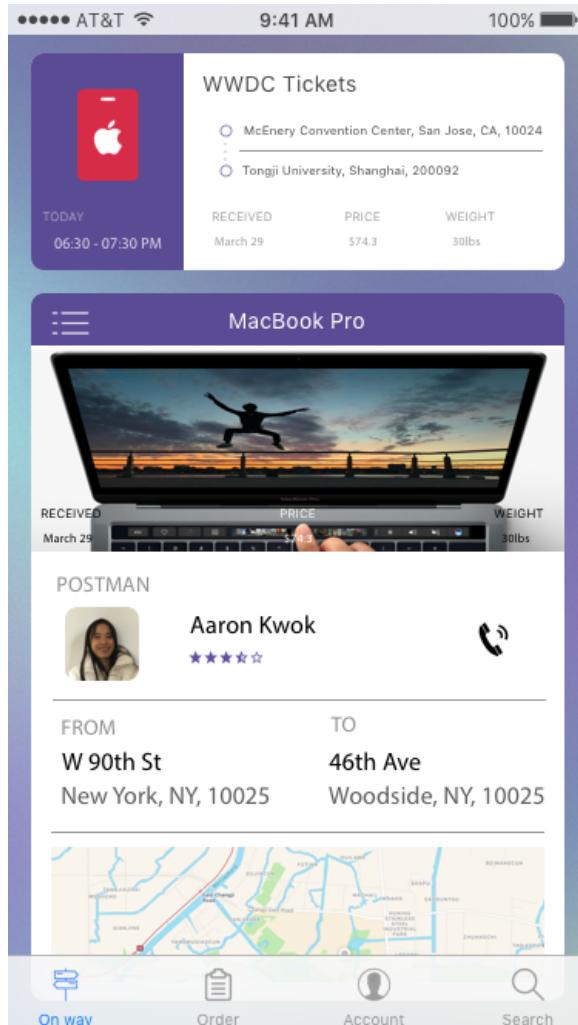


Figure 4.2: On way

This is the main page of our app. It shows the user at all glance all the current package, and click on the user after the show the details of the package. Details of the courier to provide a contact, historical evaluation, and the location of real-time display on the map, easy to track users. In addition, the basic information about the package is provided: including estimated time of arrival, delivery costs and weight.

#### 4.1.3 Search Page

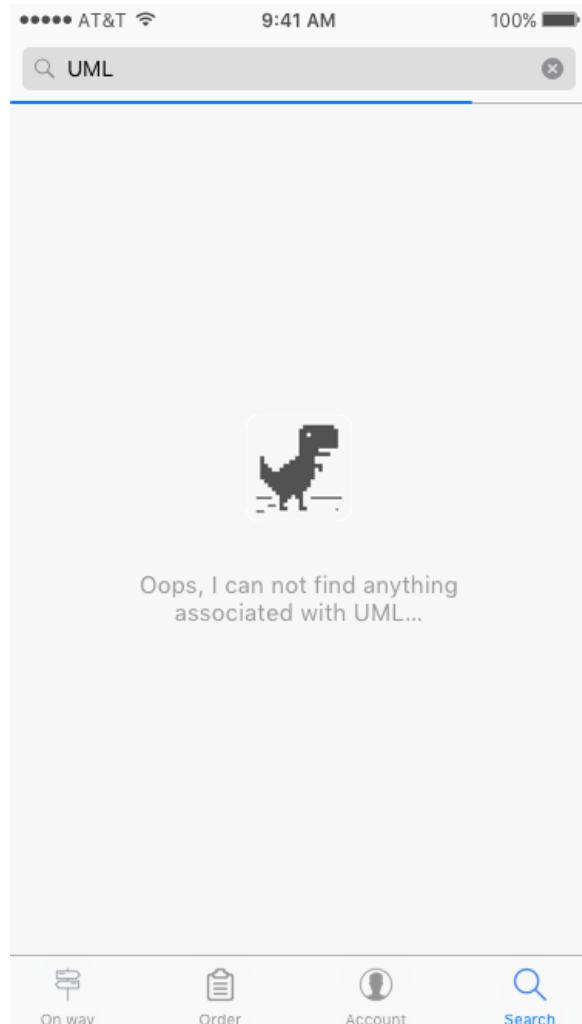


Figure 4.3: Search

This is the search page of our app. User can type everything he/she want to. And we will search both locally and in the server.

#### 4.1.4 Order Page



Figure 4.4: Order

This is the order page of our app. It shows all the packages both on the way and delivered. Like the main page, it can show details and ordered with timeline.

#### 4.1.5 Account Page

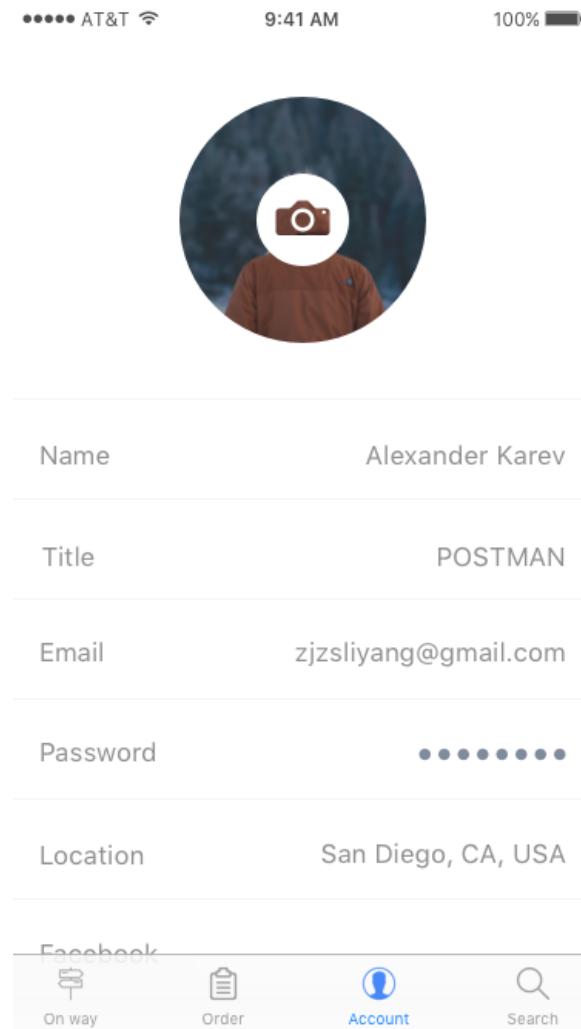


Figure 4.5: Account

This is the account page of our app. It shows the basic information of users, including name, title, email, password, location and social account. Users can change settings there and it's simple and concise.

## 4.2 Website

There is basic information of the system showed on the page. The services can be ordered on this website after the user logs in. The customer can search for their packages' particulars after logging in. In addition, the significant notations of the Onion Express® are showed on

the web page, such us the forbidden objects etc. Any common browsers of the website can contact the Onion Express® company and know about the company freely.

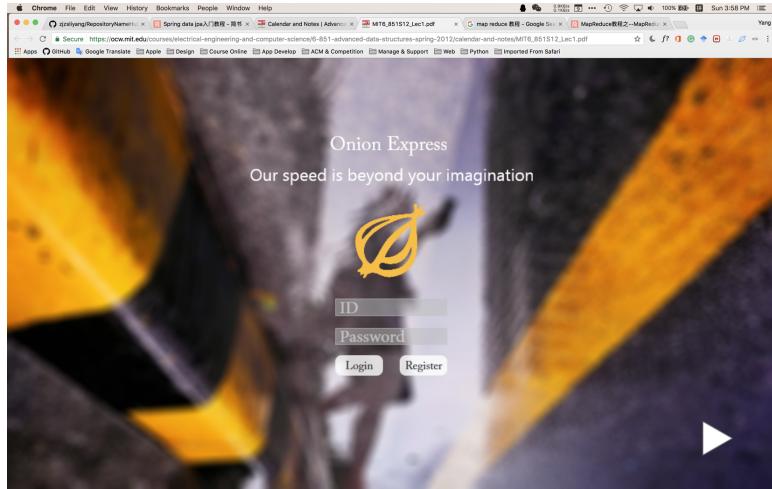


Figure 4.6: Index1

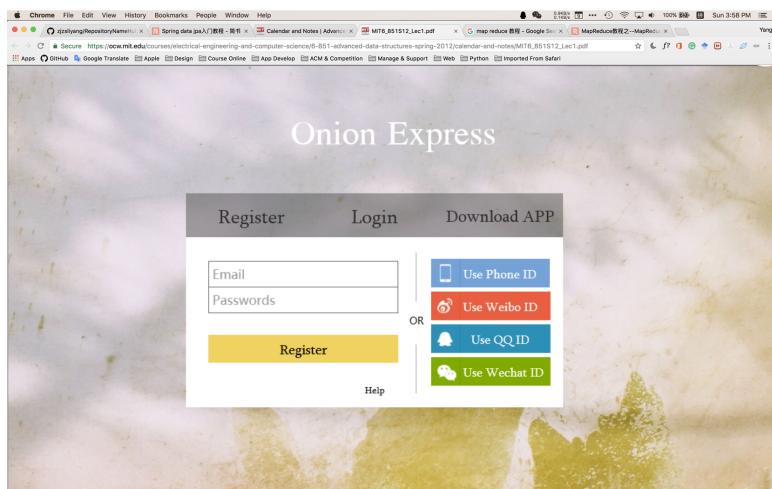


Figure 4.7: Index2

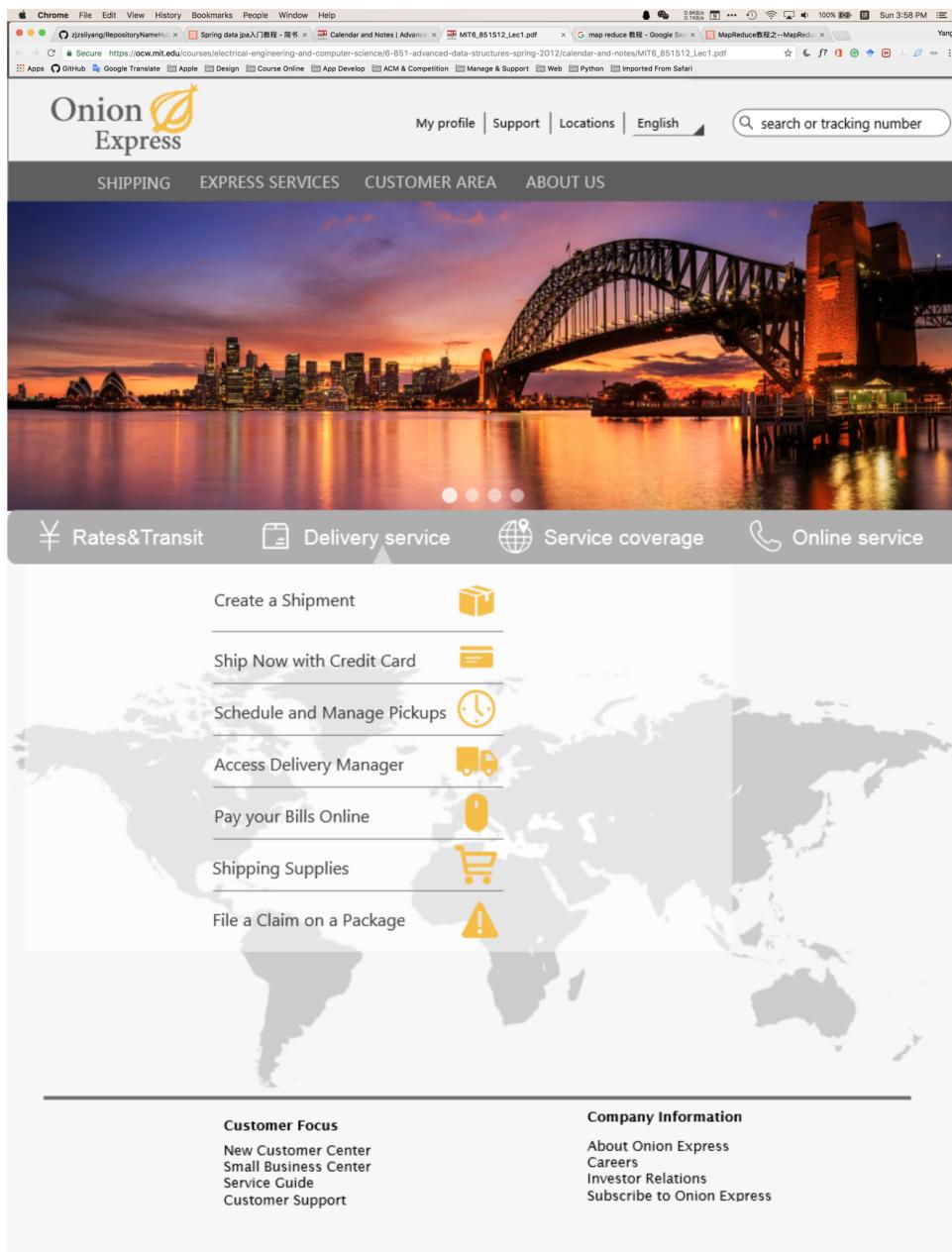


Figure 4.8: Index3

# 5 Glossary of Terms

## **after-sales service**

Also called customer service, after sales service is the provision of service to customers before, during and after a purchase.

## **article**

The material in the package which is sent by a normal customer.

## **bi-directional read**

The information can be read in both direction.

## **cash-on-delivery express**

The sale of goods by express where payment is made on delivery rather than in advance.

## **claim**

When packages are damaged or lost, customers have right to ask for compensation.

## **courier**

A courier is a person who delivers messages, packages, and mail. Here it refers to postmen.

## **customer service staff**

The staff in the logistics company serving customers.

## **damaged express item**

The package that is damaged during express.

## **decision support system(DSS)**

A decision support system is a computer-based information system that supports business or organizational decision-making activities.

## **delivery**

A single task to send the package to a customer.

**delivery terminal**

The destination of the delivery where the receiver receive and sign the package.

**dispath list**

The digital list of information of the packages to be delivered in postmen's port.

**distribution center**

A station in a large district to transfer packages to the regional distribution center.

**door-to-cfs**

From the shipper factory or warehouse to the destination or the Container freight station of the discharging port.

**door-to-door**

From the shipper factory or warehouse to the consignee's factory or warehouse.

**Electronic Data Interchange(EDI)**

Electronic Data Interchange is an electronic communication method that provides standards for exchanging data via any electronic means.

**Electronic Order System(EOS)**

Electronic Order System is to meet demand instantly, with perfect quality and punctuality.

**express item**

Packages to be delivered.

**express item tracking system**

A subsystem in our system to track the packages with GIS automatically.

**express network**

A service network within the scope to help delivery.

**express waybill**

An express receipt given by the carrier to the shipper acknowledging receipt of the packages being shipped and specifying the terms of delivery.

**first time delivery**

The first time for particular postman to send the package to a position.

## **Global Position System(GPS)**

The Global Positioning System is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

## **Geographic Information System(GIS)**

A geographic information system is a system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data.

### **handheld terminal**

Handheld terminal refers to the portable data processing terminal with some particular features. Here it refers to mobile phones with our app.

### **inquiry**

The customer logins the system or connects with customer service staff to get information about the order, operation instruction etc.

## **Integrated Services Digital Network(ISDN)**

Integrated Services for Digital Network is a set of communication standards for simultaneous digital transmission of voice, video, data, and other network services over the traditional circuits of the public switched telephone network.

### **interchange receipt**

A voucher to certify that the customers or e-business commits articles or products to the logistics company for delivery.

## **Invoice(INV)**

An invoice is a commercial document issued by a seller to a buyer, relating to a sale transaction and indicating the products, quantities, and agreed prices for products or services the seller had provided the buyer.

## **Just-in-time logistics(JIT logistics)**

Just-in-time logistics is a modern logistics method based on the JIT management philosophy.

### **lost express item**

The package that is lost during express.

### **order number**

The number generalized when the order is created.

**order processing**

A series automatic operation in system to deal the order, such as creating an order, completing an order and so on.

**package**

The material to be delivered after customers or the e-business company create orders.

**product**

The material in the package which is ordered by customers from the e-business company.

**receiver**

Generalized from Customer and Agent, the person receiving and signing the package directly.

**redelivery**

When no one can sign the package, the postman will carry it back to the delivery terminal and the order will be rescheduled in the system.

**redirect express item**

When customer changes the destination or the destination is out of scope, the package will be reassigned.

**regional distribution center**

The substation in a certain region of the logistics company to assign packages to postmen.

**return**

If customers are unsatisfied with the product, he or she can send it back with a label from system.

**sender**

The customer or the e-business company who sends the package.

**serial number of express**

i.e. the tracking number of packages in the system.

**sign in**

The receiver sign the package and get it.

**sorting**

The packages in the regional distribution center are sorted to transfer to corresponding postmen or the packages in the distribution center are sorted to transport to regional distribution centers.

**tracking number**

Especially for tracking the real-time GPS location of the package.

**withdrawal**

If the customer is unsatisfied with the product and has sent it back, he or she can choose withdrawal the order and the payment will be reimbursed.

# 6 Contributions

More information, please visit more on GitHub

<a href="#">1452559</a> Yang LI	iOS UI, Document	17%
<a href="#">1453645</a> Zhongjin LUO	Scenario One & Two Diagrams	17%
<a href="#">1451229</a> Guohui YANG	Scenario Three & Four Diagrams	17%
<a href="#">1552705</a> Yiqun LIN	Scenario Five & Six Diagrams	17%
<a href="#">1552651</a> Yirui WANG	Scenario Eight & Global Diagrams	17%
<a href="#">1552677</a> Xinying WU	Web UI, Scenario Seven Diagrams	17%

# Bibliography

- [1] 830-1998, *IEEE Recommended Practice for Software Requirements Specifications*, IEEE, Oct 1998.
- [2] 29148-2011, *Systems and software engineering – Life cycle processes –Requirements engineering*, ISO/IEC/IEEE International Standard, Dec 2011.
- [3] Russ Miles, Kim Hamilton, *Learning UML 2.0*, O'REILLY, 1st edition, April 2006.
- [4] Jim Arlow, *UML 2.0 and the Unified Process: Practical Object-oriented Analysis and Design*, ADDISON WESLEY, 2nd edition, 2005.
- [5] Karl Eugene Wiegers, Joy Beatty, *Software Requirements*, Microsoft Press, 3rd edition, 2013.
- [6] Craig Larman, *Applying UML and Patterns*, Pearson Education International, 3rd edition, 2005.
- [7] Simon J. Bennett, Steve McRobb, Ray Farmer, *Object-oriented Systems Analysis and Design Using UML*, McGraw-Hill Education, 2nd edition, Dec 2001.
- [8] Yunjie TAN, *Thinking in UML*, China Water Conservancy Hydropower, 2nd edition, March 2012.