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Design and Implementation of SaaSExport Freight Forwarding Cloud Platform

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Abstract

Freight forwarder means to carry the goods designated by consumers from the original place to the destination through the shipping route (sea, land and air) designated by consumers according to their needs. In the international freight forwarding market, between the shipper and the carrier, it is the process of accepting the shipper's entrustment, chartering, stowage, packing, export reporting, invoicing and financial reporting. The system is mainly responsible for the transportation of freight or goods, and finally transports the goods from the receiving place to the destination. SaaSExport freight forwarding cloud platform system is used to serve freight forwarding enterprises, and assist small and medium-sized enterprises to manage the whole process of freight forwarding simply and conveniently.

Keywords

International logistics; SaaSExport; Freight forwarding cloud platform; SSM; Tenant.

1. INTRODUCTION

Freight forwarding software is the software used by freight forwarding companies to count the internal business information and system data. There is an obvious technical problem in traditional freight forwarding software, that is, due to the limitation of local area network, freight forwarding operators can only operate the software and carry out related operations in the coverage area of the company's local area network.

This is only a limitation on details, and the more important factor is that the excellent freight forwarding operation system serves the vast number of users in major port cities across the country. However, the traditional freight forwarding software needs to be updated on site every time the system is maintained and updated and its performance is expanded, which brings more difficulties to software service providers. Not to mention the labor-consuming, the time, manpower and financial resources wasted in updating the system are enormous, and the more markets are occupied, the difficulty will rise straight.

The freight forwarding software developed in the past is limited by the technical level and the development degree of the Internet, so the freight forwarding software starts from the local area network. However, with the rapid development of network technology in China, the SaaS platform technology in China is relatively perfect, and the freight forwarding software and cloud technology are gradually integrated. In recent years, with the emergence of Skylog and other related shipping software, SaaS has become more and more perfect in the scope of freight forwarding software.It not only makes it convenient for freight forwarders to work without time and space, but also enables automatic upgrade and permanent free upgrade in the software background. All users in the system can enjoy the service of actively developing modules and

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upgrading the system free of charge according to the common requirements put forward by other users based on the whole system.

The freight forwarding software has further deepened SaaS technology, which is the development trend. Although there are a large number of freight forwarding data in the traditional freight forwarding system, many freight forwarding companies are reluctant to replace the freight forwarding software. However, with the increasingly advanced cloud loan software, it has become an irreversible trend for freight forwarding companies to replace the traditional software with cloud freight forwarding, but this is only a matter of time.

2. APPLICATION FIELDS AND DEVELOPMENT TOOLS AND TECHNOLOGIES

SaaS software can be divided into individual oriented and collective oriented in terms of application groups.

2.1. Individual-oriented Saas Products

Cloud-type functions such as online document editing, address book management, schedule scheme, file management, photo management and financial management.

2.2. Group-oriented SaaS Products

Customer relationship management, enterprise resource planning management, online video, group conference, human resource management, office software, site management, financial management, examination and approval management, etc.

2.3. Development Tools

In this design, JDK1.8+ database mysql 5.7+ development tool idea 2018.2.2+maven version 3.3.9+Tomcat are proposed to develop and implement SaaSExport freight forwarding cloud platform based on SSM framework [5].

2.4. Other Frameworks

AdminLTE front-end framework [3], RBAC authority design scheme, Shiro security control framework, Dubbo distributed governance framework, POI class library, jasperReport, Quartz, spring framework to send mail, message queue MQ, webService, CXF, e-Echarts.

3. RESEARCH METHODS AND FEASIBILITY ANALYSIS

3.1. Technical Feasibility Analysis

This system adopts SSM framework to realize the development of the system.

The SSM framework integrated by the three frameworks is of great help to the development efficiency and difficulty of the whole application [2]. Whether it is the user's request or the access to the database, it will be easily realized, and it is completely feasible in technical support [6].

3.2. Operational Feasibility Analysis

The SaaSExport system will display different login pages and function modules according to the different rights and roles of login users. For example, the SaaSExport system administrator is responsible for the daily maintenance and function management of the SaaSExport system, including tenant enterprise management and function module management. It should be noted that the SaaSExport system administrator cannot operate and manage specific businesses of tenant enterprises. Enterprise tenant refers to the tenant enterprise accessing the SaaSExport system, in which the data and information between tenants do not influence each other.

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3.3. Economic Feasibility Analysis

Considering that the customer groups served by the freight forwarding operating system are all over the major port cities in China, and its regional span is relatively large, while the traditional freight forwarding software consumes time, energy and financial resources every time it is updated, maintained and expanded, which is a huge waste of time and money for both service providers and consumers.

With the rapid development of the Internet and the Constantly improve of SaaS platform technology, freight forwarding software is moving towards the convergence of cloud technology. The application of SaaS in freight forwarding software is also more mature. It not only facilitates the later software maintenance and function expansion of the service provider, but also realizes the mobile office of the freight forwarder administrator without time and space. Greatly saves the time cost of both parties and improves the working efficiency of both parties.

3.4. Legal Feasibility Analysis

This system is completely developed independently by individuals. The development framework, development tools and software servers used in this system are completely open source and free of charge. The technologies and methods used in this system are completely provided by the framework and realized by individuals, and there is no infringement problem.

4. DEMAND ANALYSIS

4.1. Overall System Requirements

4.1.1 Overall demand of front desk

The main function of the front desk (enterprise application) of the design is that the enterprise registers into the SaaSExport freight forwarding cloud platform system by filling in the basic information such as enterprise name, enterprise address, contact person, telephone number, company scale and industry, and then the SaaS background manages the enterprise, and its functional diagram is shown in Figure 1:

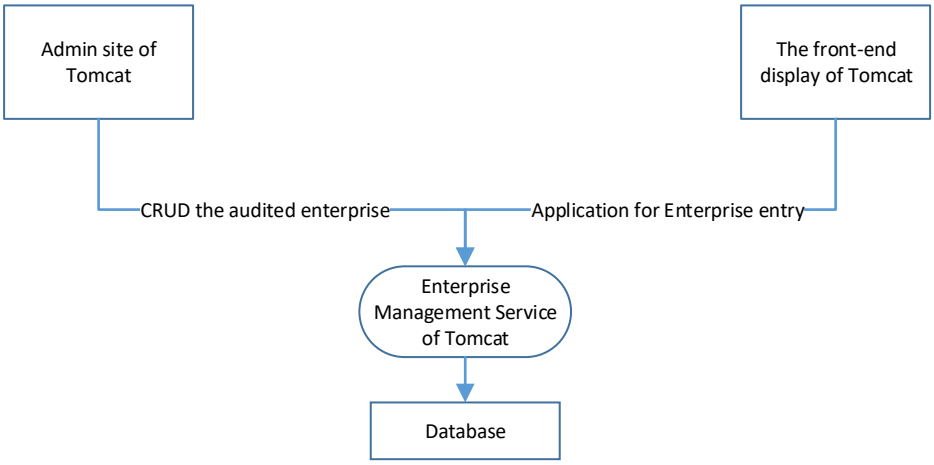

Figure 1. System overall demand architecture diagram

4.1.2 Overall Background Demand

The background management module of this design is mainly the SaaS platform administrator responsible for managing the enterprise information and function modules in the system; Tenant administrators in an enterprise manage the enterprise internally. Its structure is shown in Figure 2

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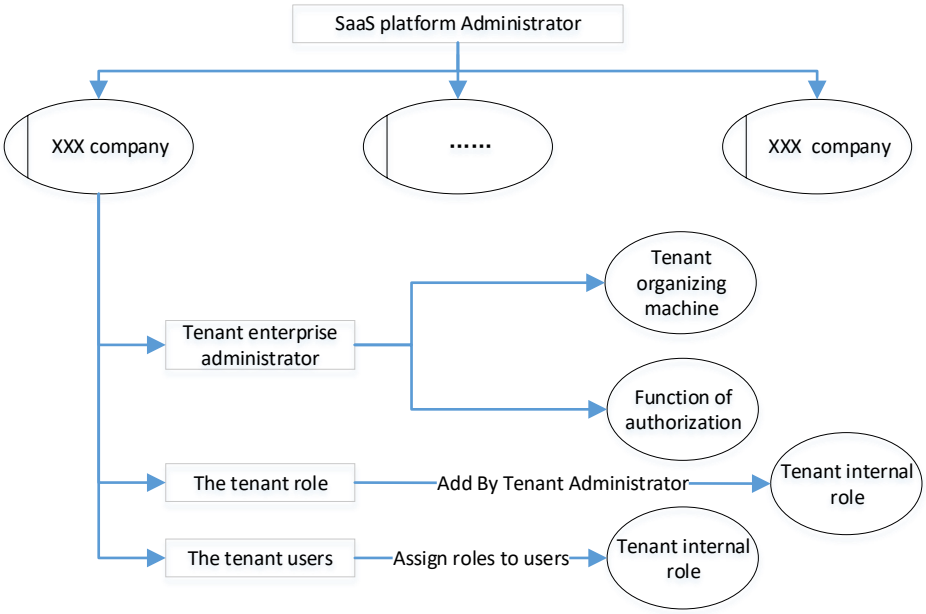

Figure 2. SaaSExport platform element

4.2. Functional Structure Diagram

The background management module of this design displays different pages according to different roles of loggers. For example, the super administrator login of SaaS system can see module management and enterprise management under SaaS management module; Tenant enterprise administrators manage all sub-departments of their enterprises; The department manager is responsible for the management of the department; Ordinary employees can only view their own data. Therefore, the functional structure diagram of the system is mainly introduced around the roles of SaaSExport Administrator and Tenant Enterprise Administrator.

4.2.1 The overall structure of the system is shown in Figure 3:

Figure 3. Overall system structure diagram

4.2.2 The functional structure of SaaSExport administrator is divided as shown in Figure 4:

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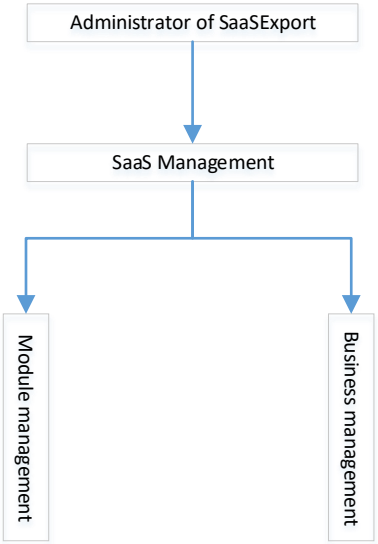

Figure 4. SaaSExport administrator functional structure diagram

4.2.3 The functional structure division of tenant enterprise administrator is shown in Figure 5:

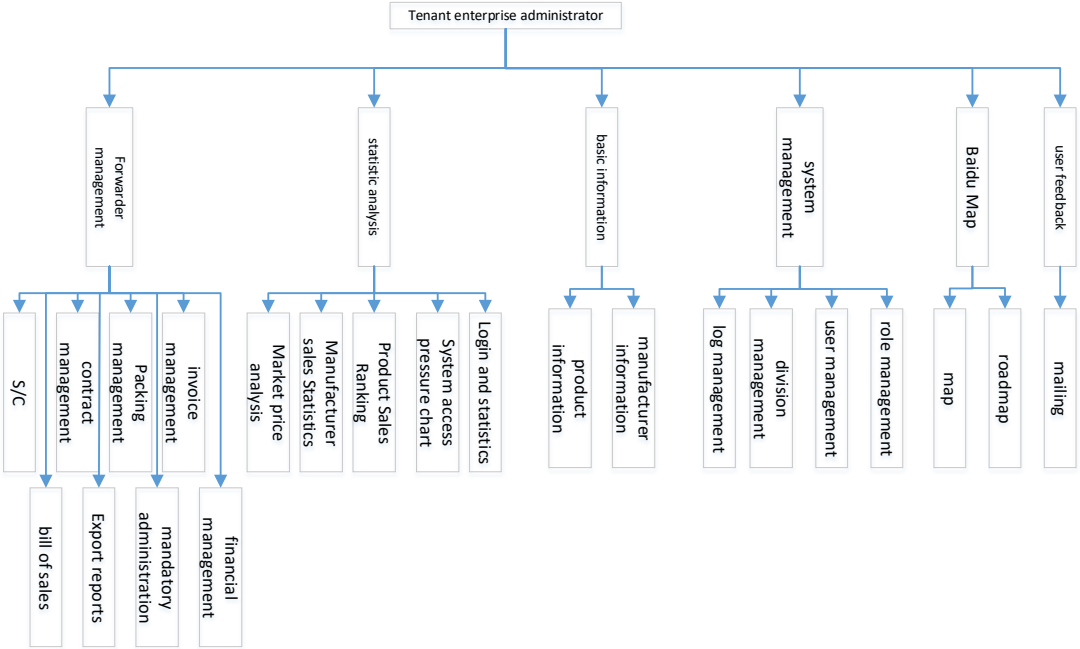

Figure 5. Functional structure diagram of tenant enterprise administrator

4.3. Analysis of System Function Module

4.3.1 SaaSExport administrator

(1) Module management

This module is mainly used to display all functional modules in the system, and SaaSExport administrator can perform basic operations such as creating, deleting and modifying functional modules. When adding, deleting and modifying this module, the functional modules of the tenant administrator interface will make corresponding changes.

(2) Enterprise management

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Enterprise management is mainly used to display the basic information of enterprise tenants who have registered for SaaSExport system, and can create, delete and edit the information of enterprise tenants.

4.3.2 Tenant enterprise administrator

(1) Purchase and sale contract

Purchase and sales contracts display all purchase and sales contract data, query and perform basic operations on the corresponding purchase and sales contract details according to contract id, and modify the basic contract information according to contract id. When the export shipping module sends its corresponding shipping bill electronically, the status of the purchase and sale contract will automatically change to "Shipped".

(2) Shipment table

Enter xxxx year xx month in the shipment table column and click "price increase", and the detailed information document of the shipment table of xxxx year xx month will be downloaded.

(3) Contract management

Contract management displays the purchase and sale contract data in Submitted status, and views the data according to the contract id.

(4) Export report and shipment

This module is mainly used to display the information of the contract bill of lading after shipment, and perform operations such as removal, submission, cancellation, electronic shipment, packing, editing, viewing, etc. When the status of the bill of lading is "Shipped", the detailed information in pdf format can be downloaded.

(5) Packing management

Packing management displays the packing data corresponding to the consignment note in the status of "Shipped", and deletes and edits the packing data. When the packing data status is Submitted, this piece of packing data can only be viewed; when the packing data status is Draft, this piece of data can be viewed and edited.

(6) Commissioned management

Entrust the packing list in the status of "Shipped", and generate the corresponding entrustment document data. You can delete, submit, cancel, and ship the newly generated order data. When the status of the order is Draft, you can edit and view it; otherwise, you can perform map operation. When an invoice has been generated for this commission, the status of this commission document will be automatically changed to Invoiced.

(7) Invoice management

Generate invoice documents for delegated documents in Submitted status, and display them in the invoice list. You can delete, submit and cancel the data of invoice list. When the invoice is in Draft status, you can edit and view it; otherwise, you can only view it. After the invoice data is submitted for financial reporting, the status of the invoice will be automatically updated to Financial Reporting.

(8) Financial management

Generate the corresponding financial bill of lading for the invoice in Submitted status and display it in the list of financial bill of lading. The financial bill can be deleted, submitted and cancelled. When the status of the financial bill is Draft, you can view and edit it; otherwise, you can only view it.

(9) Market price analysis

Show the names and price information of the top five manufacturers in the market price in the form of histogram.

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(10) Sales situation of manufacturers

Show the sales situation of manufacturers in the form of pie chart.

(11) Product sales ranking

Show the number, price and year-on-year sales of each product in the form of a graph

(12) System access pressure diagram

Show the system access pressure between 0-23 points in the form of dynamic line chart.

(13) Login IP statistics

Show the top 10 IP addresses and specific login times in the form of a line chart.

(14) Commodity information

This module is mainly used to display the basic information of all commodities, add, edit and remove commodities and other basic operations.

(15) Manufacturer information

Show all manufacturer information, add new manufacturers, query detailed information of manufacturers according to their id, modify basic information of manufacturers according to their id, and delete manufacturer information according to their id.

(16) Log management

The log list shows the IP address and specific operation of the current user in the current system.

(17) Sector Management

Department management is mainly used to display all departments of tenant enterprises, and perform basic operations of creating, deleting and modifying departments.

(18) User management

This module mainly displays the personal information of all users, creates new users, removes, edits and assigns roles to new users.

(19) Role management

Show the basic information of all roles and roles in the tenant enterprise system, create new roles, and delete, modify and assign permissions to the roles.

(20) Map management

Show the detailed address and weather conditions of the administrator's location in the form of map/satellite/3D. Users can also manually enter the address to search. When the address entered by the user cannot be searched on the map, it will be displayed as Beijing by default.

(21) Distance management

Show the specific distance between the administrator's location and Beijing (the default address is the distance between Handan and Beijing).

(22) Mail delivery

Send feedback information to the administrator.

5. SYSTEM DESIGN

5.1. Engineering Construction

5.1.1 Modular construction project

In the real development, a large project needs to be divided into several groups to develop different modules at the same time, so it is necessary to use the sub-module development mode [4].

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Maven's modular development can divide the project into multiple layers, such as domain layer, dao layer, service layer, web layer, etc., which may be assigned to different development teams for development and associated through maven warehouse [7].

The general framework of maven's sub-module development includes a parent project and multiple sub-modules.

5.1.2 Sub-module development, the relationship between each module:

(1) export_parent parent project (pom)

(2) export_commons sub-module (jar)

(3) export_domain sub-module (jar)

(4) export_dao sub-module (jar)

(5) export_system_service sub-module (jar)

(6) export_manager_web sub-module (war)

5.2. Database Design

5.2.1 Overall design description of database

SaaSExport freight forwarding cloud platform management system adopts MySQL background database development tool [6]. According to demand analysis, the tables involved in the system module mainly include purchase and sale contract goods table [10], product table, financial bill of lading table, invoice table, packing list table, entrustment table, department table, user table, enterprise table, SaaS module management table, temporary graph table, system log table, totally 12 tables.

5.2.2 Database table design

(1) System log table

The system log table is mainly used to save basic information such as logging time, logging action, logging method, company number and company name. The table structure is shown in Table 1.

Table 1. System log table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
id	varchar	40	0	Not allowed	Primary key
user_name	varchar	30	0		
ip	varchar	200	0		
time	datetime	0	0		
method	varchar	40	0		
action	varchar	40	0		
company_id	varchar	40	0		
company_name	varchar	40	0		

(2) Packing list table

Packing list table is mainly used to save packing list number, seller, buyer, invoice number, invoice creation time, remarks, description, freight order number, freight sorting number, status, creator, creation department, creation date, company number and company name. The table structure is shown in Table 2.

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Table 2. Packing list table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
packing_list_id	varchar	40	0	Not allowed	Primary key
seller	varchar	200	0		
buyer	varchar	200	0		
invoice_no	varchar	200	0		
invoice_date	datetime	0	0		
marks	varchar	200	0		
descriptions	varchar	200	0		
export_ids	varchar	200	0		
export_nos	varchar	200	0		
state	decimal	11	0		
create_by	varchar	40	0		
create_dept	varchar	40	0		
create_time	datetime	0	0		
company_id	varchar	40	0		
company_name	varchar	40	0		
create_time	datetime	0	0		

(3) Invoice sheet table

The invoice table is mainly used to save information such as invoice number, confirmation letter, letter of credit, trade terms, status, status, creator, creation department, creation date, company number and company name. The table structure is shown in Table 3.

Table 3. Invoice sheet table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
INVOICE_ID	varchar	40	0	Not allowed	Primary key
SC_NO	varchar	100	0		
BL_NO	varchar	100	0		
TRADE_TERMS	varchar	100	0		
STATE	int	11	0		
CREATE_BY	varchar	40	0		
CREATE_DEPT	varchar	40	0		
CREATE_TIME	datetime	0	0		
company_id	varchar	40	0		
company_name	varchar	40	0		

(4) Product table

The product table is mainly used to store information such as product number, product category, quantity, product photo, product name, manufacturer number, manufacturer description, market price, length, width, height, color, packaging form, packaging unit, total amount, volume, large box length, large box width, large box height, remarks, creator, creating department and creating time. The table structure is shown in Table 4.

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Table 4. Product table (co_produce)

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
id	varchar	40	0	Not allowed	Primary key
ctype	varchar	20	0		
p_number	varchar	40	0		
p_img	varchar	255	0		
synopsis	varchar	255	0		
factory_id	varchar	40	0		
describe_factory	varchar	255	0		
price	decimal	10	3		
size_length	decimal	10	3		
size_width	decimal	10	3		
size_heigth	decimal	10	3		
color	varchar	255	0		
pack	varchar	20	0		
packing	varchar	20	0		
container_type_two	decimal	10	3		
container_type_four	decimal	10	3		
container_type_HC	decimal	10	3		
amount	int	11	0		
bulk	decimal	10	3		
big_box_length	decimal	10	3		
big_box_width	decimal	10	3		
big_box_heigth	decimal	10	3		
remark	varchar	255	0		
create_user	varchar	30	0		
create_dept	varchar	10	0		
create_time	datetime	0	0		

(5) Financial bill of lading

The financial report bill table is mainly used to save information such as financial report shipment number, preparation date, creator, status, creator, creation department, creation date, company number and company name. The table structure is shown in Table 5.

Table 5. Financial bill of lading

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
FINANCE_ID	varchar	40	0	Not allowed	Primary key
INPUT_DATE	datetime	0	0		
INPUT_BY	varchar	30	0		
STATE	int	11	0		
CREATE_BY	varchar	40	0		
CREATE_DEPT	varchar	40	0		
CREATE_TIME	datetime	0	0		
company_id	varchar	40	0		
company_name	varchar	40	0		

(6) Temporary table of graphs

Temporary table of graph is mainly used to make statistics of system access pressure at 00-23 points. The table structure is shown in Table 6.

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Table 6. Temporary table of graphs

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
A1	char	2	0		

(7) Entrustment form table

The order form table is mainly used to store information such as order number, transportation mode, owner, bill of lading header, original notifier, letter of credit, port of shipment, port of transshipment, port of discharge, shipment date, expiry date, batch, brief description, transportation requirements, freight, reviewer, status, creation department, creation date, company number and company name. The table structure is shown in Figure 7:

Figure 7. Entrustment form table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
SHIPPING_ORDER_ID	varchar	40	0	Not allowed	Primary key
ORDER_TYPE	varchar	10	0		
SHIPPER	varchar	200	0		
CONSIGNEE	varchar	200	0		
NOTIFY_PARTY	varchar	200	0		
LC_NO	varchar	300	0		
PORT_OF_LOADING	varchar	30	0		
PORT_OF_TRANS	varchar	30	0		
PORT_OF_DISCHARGE	varchar	30	0		
LOADING_DATE	datetime	0	0		
LIMIT_DATE	datetime	0	0		
IS_BATCH	char	1	0		
IS_TRANS	char	1	0		
COPY_NUM	varchar	20	0		
REMARK	varchar	200	0		
SPECIAL_CONDITION	varchar	200	0		
FREIGHT	varchar	200	0		
CHECK_BY	varchar	30	0		
STATE	int	11	0		
CREATE_BY	varchar	40	0		
CREATE_DEPT	varchar	40	0		
CREATE_TIME	datetime	0	0		
COMPANY_ID	varchar	40	0		
COMPANY_NAME	varchar	20	0		

SaaS module table is mainly used to store information such as module id, link, type, status, subordinate, remarks, sort number, etc. The table structure is shown in Table 8.

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Table 8. SaaS module table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
module_id	varchar	40	0	Not allowed	Primary key
parent_id	varchar	40	0		
parent_name	varchar	100	0		
name	varchar	100	0		
layer_num	decimal	11	0		
is_leaf	decimal	11	0		
ico	varchar	20	0		
cpermission	varchar	20	0		
curl	varchar	200	0		
ctype	decimal	11	0		
state	decimal	11	0		
belong	varchar	100	0		
cwhich	varchar	20	0		
quote_num	decimal	11	0		
remark	varchar	100	0		
order_no	decimal	11	0		

Table 9. User table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
user_id	varchar	40	0	Not allowed	Primary key
dept_id	varchar	40	0		
email	varchar	60	0		
user_name	varchar	50	0		
station	varchar	20	0		
password	varchar	64	0		
state	decimal	11	0		
company_id	varchar	40	0		
company_name	varchar	40	0		
dept_name	varchar	40	0		
manager_id	varchar	40	0		
gender	char	1	0		
telephone	varchar	11	0		
birthday	varchar	20	0		
degree	int	2	0		
salary	decimal	10	0		
join_date	varchar	20	0		
order_no	int	3	0		
create_by	varchar	40	0		
create_dept	varchar	40	0		
create_time	datetime	0	0		
update_by	varchar	40	0		
update_time	datetime	0	0		
remark	varchar	255	0		
wxunionid	varchar	60	0		

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(9) User table

The user table is mainly used to store information such as user number, department number, email address, user name, status, password, enterprise number, enterprise name, department name, boss number, gender, telephone number, date of birth, grade, salary, employment time, sorting number, creator, creation department, creation date, editor, modification time, description, WeChat login number, etc. The table structure is shown in Table 9.

The enterprise table is mainly used to store information such as enterprise number, enterprise name, deadline, enterprise address, business license, legal representative, telephone number, company scale, industry, remarks, status, balance and city. The table structure is shown in Table 10.

Table 10. Enterprise table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
id	varchar	40	0	Not allowed	Primary key
name	varchar	255	0		
expiration_date	datetime	0	0		
address	varchar	255	0		
license_id	varchar	255	0		
representative	varchar	255	0		
phone	varchar	255	0		
company_size	varchar	255	0		
industry	varchar	255	0		
remarks	varchar	255	0		
state	int	2	0		
balance	double	0	0		
city	varchar	20	0		

Table 11. Purchase and sale contract goods list (co_contract_produt)

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
id	varchar	40	0	Not allowed	Primary key
contract_id	varchar	40	0		
factory_id	varchar	40	0		
factory_name	varchar	200	0		
product_no	varchar	50	0		
product_image	varchar	200	0		
product_desc	varchar	255	0		
loading_rate	varchar	80	2		
box_num	decimal	11	0		
packing_unit	varchar	10	0		
cnumber	decimal	11	0		
out_number	decimal	11	0		
finished	decimal	11	0		
product_request	varchar	255	0		
price	decimal	10	2		
amount	decimal	10	2		
order_no	decimal	11	0		
company_id	varchar	40	0		
company_name	varchar	40	0		

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(11) Purchase and sale contract goods list

The purchase and sale contract goods table is mainly used to store information such as purchase and sale contract goods number, contract number, manufacturer number, manufacturer name, article number, goods photo, product description, packing rate, number of cases, packaging unit, quantity, shipment quantity, completion status, requirements, unit price, total amount, sequencing number, company number and company name. The table structure is shown in Table 11.

(12) Departmental table

The department table is mainly used to save information such as department serial number, department name, superior department, status, company number and company name. The table structure is shown in Table 12.

Table 12. Departmental table

Field name	Finger end type	Length	Decimal point	Allow null values	Remarks
dept_id	varchar	40	0	Not allowed	Primary key
dept_name	varchar	50	0		
parent_id	varchar	40	0		
state	decimal	6	0		
company_id	varchar	40	0		

6. SYSTEM IMPLEMENTATION

6.1. Document Structure and Use

Based on the SSM three-tier architecture, the file structure and uses of this system will be introduced in layers. It mainly introduces Dao layer, Service layer, web layer and domain layer.

(1) Dao layer, that is, data access layer, its main job is to interact with databases, execute the operations of adding, deleting and modifying tables or entities, and facilitate the connection between other programs and databases. In the configuration file of spring, you can configure the data source of the persistence layer, and the relevant parameters connected with the database are also in it [1].

(2) Service layer is business layer, and its main work is the design of program logic application, which mainly includes interface service and implementation class serviceImpl, and data can be accessed by calling Dao interface [2].

(3) The Controller layer is the control layer, which is mainly responsible for controlling the flow of business modules. The Controller layer mainly controls the business process by calling the interface of the Service layer, and the Controller receives the parameters for business operation from the front end and returns the specified path or data table. For a specific business process, there will be different controllers to execute the business process [9].

(4) The Domain layer is mainly the entity class of the object [8].

6.1.1 Dao layer

The Dao layer structure is shown in Figure 6:

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Figure 6. Dao file structure

Dao file function notes are shown in Table 13:

Table 13. Dao menu

File name	explain
ContractDao	Contract management
ContractProductDao	Goods management under contract
ExportDao	Management of bill of lading
ExportProductDao	Goods management under the bill of lading
ExtCproductDao	Attachment management of goods under contract
ExtEproductDao	Management of goods attachments in the bill of lading
FactoryDao	Manufacturer information management
FactoryProductDao	Goods management under manufacturers
FinanceDao	Financial management
InvoiceDao	Invoice management
PackingDao	Packing management
ShippingOrderDao	Commissioned order management
CompanyDao	Enterprise management
DeptDao	Sector Management
ModuleDao	Module management
RoleDao	Role management
StatDao	Statistical analysis management
SyslogDao	Log management
UserDao	User management
WechartDao	WeChat user management

6.1.2 Service layer

Service layer structure is shown in figure 7:

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Figure 7. Service layer file structure

The function notes of Service layer files are shown in Table 14:

Table 14. Service layer menu

File name	Explain
ContractProductServicel	Goods interface under the contract
ContractService	Bill of lading interface
ExportProductService	Goods interface under the bill of lading table
ExportService	Attachment interface of goods under contract
ExtCproductService	Interface of Goods Attachment in Bill of Lading
FactoryService	Manufacturer information interface
FactoryProductService	Goods interface under manufacturer
FinanceService	Financial interface
InvoiceService	Invoice interface
PackingService	Packing interface
ShippingOrderService	Entrustment doc interface
CompanyService	Enterprise interface
DeptService	Departmental interface
ModuleService	Module interface
RoleService	Role interface
StatService	Statistical analysis interface
SysService	Log interface
UserService	User interface

6.1.3 Controller layer

The Controller layer structure is shown in Figure 8:

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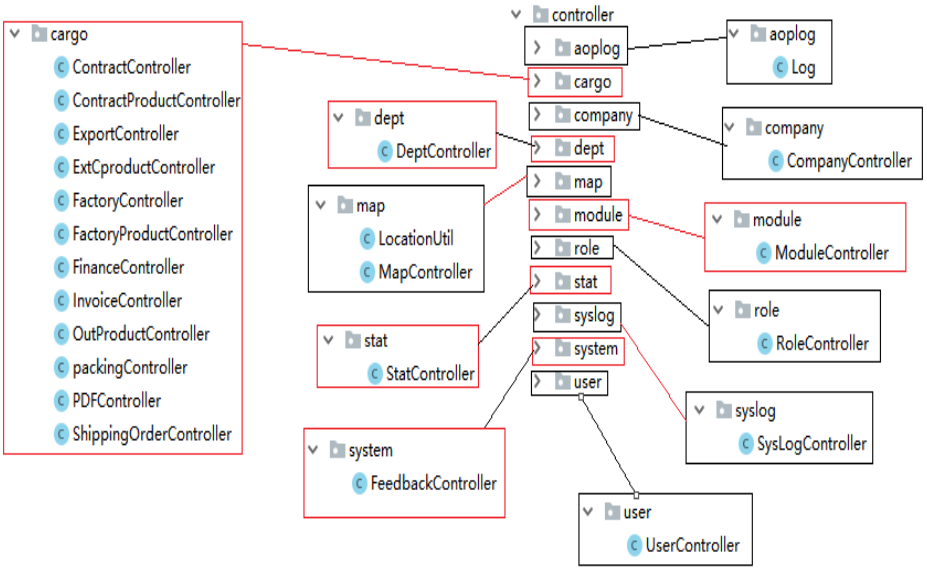

Figure 8. Controller level file structure

The function notes of Controller layer files are shown in Table 15:

Table 15. Controller level menu

File name	Explain
Log	Log
ContractController	Contract
ContractProductController	Goods under the contract
ExportController	Report waybill
ExtCproductController	Attachments under goods
FactoryController	Manufacturer information
FactoryProductController	The manufacturer releases the goods
FinanceController	Finance
InvoiceController	Invoice
OutProductController	Shipment table
PackingController	Packing
PDFController	Export PDF declaration form
ShippingOrderController	order
CompanyController	Enterprise
DeptController	department
LocationUtil	The latitude and longitude coordinates of the address
MapController	Baidu Maps
ModuleController	module
RoleController	Role
StatController	Statistical analysis
SysLogController	Log
FeedbackController	Feedback
UserController	User

6.1.4 Domain file structure

The file structure of domain is shown in figure 9:

Note: The entity classes in cargo in this file structure are generated by mybatis reverse engineering.

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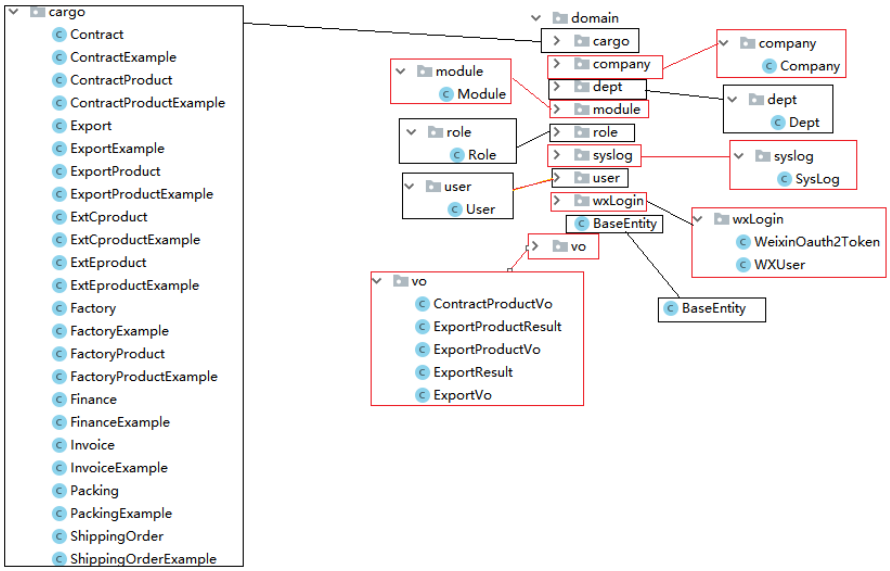

Figure 9. Domain file structure

The functional notes of domain file structure are shown in Table 16:

Table 16. Domain file structure menu

File name	Explain
ContractProductController	Goods under the contract
ContractProduct/ContractProductExample	Entity class of goods under contract
Export/ExportExample	Entity class of guarantee shipment table
ExportProduct/ExportProductExample	Goods entity class under guarantee shipment table
ExtCproduct/ExtCproductExample	Attachment entity class of goods under contract
Extproduct/Extproduct/Example	Entity class of goods attachment in bill of lading
Factory/FactoryExample	Entity class of manufacturer
FactoryProduct/FactoryProductExample	Entity class of manufacturer's goods
Finance/FinanceExample	Financial entity class
Invoice/InvoiceExample	Invoice entity class
Packing/PackingExample	Packing entity class
ShippingOrder/ShippingOrderExample	Delegation entity class
Company	Enterprise entity class
Dept	Department entity class
Module	Module entity class
Role	Role entity class
SysLog	Log entity class
User	User entity class
WeixinOauth2Token	WeChat authorization entity class
WXUser	WeChat user entity class
BaseEntity	Public class
ContractProductVo	Entity class of contract goods delivered by customs electronic newspaper
ExportProductResult	Entity class of goods reported by customs electronic newspaper
ExportProductVo	Entity class of goods reported by customs electronic newspaper
ExportResult	Entity class of customs electronic report delivery results
ExportVo	Entity class of customs electronic newspaper table transport

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6.2. Page and Core Code

6.2.1 User login

The login page is shown in Figure 10:

Figure 10. User login page

Core code

```
@RequestMapping("/login")
public String login(String email,String password) {
    try {
        Subject subject = SecurityUtils.getSubject();
        UsernamePasswordToken uptoken = new UsernamePasswordToken(email, password);
        subject.login(uptoken);
        User = (User) subject.getPrincipal();
        session.setAttribute("loginUser",user);
        List<Module> MenusList = userService.findMenus(user);
        session.setAttribute("modules",MenusList);
    }catch (Exception e){
        request.setAttribute("error","Wrong username or password...");
        return "forward:/login.jsp";
    }
     return "home/main";
}
```

6.2.2 Packing management

Packing management module mainly displays the packed data of the bill of lading. The list mainly displays the basic information such as packing list number, buyer, seller, creator, creation time, description, remarks and status. On this page, you can delete according to packing slip number, and modify packing slip data status by submitting and canceling. And fine-grained

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control is carried out according to the state of packing list. The implementation effect is shown in Figure 11.

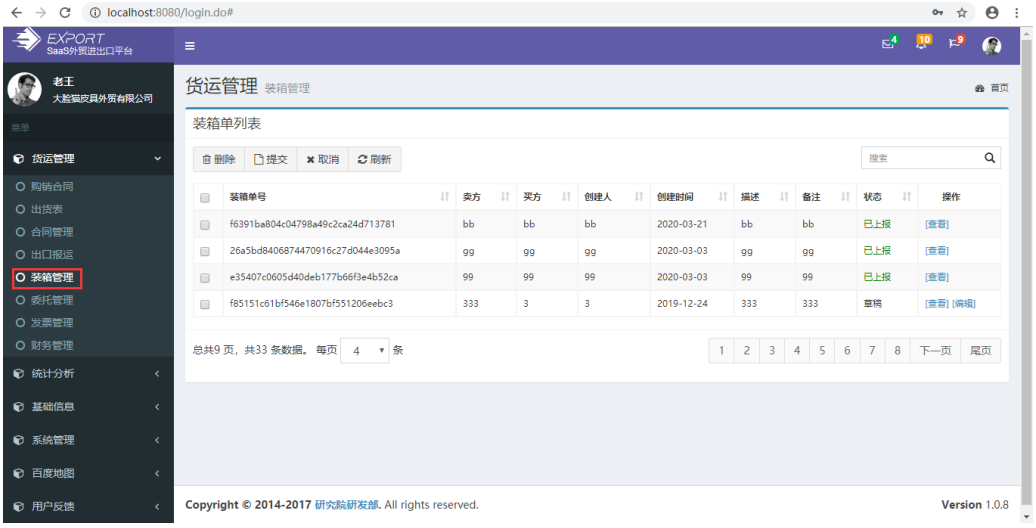

Figure 11. Packing list

Core code:

```
@RequestMapping(value = "/list", name = "Management")
public String findAll(@RequestParam(defaultValue = "1") int pageNum, @RequestParam(defaultValue = "4") int pageSize) {
        PackingExample packingExample = new PackingExample();
        packingExample.setOrderByClause("create_time desc");
        PackingExample.Criteria criteria = packingExample.createCriteria();
        criteria.andStateBetween(0l,1l);
        criteria.andCompanyIdEqualTo(companyId);
        PageInfo pb = packingService.findAll(packingExample,pageNum, pageSize);
        request.setAttribute("pb", pb);
        return "cargo/packing/packing-list";
}
```

6.2.3 Commissioned management

The entrustment management module mainly manages the packing list in Submitted status. Click Add Entrustment Doc in the entrustment management list to jump to Add Entrustment Doc Page. There are two main parts in the page of adding orders: the first part is to add orders, which need to fill in the basic information such as owner, bill of lading header, original notifier, transportation mode, loading port, transshipment port, unloading port, loading period, effective period, whether to transfer in batches, number of copies, brief description, transportation requirements, freight, reviewer, etc. The second part is to show the packing list data in the status of "Submitted". After filling in the basic information of the new order, the user selects the packing data that has been reported for shipment and entrusts it to generate a new order and returns it to the order list for display. The initial status of the newly generated order data is Draft. On the packing list page, the basic information such as transportation mode, consignor, letter of credit, loading port, transshipment port, unloading port, loading date, expiry date and status are mainly displayed. On this page, you can delete, submit, cancel, ship a map, add a new order, and perform fine-grained control according to the status of the order. The realization effect diagram is shown in Figure 12:

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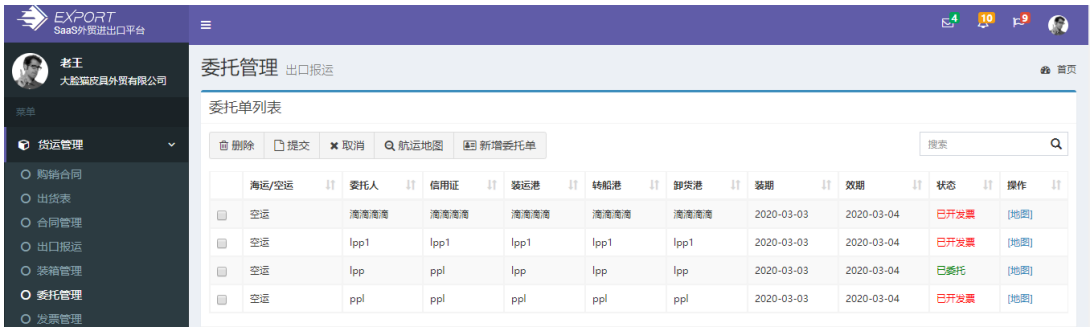

Figure 12. Order list page

Core code

```
@RequestMapping(value = "/list", name = "Go to delegation page")
public String findAll(@RequestParam(defaultValue = "1") int pageNum, @RequestParam(defaultValue = "4") int pageSize) {
    ShippingOrderExample = new ShippingOrderExample();
    shippingOrderExample.setOrderByClause("create_time desc");
    PageInfo pb = shippingOrderService.findAll(shippingOrderExample, pageNum, pageSize);
    request.setAttribute("pb", pb);
    return "cargo/shippingOrder/shippingOrder-list";
}
```

6.2.4 Invoice management

The invoice management module mainly issues invoices for delegated orders in delegated status and displays them on the invoice list page. Click "Add" in "Invoice Management Module" to jump to the page of adding invoice. This page is divided into two parts: the first part enters the basic information of the new invoice; The second part shows the list data of delegated orders in delegated status. After the user finishes adding invoices, the newly added invoice data will be automatically displayed in the invoice list. The invoice page mainly displays basic information such as invoice number, confirmation letter, letter of credit number, trade terms and status. On this page, you can delete, submit and cancel invoice data, and perform fine-grained control according to the status of invoice documents. The realization effect diagram is shown in Figure 13:

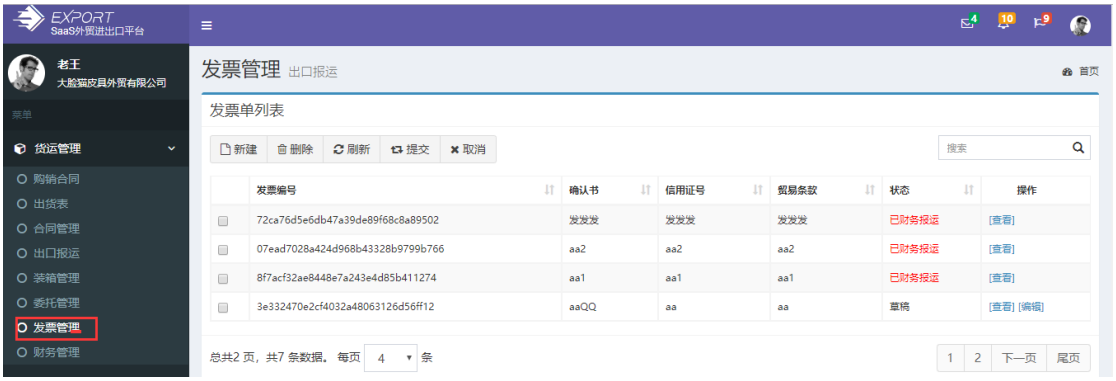

Figure 13. Invoice list page

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Core code

```
@RequestMapping(value = "/list",name = "Paging data query of invoice")
    public String findAll(@RequestParam(defaultValue = "1") int pageNum, @RequestParam(defaultValue = "4") int pageSize){
        InvoiceExample invoiceExample= new InvoiceExample();
        invoiceExample.setOrderByClause("create_time desc");
        PageInfo pb = invoiceService.findAll(invoiceExample, pageNum, pageSize);
        request.setAttribute("pb",pb);
        return "cargo/invoice/invoice-list";
    }
```

6.2.5 Financial management

The financial management module mainly reports and transports invoices in the status of "Submitted", and displays them in the list of financial reporting bills. On the financial delivery management list page, click Add to jump to the new financial delivery page, which is divided into two parts: the first part enters the basic information of the new financial delivery note; In the second part, the invoice list data in Submitted status is displayed, and the invoice in Submitted status is generated into the corresponding financial bill of lading, which is displayed on the financial bill of lading list page. The newly generated financial bill of lading data is initially in Draft status. The list of financial bill of lading mainly displays basic information such as the number, preparation date, creator and status of financial bill of lading. On this page, you can delete, submit, cancel and other operations of financial reporting data, and carry out fine-grained control according to the status of financial reporting bill. The realization effect diagram is shown in Figure 14:

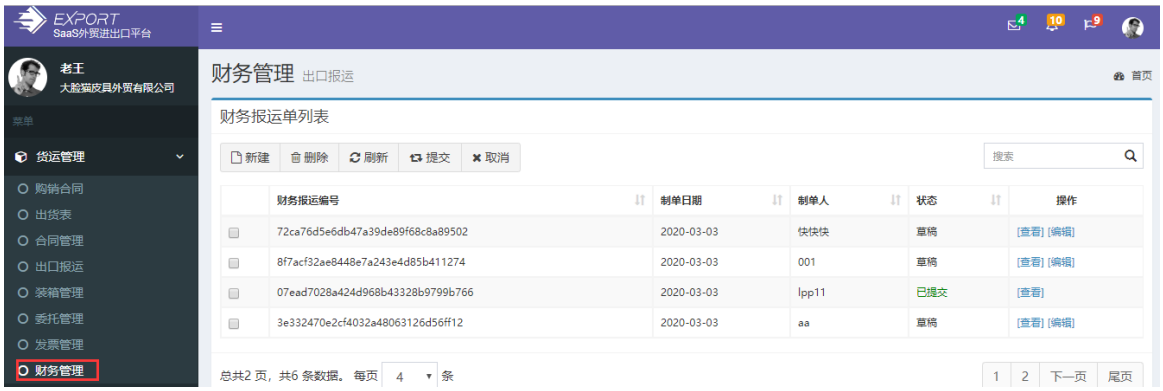

Figure 14. List page of financial statements

Core code

```
@RequestMapping(value = "/list",name = "Paging data query of finance")
public String findAll(@RequestParam(defaultValue = "1") int pageNum, @RequestParam(defaultValue = "4") int pageSize){
    FinanceExample example = new FinanceExample();
    example.setOrderByClause("create_time desc");
    PageInfo pb = financeService.findAll(example, pageNum, pageSize);
    request.setAttribute("pb",pb);
    return "cargo/finance/finance-list";
}
```

6.2.6 Sector Management

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The department management module is mainly used by enterprise tenant administrators to manage the departments within the enterprise. On the department management list page, you can query and display the serial number, number, superior, department name and other information of the enterprise department, and perform basic operations such as adding, deleting and modifying the department. The realization effect diagram is shown in Figure 15:

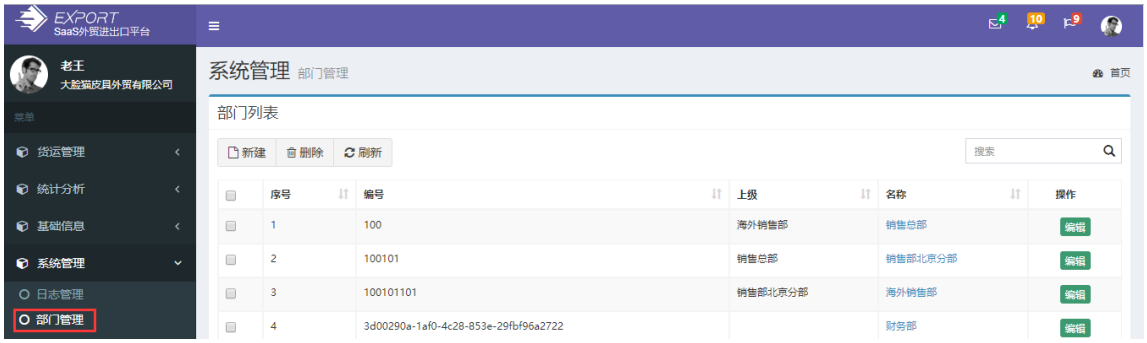

Figure 15. Department management list page

Core code:

```
@RequestMapping(value = "/list",name = "Paging data query of department")
public String findAll(@RequestParam(defaultValue = "1")int pageNum,@RequestParam(defaultValue = "4") int pageSize){
    PageInfo pb = deptService.findAll(pageNum,pageSize,companyId);
    request.setAttribute("pb",pb);
    return "system/dept/dept-list";
}
```

6.2.7 SaaS management

SaaS management module is the management of SaaS system software function and tenant enterprise by SaaSExport administrator, namely module management and enterprise management. The module management page mainly contains basic information such as serial number, module name, superior module, permission identification, link, type, subordinate and status. The enterprise management page mainly displays the basic information such as the name, location, address, legal person, contact information, industry, status and balance of the tenant enterprise. The addition, deletion and modification operations of SaaS administrators in module management and enterprise management will affect the tenant enterprise and internal system functions. The realization effect diagram is shown in Figure 16:

Figure 16. SaaS management list page

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Core code:

```
@RequestMapping(value = "/list",name = "Paging data query of menu")
@RequiresPermissions(value = "Module management")
public String findAll(@RequestParam(defaultValue = "1")int pageNum,@RequestParam(defaultValue = "4")int pageSize){
    PageInfo pb = moduleService.findAllPage(pageNum,pageSize);
    request.setAttribute("pb",pb);
    return "system/module/module-list";
}
@RequestMapping(value = "/list",name = "plug-inpageHelperPaging query all enterprises")
public String findAll(@RequestParam(defaultValue = "1")int pageNum,@RequestParam(defaultValue = "4")int pageSize){
    PageInfo pb = companyService.pageHelperFindAll(pageNum,pageSize);
    request.setAttribute("pb",pb);
    return "company/company-list";
}
```

6.2.8 Statistical analysis

Statistical analysis module mainly includes market price analysis, manufacturer sales situation, product sales ranking, system access pressure diagram, login IP statistics, etc. The market price analysis shows the names and price information of the top five manufacturers in the market price; The sales situation of the manufacturer shows the sales situation of the manufacturer; Product sales ranking shows the number, price and year-on-year sales of each product; The system access pressure diagram shows the system access pressure between 0-23 points; Login IP statistics show the top 10 IP addresses and specific login times. The realization effect diagram is shown in Figure 17:

Figure 17. Statistical analysis view page

7. SYSTEM TESTING

7.1. User Login Test

The user login test results are shown in Table 17:

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Table 17. Packing management test

Numbering	Test data	Test result	Expected result
01	Email and password are both blank	Wrong username or password	Wrong username or password
02	Either email or password is blank	Wrong username or password	Wrong username or password
03	Email and password are wrong	Wrong username or password	Wrong username or password
04	Either email or password is wrong	Wrong username or password	Wrong username or password
05	When you enter the correct email and password	User login succeeded	User login succeeded

7.2. Packing Management Test

Test results of packing management module are shown in Table 18:

Table 18. Packing management test

Numbering	Test data	Test result	Expected result
01	Select the packing data in Draft status and click Submit"	The status of this piece of data changes to "Submitted"	The status of this piece of data changes to "Submitted"
02	Select the packing data in "Submitted" status and click "Cancel"	The status of this piece of data changes to Draft	The status of this piece of data changes to Draft
03	View and modify packing data in Draft status	You can not only view the detailed information of the data, but also modify the data	You can not only view the detailed information of the data, but also modify the data
04	For data in the status of "Submitted"	You can only view its details	You can only view its details
05	Select data to delete it	Delete succeeded	Delete succeeded

Table 19. Commissioned management test

Numbering	Test data	Test result	Expected result
01	Select the data to be deleted and delete it	Delete succeeded	Delete succeeded
02	Select the data in Draft status and click Submit	The status of this piece of data changes to Delegated	The status of this piece of data changes to Delegated
03	Select the data in delegated status and click cancel	The status of this piece of data changes to Draft	The status of this piece of data changes to Draft
04	Delete, modify and query the data in Draft status	You can view the detailed information of this data, modify the basic information of this data, and delete this data directly	You can view the detailed information of this data, modify the basic information of this data, and delete this data directly
06	Commissioned management of packing data in "Shipped" status	List the packing data in Shipped status, fill in the order form, and generate the order form data for it	List the packing data in Shipped status, fill in the order form, and generate the order form data for it

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7.3. Commissioned Management Test

The test results of the entrusted management module are shown in Table 19:

7.4. Invoice Management Test

The test results of invoice management module are shown in Table 20:

Table 20. Invoice management test

Numbering	Test data	Test result	Expected result
01	Add an invoice form to invoice the delegated data in Submitted status	List the delegated data in Submitted status, fill in the invoice form and generate invoice data	List the delegated data in Submitted status, fill in the invoice form and generate invoice data
02	Modify the page status of the order	The status is automatically changed to Invoiced	The status is automatically changed to Invoiced
03	Delete invoice data	Delete succeeded	Delete succeeded
04	Select the data in Draft status and click Submit	The status of this piece of data changes to Submitted	The status of this piece of data changes to Submitted
05	Query the details of data whose status is not Draft	Data in non-Draft status can be queried	Data in non-Draft status can be queried

7.5. Financial Management Test

The main test results of the financial management module are shown in Table 21:

Table 21. Financial management test

Numbering	Test data	Test result	Expected result
01	Add a financial document, and add a financial bill of lading for invoice data in the status of Submitted	List the invoice data in Submitted status, fill in the financial bill of lading, and generate the financial bill of lading data for it	List the invoice data in Submitted status, fill in the financial bill of lading, and generate the financial bill of lading data for it
02	Modify invoice sheet page status	The status is automatically changed to "Financial Shipment"	The status is automatically changed to "Financial Shipment"
03	Delete financial data	Delete succeeded	Delete succeeded
04	Select the data in Draft status and click Submit	The status of this piece of data changes to Submitted	The status of this piece of data changes to Submitted
05	Select the data in Submitted status and click Cancel	The data status changes to Draft	The data status changes to Draft
06	Query the details of data whose status is not Draft	You can query data whose status is not "Draft"	You can query data whose status is not "Draft"

8. SUMMARY

This paper studies the design and implementation of SaaSExport Freight Forwarding Cloud Platform. At the beginning of this paper, the SaaS freight forwarding cloud platform and its

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application fields are briefly introduced, and then through system analysis, the main content of this system research is extended.

By introducing SSM framework and MYSQL database, the feasibility of SaaSExport freight forwarding cloud platform management system is briefly explained, and the SaaS freight forwarding cloud platform management system based on JSP and MYSQL is realized.

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