ABSTRACT: This study proposed a port logistics information platform based on Java2 Platform Enterprise Edition (J2EE), which was integrated with three levels: client, Web, and business logic. These levels aimed to resolve the low-level informationization, low sharing information, information risk, and other problems of Dushan Port logistics. Seven function modules based on JavaScript, CSS + HTML technology, and business demand were developed, such as the public information service module and the e-port module of the harbor. The practical operation results show that, the establishment of a port logistics information platform efficiently can improve customs clearance speed, reduce logistics costs, and improve government administration efficiency. As a result, the utilization rate of information and the safety of port logistics information management can be enhanced.

Subject Categories and Descriptors
K.6 [Management of Computing and Information Systems]

General Terms: Information Platform, Logistics

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1. Introduction

Global economic integration and information technology development, especially modern logistics development, have expanded the competition among logistics services beyond the hardware to the information construction of logistics management and the level of application. The impact of information technology implementation improves service quality thereby creating competitiveness[1]. In logistics firms, the information system plays an essential role between logistics users and their customers[2]. The modern port logistics information platform is the internal management information system that connects government departments (e.g., transportation, customs, foreign trade, and quarantine) related to domestic and foreign trade, social services (e.g., banking, insurance, transportation, storage, ports, and airports), and various trade, production, and transportation companies. The data from these departments are integrated through the platform. The information network system also conducts electronic data interchange and e-commerce services. Information systems can improve the efficiency of logistics industry[3,4].

Dushan Port, the economic hinterland of the Hangzhou–Jiaxing–Huzhou region, is one of the most developed areas in China’s export-oriented economy. In recent years, the proportion of container load freight of foreign trade cargo and the container rate has continuously improved by two digits annually. Based on the statistical analysis of the variety of import and export products in Jiaxing, the proportion of foreign trade cargo is very high, especially for the cargo suitable export container, the generation of container transport is very high. The proportion of the export
cargo suitable for the container is 95%, and that of the import cargo suitable for the container is 70%. Currently, China’s container transport is completed mainly through the Shanghai and Ningbo ports. More than 95% of the volumes of containers are imported and exported through Shanghai Port.

One of the strategic measures of Dushan Port Logistics Park is to promote the shift from the traditional to the modern trading method through the gradual promotion of e-commerce and other modern trading methods, as well as to extend the service function of the logistics services of the logistics park to a higher-level service so that it becomes a commodity trading and information center in northern Zhejiang Province.

2. Current Status and Demand Analysis of Informationalization Construction of Dushan Port Logistics Park

The first task to achieve the goal of transforming Dushan Port into a comprehensive modern port logistics base is to construct the port logistics information platform. Dushan Port should be equipped with all levels of logistics enterprises with modern information technology as soon as possible. Its level of logistics of production, operation, management, and decision making, and its efficiency should be improved through the deepening development and widespread use of information resources, which will ultimately realize the purpose of improving the social economic efficiency and competitiveness of the logistics business enterprises. Currently, the major problems of Dushan Port in the process of informationization are as follows:

(1) The degree of electronic information and coverage is not high, and the level of computer application is low among the companies related to the e-port at Dushan Port and even among all of the ports in Jiaxing.

(2) The electronic document proportion is small for the entire container trade process, which has not been given ample importance to.

(3) The technical level of port trade is limited. Most companies rely on outsourcing, which has limitations.

(4) The standards of business systems are different. Thus, the data are limited, and the degree of standardization of electronic data is not high.

(5) The information service function and range are not wide enough, only having narrow coverage.

The goal of Dushan Port is to create a port logistics information platform with favorable operating conditions, expand the coverage and the application, and develop a modern logistics information platform with the core of port logistics service. Such service is integrated with the information publicity of the port logistics service node, the query platform, the visualization of document transmission, and the cargo tracking platform. It also provides a unified data transmission standard, the comprehensive logistics information technology, and full-speed port logistics to realize electronic and modern port logistics information. The business process is shown in Figure 1.

3. Design and Realization of the Port Logistics Information System

3.1 Introduction of technology related to the system

3.1.1 Introduction of the J2EE framework

J2EE is an open and standard-based platform that can open, deploy, and manage the N-level framework, which faces the Web-oriented and server-centric enterprise applications[5]. The J2EE technology framework is shown in Figure 2.

The figure shows the three-level structure of J2EE.

a. Client-level components running on the client machine, such as client programs and applets, can directly access the database.

b. Web-level components running on the J2EE server can also directly access the database. For example, Java Servlet and JavaServer Pages are the assemblies at the Web level, and they run in the Web container of the server.

c. Business logic components running on the J2EE server can also directly access the database[6]. For example, Enterprise JavaBeans (EJB) is the assembly at the Web level that runs in the Web container of the server.

To compare the booming port logistics development of Dushan Port and the obvious undeveloped logistics information, the industry-leading multi-level structure is utilized for the design of a system structure, namely, browser / application server / database server built on the J2EE framework. This structure is in line with the technological hierarchy of the application characteristics of port logistics information.

(2) JavaScript script

JavaScript is a widely used client-side scripting language. It is used to add dynamic effects to HTML pages to develop more active and lively pages and improve the observability of the pages[7].

Figure 1.

Figure 2.
(3) CSS + HTML technology

CSS is a style design language that can separate the Web content from the page. It can edit the Web object and realize the simple initial interaction design. Currently, it shows the best performance of the design language based on the text display. HyperText Markup Language (HTML) can create Web pages with powerful functions after combining with other Web technologies.

3.2 System structure
The J2EE platform was chosen for the information system structure of Dushan Port. It is composed of four levels of system structure, namely, browser, Web server, business logic, and data server. The system structure is shown in Figure 3.

![Business process diagram]

Figure 1. Business process
Figure 2. J2EE technology framework

Figure 3. Diagram of the Database
(1) **Client:** Client is operated on Internet Explorer (IE) or Netscape to execute the assembly of HTML, JavaScript, and Java applets and complete the interaction with the user.

(2) **Web Service Level:** Web service level operates in the Web container of J2EE[8], which can be WebLogic or WebSphere. It generates the expressing logic of the application program to process the response of user requests. It does not directly access the database, but it completes the relevant business logic operations through the EJB assembly.

(3) **Business Logic Level:** This level is also known as business logic service level. The business logic of the port logistics information system is written in the form of the EJB assembly and operated in the EJB container of J2EE. The EJB assembly visits the database through a standard interface provided by J2EE[9].

(4) **Database Service Level:** The database service stores the application data of the port logistics information system and completes the data storage and access operations. The informationization construction of wisdom engineering of the Dushan Port Logistics Park project is shown in Figure 4.

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**Figure 4. Information construction of wisdom engineering of the Dushan Port Logistics Park project**

### 3.3 System Implementation Technology

(1) **System frame:** This system uses J2EE framework technology. It also uses the Spring framework and integrates Struts with Hibernate, which is the best choice for the current enterprise development.

(2) **Front-end technology:** This technology utilizes the powerful enterprise-level Web control-base MiniUI, combined with the outstanding lightweight jQuery. The system uses Ajax technology to realize the asynchronous refreshing effect among the data, reduce the burden on the server, refresh the data instantly, and reduce the actual and psychological waiting time of users.

(3) **Safety technology:** The user account passwords are encrypted by MD5 encryption technology. Even the system administrator cannot see others’ log-in password which increases the safety and reliability of information.

### 3.4 Environment of System development

(1) **Browser:** IE, Chrome, and other browsers: the major browsers, such as IE and Chrome

(2) **Server:** Tomcat7.0 server: Tomcat7.0

(3) **Operating Environment:** JDK7.0 operating environment: JDK7.0

(4) **Development Tool:** MyEclipse10

(5) **Framework:** J2EE frame: J2EE

### 4. Function Module Design Of Port Information System

The wisdom engineering information system of the Dushan Port Logistics Park project mainly includes the information and the intelligent construction. Based on the development strategy of the Dushan Port Logistics Park, the future logistics park information system will be composed of the following subsystems:

A logistics information platform can coordinate the development of logistics enterprises, commercial enterprises, ports, banks and so on[10]. A “one-stop” logistics service is supplied to enhance the overall
competitiveness of the park by constructing an information platform to connect Dushan Port Logistics Park, the relevant government departments, the enterprises in the park, and the related upstream and downstream enterprises of supply chain, all of which will become the benchmarking model of Yellow River Delta logistics information services. The construction of Dushan Port logistics information provides the intelligent information service mainly to the enterprises in the port park, the local regulatory authorities related to the industries, the surrounding trade and logistics companies, the peripheral manufacturing enterprises, and the e-commerce service providers.

(1) Wisdom Logistics Matching Service

The matching service is composed of logistics service brokering center, LTL cargo center, and trade and logistics supermarket online, which can meet the demand of the enterprises of the commercial owner, the third-party logistics companies, and the small and medium motorcade.

(2) Visualization Management of Wisdom Logistics

All trade and logistics in the park are visually managed via a 3G/4G intelligent video surveillance platform. Thus, the logistics enterprises can fully understand the real-time information of people, vehicles, and cargoes; summarize, analyze, and schedule information; and ensure the accurate and timely delivery of goods. The enterprises of the commercial owner can determine the status of goods on the way and their security and arrival. The logistics co-op providers can understand the real-time information of the driver, vehicle routes, and mileage and prevent the unauthorized transport of cargo. Finally, the consignee can determine the time of arrival of goods, goods category, volume, and other information.

(3) Mobile terminal service of wisdom logistics

(4) Smart Support – Supplies the user experience and mobile office support.

(5) Real-time processing – Provides the real-time goods information for the reasonable allocation of resources.

(6) Terminal submission – Provide the information to collect, send, and receive the cargo.

5. System Functional Module

According to the business demand and system function[11], the port logistics information systems can be divided into Seven functional modules, namely, public information service module, e-port module of the harbor, function module of freight exchange, settlement management module, vehicle management subsystem, multimedia interactive information distribution system, and wisdom functional module. These modules are shown in Figure 5.

5.1 Public information Service Module

The construction of a public information service platform is a comprehensive public service platform for the modern logistics business, the enterprise-oriented service, the public service, the investment, and the online approval, which are centralized on the supply chain. The public information service platform should establish a complete information site for the park system, and this site should contain customer, staff, and partner portals. The following objectives should be concretely achieved, particularly for the partner portal and the expansion and improvement of internal and external portals: provide the content aggregation of information resources, provide the personalized information services, provide a unified collaborative office platform, and provide an access to information resources with a single entry.

The public information service platform of the harbor logistics aims to provide users with relevant public
information on the logistics park, including the following functions:

1. Provide policies, regulations, and other information resources about business management, traffic management, rail transport, and cargo transport, among others, and provide the administrative work online system of the abovementioned departments for the enterprises in the park.

2. Provide relevant information about the logistics park and the enterprises in the park: the main business scope, co-products and services, technology and equipment, office to rent, warehousing information, sales and rental conditions, investment inquiries, etc.

3. Provide basic data about the enterprises in the logistics park: the basic company information, location and position, main business products and services, general price information, special services, contact information, etc.

4. Provide basic data about the life services: city information, station information, public transport information, main roads, schedules, and hotel (contact and booking, etc.)

5. Provide a detailed introduction of image display advertising and logistics services to member companies.

5.2 E-port Module of Harbour

E-port uses modern information technology to collect the information flow, capital flow, and goods flow data of import and export businesses in the public data center, which are managed by the various administrative organs separately, in order to share the import and export business data and exchange the data. The relevant administrative departments can perform the cross-sector and cross-department networking data verification via e-port, and the enterprises can handle a variety of import and export businesses on the Internet.

E-port is integrated with the customs clearance, law implementation, and related logistics and business services, which provide the online collaborative work; public government affairs; information inquiry; e-logistics and e-commerce services, including port inspections, vessel inspection, and quarantine; electronic clearance services; and other functions. The companies can declare the various import and export procedures via the e-port to achieve the government’s “one-stop” business service for the customs, national inspection, foreign trade, foreign exchange, taxation, banking, and other government agencies.

The political projects of the Dushan Port electronic port construction are operated by the “government-led, market operating” Mode. The bonded logistics center has set up an entry and an exit to cooperate with the construction and operation of the electronic port. The entry goes out from the customs, and the exit comes in from the customs. The entry and exit system consists of an electronic weighbridge system, a container number automatic identification system, an electronic license plate recognition system, a driver IC card identification system, an electronic lock, a GPS, electronic gates, and other parts. All these components can identify the vehicles and driver information of the entry and exit system, as well as authenticate and verify the validity of the certificate of the customs formalities.

5.3 Function Module of Freight Exchange

The freight transaction management subsystem includes freight resources management, supply management, commission management, cargo tracking, and storage resource management. For the main trading method, the information providers and manufacturers release the information of freight requirements, and the drivers and logistics companies provide the selection of transportation services by the service line and retrieval of user demands. The bidding service can be made through the data exchange system to offer and receive the order of transport services and other logistics. The supplier and the purchaser will operate and manage the e-commerce information system after the realization of the transaction through the logistics service transaction system.

5.4 Settlement Management Module

The streamlined management of logistics service is implemented for the enterprises by the settlement management, which includes the calculation of warehouse rental costs of a variety of modes, transportation costs, handling costs, distribution costs, freight costs, and so on. Meanwhile, the interface of the financial system is provided to achieve a seamless transfer of financial data, which include the financial management and bills required in the process of transport management, online banking, customs management, billing, transportation management, document processing, and quality management.

5.5 Vehicle Management Subsystem

The vehicle management subsystem records the vehicle and the condition of the goods in the logistics park through the bar code reader and the radio frequency identification device (RFID), which will be used to establish the contact between the goods and the vehicles. Recording cargo damage, loss, and tag numbers into the information system is possible during the entry and exit management of the logistics park.

The entry and exit are equipped with an electronic control bar with an automatic electro-photographic device. The driver should show the electronic information card when the vehicle enters and exits the platform. This card contains the driver’s personal information and the company’s information. The information is read by the reader and compared with the database information, and all the information of the driver is recorded. The driver’s license information is recorded on the card to prevent the card from being stolen.
5.6 Multimedia Interactive Information Distribution System
The multimedia information system is the information processing system that serves the management of the park. This system is based on the computer, communications networks, and other modern tools and means. The major professional market and office buildings of the park are deployed by the text, sound, graphics, images, animation, video, and other functions to provide enterprises, merchants, and consumers with all types of information, provide a more vivid and intuitive method for the better display and advocacy of the park, and enhance the competitiveness and level of information of the park.

5.7 Wisdom Functional Module
(1) Cloud Computing Data Center
This center provides the virtualized server and storage space for the enterprises in the park by the virtualized physical device and builds a cloud computing platform on which the cloud service developers can develop cloud applications. The cloud service providers will manage the virtual resources and distribute the cloud services uniformly. The consumers of the cloud service will be business users, who can enjoy a lower cost of IT services.

(2) Intelligent Warehouse

Data collection in different locations and different processes for the different SKUs (tray-level, independent packaging stage, single-grade) materials is realized by the “electronic tag and bundling materials, electronic tags and bundling location, and the bundling of operator between the account number and password and handheld device,” which meet the demand of manufacturing warehouses (raw material and finished products), such as goods entry, delivery, distribution, and inventory calculation. The sound interaction among procurement, production, sales, and finance is achieved through accurate and timely data collection.

(3) Wisdom Distribution Center
The intelligent distribution center is an automated center built on sensing, RFID, sound, light, mechanical, electrical, mobile computing, and other advanced technologies. The full collaborative business flow, logistics, information flow, and capital flow can be realized by the intelligent control and automation network of the distribution center network. It is possible to palletize by robot, move the material by the carrying device without person, sort automatically by the sorting lines, stack by the computer, and store automatically. The logistics and manufacturing operation of the automation, intelligentization, and networking can be realized through network and sensors.

Figure 6. Public information service platform of harbor logistics
6. Conclusion

The port logistics information platform of Dushan Port will connect the enterprise network through the network platform and IT. This information platform can optimize the internal resources allocation of enterprises and share the resources and information through linking among networks and users, manufacturers, suppliers, and related linked units. This platform will then conduct real-time tracking, effective control, and full management of each part of the logistics.

One of the important principles in establishing the port logistics information system is to develop it with major or potential partners, which is the key to the success of the information system. The majority of domestic public logistics information platforms fail because they are separated from the actual needs of users. Thus, the future construction of the Dushan Port Logistics Park information system should observe the following principles:

1) The information platform should be developed and constructed first by the construction and development company, but the terminals should be left for the future logistics and sales companies that will be stationed in the park.

2) The information platform is free for the companies that will be stationed in the park. Obtaining the approval of the other transport companies is necessary, and logistics service providers should take advantage of the information system of the park. It is completely open for the users of logistics, who are free to browse the service information.

3) At the initial construction, one or several enterprises who may use the park service in the future should be involved. They may even set the platform management functions based on their requirements.

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References