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Design and Implementation of Warehouse Information Management System Based on Java

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Abstract: This system leverages the cross platform, secure, stable, and highly scalable features of Java, as well as the advantages of Vue3 in building an efficient user interface. With the support of WeChat's vast user base and convenient mobile operation functions, it achieves efficient management of warehouse material inbound and outbound. This system covers multiple functional modules such as user management and asset management, and implements automated operations for material inbound and outbound as well as real-time inventory queries, greatly improving warehouse management efficiency and reducing management costs. However, there are still issues with poor data compatibility, low level of intelligence, and room for improvement in user experience in warehouse material management systems both domestically and internationally. In the process of system design and implementation, this study explored and improved these issues to provide new ideas and methods for optimizing the warehouse material management system, further improving the system's functionality and performance, enhancing the level of intelligence and user experience, and providing more reliable technical support for enterprise warehouse management.

1. Introduction

1.1 Project Background

With the rapid development of information technology, the operational management methods of enterprises have undergone tremendous changes. In the current fiercely competitive market environment, warehouse material management plays a crucial role in enterprise operations, directly shaping core areas such as production, sales, and cost control. In the past, traditional warehouse material entry and exit management mainly relied on manual operations and recording forms, which caused resource waste and time loss, and easily led to data errors and information timeliness issues, resulting in chaotic inventory management and inability to meet the efficient material management needs of enterprises. Therefore, in the context of digital transformation, the use of advanced information technology to optimize warehouse material management is unstoppable.

1.2 Research significance

In today's digital age, enterprises must rely on information management to achieve efficient

operations. As a key link for storing and circulating materials in enterprises, the management efficiency of warehouses directly affects the overall operating costs and benefits of the enterprise. It is of great research significance to implement the warehouse material entry and exit subsystem on the WeChat platform by using Java and Vue3 technologies.

In terms of optimizing business processes, the warehouse material entry and exit subsystem on the WeChat platform has broken through time and space limitations. Employees can perform material in and out operations through WeChat at any time without being constrained by fixed office locations or specialized equipment. This not only improves work flexibility, but also accelerates the speed of material circulation and enhances customer satisfaction[1]. The combination of Java and Vue3 technology ensures system stability, security, and a good user experience, making the system better adapt to the ever-changing and complex business needs of enterprises.

1.3 Research Content

This study focuses on using Java and Vue3 technologies to implement a warehouse material entry and exit subsystem based on the WeChat platform. At the technical level, we will delve into the backend development advantages of Java and use its powerful framework (such as Spring Boot) to build a stable and efficient data processing and business logic execution environment, ensuring that the system can handle high concurrency warehouse business operations[2]. At the same time, leveraging Vue3's strengths in front-end interaction design, building a simple, intuitive, and smooth user interface to enhance the operational experience of warehouse managers.

2. Introduction to Related Technologies

2.1 Java Language

The Java framework launched by Microsoft aims to promote web development. By fully utilizing Java's rich control library, developers can effectively build web applications, thereby shortening project cycles and improving work efficiency.

Java is not just a programming language, but a comprehensive technical system. Using Java, web pages can serve as the user interface for web applications and can also be used for developing backend logic. Using Java web pages, the browser can present information to users and implement various application logic through server-side code.

2.2 MySQL Language

MySQL is a small relational database management system that supports regular SQL query language and uses multiple data types for detailed queries. MySQL provides a complete set of mechanisms for database creation and access, allowing for an extremely intuitive way to create, access, and modify database tables and various data relationships between them. After years of development, it has also become a very mature technology[3].

The characteristic of MySQL database is that when applying small and simple database files, it can be used without running or starting the database service process. Generally speaking, MySQL database files can be conveniently placed in the directory of a web site. It is precisely because of these characteristics that MySQL database is often used as a database to support the development of a website.

3. System Requirements Analysis

3.1 Requirement analysis

3.1.1 System Overview

The warehouse management system software aims to optimize enterprise logistics management, including product procurement, inbound and outbound inventory management, etc. By monitoring the operation status of the warehouse, providing task planning functions, and arranging entry and exit tasks, we aim to improve the economic efficiency of the enterprise[4]. The operation center commands the procurement and shipment process to ensure timely completion of tasks.

In addition, the system monitors the real-time status of goods transportation and reports inventory changes, which helps to effectively manage and allocate resources. The system supports a comprehensive process from product procurement to final product delivery, and provides convenient and efficient logistics solutions for enterprises, committed to improving overall operational efficiency[5].

3.1.2 Overall System Requirements

The use case of the warehouse director includes several core functions:

(1) Login case: The purpose is to verify the identity of the director to ensure system security and successfully complete the director login process. This step is a crucial operation in the system as it directly affects the use of subsequent functions.

(2) Personnel management use case: Careful consideration is required before conducting employee evaluation and management after confirming that the director has successfully logged in. This process involves manipulating employee performance, evaluation, and other aspects.

(3) Personnel transfer use case: Detailed description of the director's scope of authority, including tasks such as adding new employees, removing existing personnel, and adjusting work assignments and environment settings between them. All these operations must be performed after the director has verified and logged into the system.

(4) Query case: Enable supervisors to access material storage status and obtain data on staff information at any time. Although browsing related content is allowed, this feature does not include adding or deleting items or modifying related records.

The warehouse administrator use cases include:

(1) The system should have a warehouse administrator login function to maintain system security and data accuracy.

(2) The product warehousing process involves verifying the relevant information of the product (including name, model, quantity, etc.), confirming that it is correct, filling out the warehousing form, and updating the product summary table to record the latest changes in information.

(3) When conducting product outbound operations, it is necessary to verify the sales order to ensure accurate and error free operations. After distributing the corresponding products, the product summary table needs to be updated immediately to reflect the detailed situation of outbound shipments.

The warehouse purchaser use cases include:

(1) The operational steps for implementing the login function of the warehouse purchaser system: For warehouse purchasers, the primary task is to log in to the system.

(2) Expansion of requirement acquisition use cases: Expand to various departments to gain a detailed understanding of specific requirement content.

(3) Overview of Product Inventory Query Use Cases: After a thorough understanding of specific

requirements, the inventory status of warehouse products can be viewed; Please note that this process is a search operation and does not involve modification or deletion.

(4) Example of filling out a purchase order: When demand exceeds supply, the corresponding purchase order must be filled out to meet the requirements.

The use cases for product salespeople include:

(1) In the login process use case for salespeople, the aim is to ensure the reliability of their identity verification in order to complete the product salesperson login process.

(2) The main content of the order acceptance case is to accept the order request issued by the customer, which will trigger the start of the subsequent processing flow.

(3) The inventory query case focuses on querying the warehouse inventory table without involving any deletion or modification behavior during the process.

(4) The use case for filling out sales orders requires writing sales documents with sufficient inventory to complete the transaction. This step emphasizes the need to confirm sufficient inventory before filling out the sales order.

3.2 Asset Management

(1) New feature classification: For the convenience of asset management, the system now supports storage by product category. Users can easily add new categories.

(2) Asset search tool: Users can accurately search for specific assets in the warehouse, with keywords including names or codes. When the match is successful, the system will present detailed information such as number, name, existing and upper limit quantity, lower limit quantity, storage warehouse, and shelf location.

(3) Registration process for new types of assets: When a company intends to purchase new asset products, the system supports quick data entry. Users need to fill in the number, name, category, quantity limit, and storage location of the newly added item to complete the steps.

4. System Design

4.1 Warehouse Management System Architecture

The warehouse management system adopts the widely used B/S architecture. The B/S architecture has become mainstream, giving rise to various system design architectures. In this system, we have adopted a three-tier design pattern, including the presentation layer, business layer, and data layer. Through this three-tier design pattern, the system's business functions are reasonably allocated to different levels. This not only ensures the orderliness of data flow, but also makes the relationships between various functional modules more independent[6]. This design method not only makes system design more standardized and reasonable, but also simplifies the workload required for adding new functional modules and updating existing functions in the future.

4.2 Functional Module Design of Warehouse Management System

In the research paper, although multiple functional modules are included, due to limited space, it is not possible to present all the content in detail. The discussion focused on five core functional modules: inbound management, outbound management, inventory query, user management, and data reporting, which play a key role in the warehouse system. These core modules, through careful design, can not only improve warehouse operation efficiency and optimize management processes, but also promote the achievement of information technology goals[7]. Fully considering and designing these key functions will bring significant benefits and help improve the overall operational efficiency level

and the development direction of the warehousing system. Good design and consideration have obvious advantages for warehousing systems and can make positive contributions to improving overall operational efficiency.

4.2.1 Design of Warehouse Management Function Module

The warehouse management function module is specifically designed for warehouse administrators, and each warehouse is equipped with a specific warehouse administrator. When assets need to be stored in a warehouse, the corresponding warehouse administrator needs to enter the correct username and password to log in to the system before performing the asset storage operation. This module contains three object classes: document table, asset category, and operation type.

4.2.2 Design of Outbound Management Function Module

Each warehouse is assigned a specific outbound administrator to perform outbound tasks. The administrator is required to first verify their identity through system login, enter the correct username and password, and then obtain outbound permissions for that warehouse.

4.2.3 Design of Inventory Query Function Module

Once the inbound and outbound administrators log in to the system, they can perform inventory queries. This operation covers the asset situation of each warehouse of the company, and users can search by asset number or name. The query results include detailed information such as asset number, name, existing quantity, upper and lower quantity limits, storage warehouse, and shelf location.

4.2.4 Design of User Management Function Module

The user types in the warehouse management system include system administrators, warehouse administrators, inbound administrators, and outbound administrators. In addition to system administrators, the other three types of administrators are assigned to a specific warehouse and have unique permissions for that warehouse[8].

4.3 Database Design

4.3.1 Conceptual Design of Database

The system includes multiple functional modules, including inventory equipment, equipment types, inventory equipment list, document list, warehouse information, operation classification, operation records, notifications, and users. In the user entity diagram, users have multiple attributes such as user ID, username, password, user type, account activation status, repository, and administrator privileges. The relationship between these entities and attributes can be described in detail through an E-R diagram.

Asset entities have numerous attributes in the inventory system, including model, number, name, current quantity, maximum capacity, warehouse location, shelf number, minimum quantity requirement, and classification. These attributes record and depict the characteristics and basic information of each asset, which are detailed in the Entity Relationship Chart (E-R chart).

The asset recording model covers multiple important attributes, including asset list identification, asset identification number, product price, quantity, manufacturer information, finalized specifications, production date, as well as recording the time of entry and effective use.

In the Entity Relationship (E-R) diagram, each document carries numerous attributes. These attributes include document ID, asset ID, asset quantity, demand personnel, operator, operation time,

and operation type ID.

After a thorough analysis of the characteristics of these entities, it is necessary to conduct in-depth exploration of their interrelationships.

4.3.2 Database Logic Design

The database design is aimed at the warehouse management module, and the core data structure mainly involves the inbound order, inbound detailed information table, outbound order, and inventory information table.In the process of outbound management, when a warehouse needs to release assets, the only authorized outbound administrator must log in to the system. The administrator needs to provide the ID, quantity, and applicant name of the assets to be issued, and select the required operation type (including issuance, transfer, or borrowing). After the data is entered into the database, the inventory table will be updated to clearly reflect the changes in the corresponding asset quantity, and a new record will be added to the document record table to summarize the specific operation information. If any program operation is successfully completed, the system will display in detail that the current outbound activity has been completed[9].

5. System Implementation

5.1 Overall Process Design

The inventory management work of enterprises includes multiple tasks, such as processing goods, recording incoming and outgoing information, and filling out inventory forms. After confirming the valid order, the goods will be received and stored, and relevant information will be recorded in detail in the form. Each department submits a product application according to demand, and the planning personnel formulate an outbound order to meet the overall demand. After confirmation, the warehouse personnel distribute the products. In addition, monthly statistics and analysis will be conducted based on specific situations, and corresponding reports will be generated for future reference[10]. Ensuring accurate information and efficient and orderly operations is crucial throughout the entire process.

5.2 Detailed design and implementation of the system

5.2.1 Implementation of Login Module

The main interface design of the system covers six core functions, namely basic information management, product information management, inventory operation management, inventory warning management, statistical query management, and system data maintenance. The purpose of this design is to provide users with a user-friendly interface and enable them to easily click on relevant functions to quickly enter the corresponding modules[11]. Before users access the main interface, there is a login page used to verify their identity. Users need to fill in their username and password, and the system will verify their identity. Only after confirming the legitimacy can they enter the main interface.

After the goods arrive at the warehouse, the warehousing process starts immediately. The system first displays relevant information such as the inventory number, department, product name, and quantity on the page. Subsequently, the warehouse administrator conducted an inspection of the received goods. Once the acceptance work is completed, a printed warehouse confirmation form will be submitted and further operations such as warehouse allocation will be carried out.

(1) Timely procurement and warehousing to ensure normal business needs

Automatically generating purchase receipts from purchase orders or arrival documents can reduce the risk of operational errors. At the same time, the system supports flexible setting of whether to

strictly follow the purchase order for the receipt process according to requirements. For outsourcing processing, import and other businesses, the system also has the function of generating orders to ensure efficient and smooth business processing[12].

(2) Shortage goods are allocated and stored to ensure supply

By executing transfer orders to complete material allocation between warehouses or departments, the system will then update inventory data in real-time to ensure that the production line can obtain the required materials in a timely manner.

5.2.2 Implementation of Product Inventory Module

In the daily operation of the company, various business activities are directly related to the inventory quantity of goods. The finance department supervises the value of inventory goods, while the warehouse management department monitors and adjusts the actual quantity of goods. The inventory value is closely related to the quantity: if the actual quantity of items does not match the record, it will result in a deviation in the inventory value in the financial records[13]. To maintain data consistency, the company conducts regular or irregular warehouse inventory checks, verifies actual and recorded inventory quantities, and corrects any errors.

5.2.3 Implementation of Product Outbound Module

On the "Outbound Management" page, a series of specific information are displayed, including outbound order number, sales number, warehouse where the item is located, outbound quantity, and current inventory level. These detailed data need to be reviewed and verified by the warehouse administrator. Confirming the completion of the operation means that an agreement has been reached with the customer regarding the shipment.

To reduce the possibility of errors, the system will closely monitor the shipment and invoice issuance during the product sales process[14]. In addition, in terms of flexibility, the system also allows for adjustments based on actual needs, and the administrator decides whether to allow excess supply according to the delivery note or invoice regulations.

6. Conclusion

This study successfully implemented the warehouse material entry and exit subsystem of WeChat based on Java+Vue 3 technology, which plays an important role in promoting the digital transformation of enterprise warehouse management.

From the perspective of system implementation results, through in-depth analysis of requirements, we have planned and built a comprehensive system that integrates multiple functional modules such as user management, asset management, inbound management, outbound management, and inventory query. Throughout the process, we adhered to reasonable system design principles and completed the design tasks of network structure, functional modules, and databases, ensuring that the system has excellent stability, security, and scalability. During the implementation phase, we meticulously designed and executed core modules such as login procedures, product warehousing procedures, inventory mechanisms, and shipping operations. Each module performed well and achieved the expected design goals.

Overall, the WeChat warehouse material entry and exit subsystem based on Java+Vue 3 has high practical value and promotional significance, providing an effective solution for the modern development of enterprise warehouse management.

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