University Logistics Management Data Analysis System Based on Business Intelligence

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Abstract

There are many university logistics management methods in our country. Different methods have different influence on the construction of university logistics management system. The university logistics information is a trend of logistics management. It is the core of establishing modern logistics, and a huge driving force for promoting logistical reform. The success or failure of the construction of the university logistics information system will affect the information of logistical support measures, thereby affecting the goal of establishing modern logistics. This paper analyzes the requirements of university logistics management data analysis system and its users, and based on this, the logistics management system has been constructed and developed with the business intelligence technology. In addition, the evaluation system is established to verify the feasibility of the developed system for improvement and optimization, so as to improve the efficiency of university logistics management.

Keywords: Business Intelligence, University Logistics Management, Data Analysis, System Architecture.

1. BACKGROUND

1.1 Introduction

With the development of computer and communication technologies, people's lives are moving from the era of industrialized reform to the era of information innovation. The information age are changing our life and work, and also affecting all industries (Qian, 2016). The university logistical property management has become one key part of university logistics. With the development of advanced education in China, the management level of university logistic properties is also increasing. Logistics management information is an important aspect of logistical reform. Since 1999, the universities in China started the logistics information reform. The focus of reform is transition from the traditional management model to new management. The university logistics management is moving toward marketization. Introduce various social funds actively through various means to enhance the level of logistics property management. Dig the potential of university logistics management, provide high-level management services and strengthen the construction of hardware/software for logistics management by more efforts (Lin and Su, 2016). Some progress has been made in logistics management. However, efforts should be made to move in good direction. The improvement of communication technology strengthens requirements for advanced management technology by logistic, and the property management level is facing new challenges.

1.2 Purpose

The demand for university logistics management is accelerating the pace of university logistics management information. Many new requirements have been put forward in the new logistics management methods. These requirements include improving the efficiency, changing the mode and thinking of logistics management, and focusing on service. Changing logistics management is a way to improve logistics management and more importantly, using modern management techniques to improve management level. Modern management technology refers to the use of computer network communication technology to manage the logistics of colleges and universities (Liu, 2017). Based on the technologies in business intelligence, this paper designs a modern data analysis system for university logistics management to improve the efficiency and quality of management, and bring more efficient, environment and comprehensive management experience.
2. REQUIREMENTS OF UNIVERSITY LOGISTICS MANAGEMENT DATA ANALYSIS SYSTEM

2.1 Analysis of logistics software users

UML instance diagram is used to analyze the system, and determine the system users. The users denote the persons and hardware devices exchanging information with the system. The users do not refer to the software, but the external part of the system. Through the analysis of the requirements of the dormitory management system, the system is divided into four modules (Yang, 2017). Using these modules, the users are divided into the following categories: dormitory manager, student manager, finance department worker, ordinary user, dormitory discipline inspectors and system administrators. Figure 1 shows the user details.

![User Details Diagram](image)

**Figure 1. User Details**

The following are jobs for users. Dormitory manager: help new students to arrange accommodation, return dormitory of graduates, exchange dormitory and other daily dormitory management; Student manager: to modify the information of accommodation for easy student management; Finance department worker: modify the data of various types of revenue and expenditure; Ordinary user: check the accommodation; Dormitory discipline inspectors: check dormitories regularly, register and report violations; System administrator: Set privilege of various levels and basic information.

2.2 Requirements engineering of logistics software

Requirements Engineering is process project, including some continuous work, such as documentation, requirements definition, requirements advancement (Zhang, 2017). There are two major parts in the development management of Requirements Engineering. The development of requirements in Figure 2 includes requirement elicitation, requirement analysis, requirement description and requirement verification. As an activity, requirements management runs through the analysis, design, development and construction of the entire logistics information system.

![Software Working Model](image)

**Figure 2. Logistics Management Requirements Software Working Model**

Requirement elicitation is a key part of the requirements process. As an important part of the software design requirements, the users at all levels of the software shall be investigated so as to determine their demands. The developers will communicate with users at all levels to identify the problems to be solved, the hardware/software performance and the types of services of the system (Li, 2017). These are some primary requirements. The requirement documents are created and stored according to the previous survey. In general, the requirement elicitation process refers to the feedback of users’ demands, a summary of various types of information collected.
3. ARCHITECTURE OF UNIVERSITY LOGISTICS MANAGEMENT DATA ANALYSIS SYSTEM BASED ON BUSINESS INTELLIGENCE

3.1 Objective of system development

(1) Information sharing. A unified information platform is designed for information exchange. All the information input into the system can be exchanged and interoperated between different departments. (2) Simple and clear interactive interface, easy to use. (3) High efficiency. Provide information input, output, query, print and other functions so as to reduce office costs (Sha and Zhou, 2016). (4) Intuitive and transparent. All levels of the information system are clear and well designed, easy to use, controllable and easy to operate.

3.2 Framework of the system

The logistic information management system is mainly designed for colleges and universities. The system can use the topology diagram in Figure 3. The logistics management company will provide WEB and data server. These two servers are responsible for managing the computers in each department under control. This structure is similar to the star topology, easy for later central management and network department expansion. Via the network, each logistics department can log into the data server at any time, access the server through the login interface and perform relevant operations on the department’s modules with the privilege, including uploading/downloading data, data transmission between modules and information sharing.

![Figure 3. Topology Diagram](image)

This structure has the following features: (1) Improve inter-department system security. This network is directly connected with the foreground client terminal, and connected with the background server through the middle buffer layer, beneficial for data confidential (Qiu and Gu, 2016). This structure is easy for maintenance of the system and convenient for later use. (2) Higher stability. All computers of sub-systems of various departments are backed up. They are connected the database in real-time and backed up. With this structure, the stability of the system can be enhanced effectively.

3.3 Structure diagram of system

The system can realize the communication between users, analysts and designers, and provide the basis for system design and implementation. The system comprises of three layers: user operating layer, business work layer and data processing layer. Figure 4 shows the structure diagram of each layer of the system.

![Figure 4. Structure Diagram of Each Layer of the System](image)

(1) User operating layer: This level is to deal with the data transfer between users, and not responsible for data transfer interpretation (when the lower layer user passes the information to the upper layer user, the identity of lower layer user shall be verified). This layer is developed through common development tools on the market. (2) Business work layer: The business work layer is the bridge between the user operating layer and the data processing layer, responsible for data transfer between the two layers (Yu, 2016). This layer is generally in the form of dynamic links, which is compiled from C ++, CS, etc. (3) Data processing layer: This layer is responsible
for data query and storage. Most applications carry out data access, the user's identity validation, access data sequence rules etc. in the business work layer.

Through this access, the user does not directly interact with the information database (in data processing layer), but communicates with the business work layer through COM/DCOM, and then interact with the data processing layer at the third layer through the business work layer. This data exchange is suitable for data transfer, and suitable for logistics management applications for information systems (Xiong, 2013). The three-layer system can be developed based on two-layer architecture. The two-layer architecture refers to the C/S structure, that is, the client and the server work together. Through further development, three-layer system has been extended to the B/S development series. The system designed in this paper adopts the three-layer structure of ASP.NET in business intelligence to enhance the functionality and flexibility of the system. Such structural is conducive to the future expansion and tracking maintenance.

3.4 Logistics management modules

The design idea of logistics management system is to improve the applicability. The system's main application interface is customer-focused work on the web browsing. Enhancing the browsing experience of the customer can make the system more user-friendly. To browse the logistical management webpage, users can use their own account and password to enter the system for automatic office work. Different users can log into different screens by the privilege assigned by the administrator for different managements. After entering the management screen, the user enters the user interface layer, and interacts with the database through this layer. The management system comprises of four modules (Sun, 2013): dormitory management, diet management, logistics system management and personnel management. The four modules are described in detail in Figure 5.

![Function Diagram of Logistic Management Data Analysis System](image)

**Figure 5.** Function Diagram of Logistic Management Data Analysis System

Detailed description of each module:

(1) Dormitory management: This module is designed for dormitory management. Common management modes include registration of freshmen dormitories, return dormitory of graduates and daily accommodation adjustment. Personnel Management includes entry of personal information for each bunk, which can be queried; Cost Management contains multi contents (Tian, 2015). First, the cost of accommodation is different depending on the conditions, followed by daily expenses such as utilities management. The dormitory management module is designed for fine management of the dormitory or individual, to effectively master the basic information of students.

(2) Diet management: Diet Management is the key of the school logistics management system. The diet management processes is complex and associated with many departments. Moreover, it is difficult to quantify the supervision of the quality of food and health. This module focuses on how to reduce expenses, improve efficiency and quantify the quality of diet services. Card Management involves many types of meal cards, and contains many operation issues. Teacher’s cards may be regularly related to the monthly food subsidy costs, and the costs may be different by the department, level and the nature of the work. Student’s Card Management involved in card recharge, report the loss and re-issue and other issues (Jiang, 2014). There are a large number of students and the information of cards is huge, which needs special emphasis. In addition, the temporary meal card management system in the canteen shall be designed; The Purchasing Management needs purchasing according to the
purchasing list of each department in each canteen. First, each canteen department develops a daily purchase list, including the type of procurement items, quantity, etc.; Inventory Management is the step following Purchasing Management. Inventory Management needs an inventory list in the logistics system, showing the input/output of items in the food storage and register the name of person responsible for purchase and delivery (Gao and Zhou, 2015). Inventory Management can show which foods are low in quantity and pass them to the Purchasing Management module through information processing to remind whether the food needs to be purchased.

(3) Logistics System Management: Administrator has the highest privilege of the system. The administrator of each department can be set in the module. The administrator has the right to add, delete or modify the personnel or information of each department. The privileges of other modules can be set in the administrator module. Different operators have different privileges to ensure data security of the entire system. This management module is designed to set different privilege for different personnel (Xia and Gao, 2017) to avoid unauthorized changes to system information, so as to ensure that information can be effectively managed and processed.

**4 UNIVERSITY LOGISTICS MANAGEMENT DATA ANALYSIS SYSTEM FEASIBILITY EVALUATION SYSTEM**

Suppose the system business set is denoted by \( S \), and it has \( n \) feasibility evaluation indices. The set of index system is \( \{ G_1, G_2, ..., G_m \} \). The corresponding set of weights is \( \{ w_1, w_2, ..., w_m \} \) and \( \sum_{i=1}^{m} w_i = 1, \ 0 \leq w_i \leq 1 \). The feasible solution is defined as \( \{ A_1, A_2, ..., A_n \} \), where the value of \( A_i \) under the software system index \( G_j \) is \( a_{ij} \), The index matrix of the solution \( A_i \) can be expressed as:

\[
A = \begin{bmatrix}
G_1 & G_2 & ... & G_m \\
a_{11} & a_{12} & ... & a_{1m} \\
a_{21} & a_{22} & ... & a_{2m} \\
... & ... & ... & ... \\
a_{n1} & a_{n2} & ... & a_{nm}
\end{bmatrix}
\]

(1)

Suppose there are \( n \) feasible solutions in the solution layer. Calculate the relative merits of the target \( GZ \) with respect to a certain influence factor in the principle layer by the three-scale method, and the following comparison matrix can be obtained:

\[
G_j = \begin{bmatrix}
G_{11}^j & G_{12}^j & ... & G_{1n}^j \\
G_{21}^j & G_{22}^j & ... & G_{2n}^j \\
... & ... & ... & ... \\
G_{n1}^j & G_{n2}^j & ... & G_{nm}^j
\end{bmatrix}
\]

(2)

Where, for \( G_{ik}^j = \begin{cases} 2 & A_i \text{ better than } A_k \\ 1 & A_i \text{ the same as } A_k \\ 0 & A_i \text{ poor than } A_k \end{cases} \)

Where \( Y_i = |a_i^j - a_{Fj}|, Y_k = |a_k^j - a_{Fj}| \). When \( G_j \) is the center, the center value is \( G_{Fj} \).

Through the favorable comparison of the two options, the best feasible solution can be identified. The three-scale comparison matrix can compare the favorable relations among the solutions and rank the solution’s profitability by the ranking index. Assuming that the profitability ranking index of solution \( A_i \) is \( \eta_i \), then:

\[
\eta_i = \sum_{i=1}^{n} G_{ik}^j
\]

(3)

By profitability ranking index \( \eta_i \), a system feasibility decision matrix \( B_j \) can be generated:

\[
B_j = \begin{bmatrix}
b_{11}^j & b_{12}^j & ... & b_{1n}^j \\
b_{21}^j & b_{22}^j & ... & b_{2n}^j \\
... & ... & ... & ... \\
b_{n1}^j & b_{n2}^j & ... & b_{nm}^j
\end{bmatrix}
\]

(4)
The eigenvectors $X = (X_{1j}, X_{2j}, X_{nj})^T$ of the eigenvalues $\lambda$ of decision matrix $B_j$ can be found by the following formula:

$$V_j = X \ast w = \begin{bmatrix} X_{11} & X_{12} & \ldots & X_{1m} \\ X_{21} & X_{22} & \ldots & X_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{n2} & \ldots & X_{nm} \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_m \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \\ \vdots \\ V_m \end{bmatrix}$$

(5)

Where $V$ is a hierarchical ranking vector, $X$ is an eigenvector matrix of eigenvalues, and $w$ is a weight vector of $m$ target indices. If $V_g \geq V_f \geq V_m$, then the most favorable ranking of the solution is $A_g \geq A_f \geq A_m$, and the most favorable solution is $A_g$, to ensure that the system has the quantitative and qualitative analysis of the feasibility of uniform behavior.

5. BRIEF CONCLUSION

This paper designed a logistics management system based on the requirements and user’s demands of logistics management in colleges and universities, as well as the relevant constraints in business intelligence. This system is used to change the traditional handwriting and paper records of logistical management methods. The existing networks and database are used for comprehensive management innovation. The feasibility of the logistics management system is evaluated to find the disadvantage for improvement, so as to improve the efficiency and management of logistics management and promote the all-round development of education and teaching in colleges and universities.

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