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Retraction

Retracted: Design and Implementation of Energy-Saving Logistics Management System for Route Optimization

Wireless Communications and Mobile Computing

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Zhao and P. Tie, "Design and Implementation of Energy-Saving Logistics Management System for Route Optimization," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 8389468, 6 pages, 2022.

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Research Article

Design and Implementation of Energy-Saving Logistics Management System for Route Optimization

Junqing Zhao and **Pengfei Tie**

Zhengzhou Railway Vocational & Technical College, Zhengzhou, Henan 451460, China

Correspondence should be addressed to Junqing Zhao; 202008000129@hceb.edu.cn

In order to effectively solve the problem of vehicle routing, a design and implementation method of an energy-saving logistics management system oriented to routing optimization is proposed. From the perspective of optimal calculation, this research uses the improved Dixie algorithm and clustering algorithm to design and implement a logistics company's distribution center location and distribution path planning system. First of all, the authors analyze the common models of the LRP problem in detail and give the mathematical model and calculation method of positioning rationing and the transportation route planning problem. Secondly, in view of the shortcomings of traditional evolutionary algorithms, the authors propose a series of improvement measures. The authors adopt a natural number coding scheme combined with an adaptive crossover mutation operator to improve the search ability of the solution space; the authors also introduce a penalty function to deal with constraints and take corresponding measures for illegal individuals generated in the evolution process, reducing premature convergence. *Possibility*. It has been verified that the design and development of the system saves investment costs for small and medium-sized logistics enterprises and reduces the cost of goods distribution by 80%. The effect is remarkable, which verifies the effectiveness, accuracy, and superiority of the algorithm.

1. Introduction

With the rapid development of the Internet and e-commerce, the logistics and distribution scale of the express delivery industry is increasing day by day. Just take a certain city as an example, from January to November 2013, the express delivery business volume totaled 172 million pieces, and the average daily express delivery volume exceeded 500,000 pieces. It is estimated that in 2015, the annual express business volume in Nanjing reached 450 million pieces and business revenue reached 6 billion yuan. While the number of items delivered has increased significantly, consumers also put forward new demands on the quality of distribution services. Service slogans such as "door to door," "same day delivery in the same city," "next day delivery in this province," and other service slogans were put forward; the space concept and time concept of logistics distribution service have been completely redefined. The starting and ending points of logistics transportation are

greatly dispersed to all geographical corners; the delivery time of logistics is constantly compressed by consumer experience and market competition. Design of a reasonable delivery route to shorten the delivery service time has become the key to improving logistics efficiency and reducing logistics costs. Informatization and intelligence are the key features that distinguish modern logistics from traditional logistics. Faced with the ever-increasing number of items, ever-changing delivery locations, and ever-compressing time requirements, and various other demand constraints, it is very necessary to rely on modern information technology and in-depth research on the generation algorithm of logistics distribution routes, in order to efficiently and intelligently command and schedule logistics distribution and transportation operations (Figure 1). The authors are fully studying the current situation of logistics issues, and on the basis of the related distribution routing algorithm, a clustering algorithm combined with an ant colony optimization algorithm is proposed: first, perform cluster analysis on
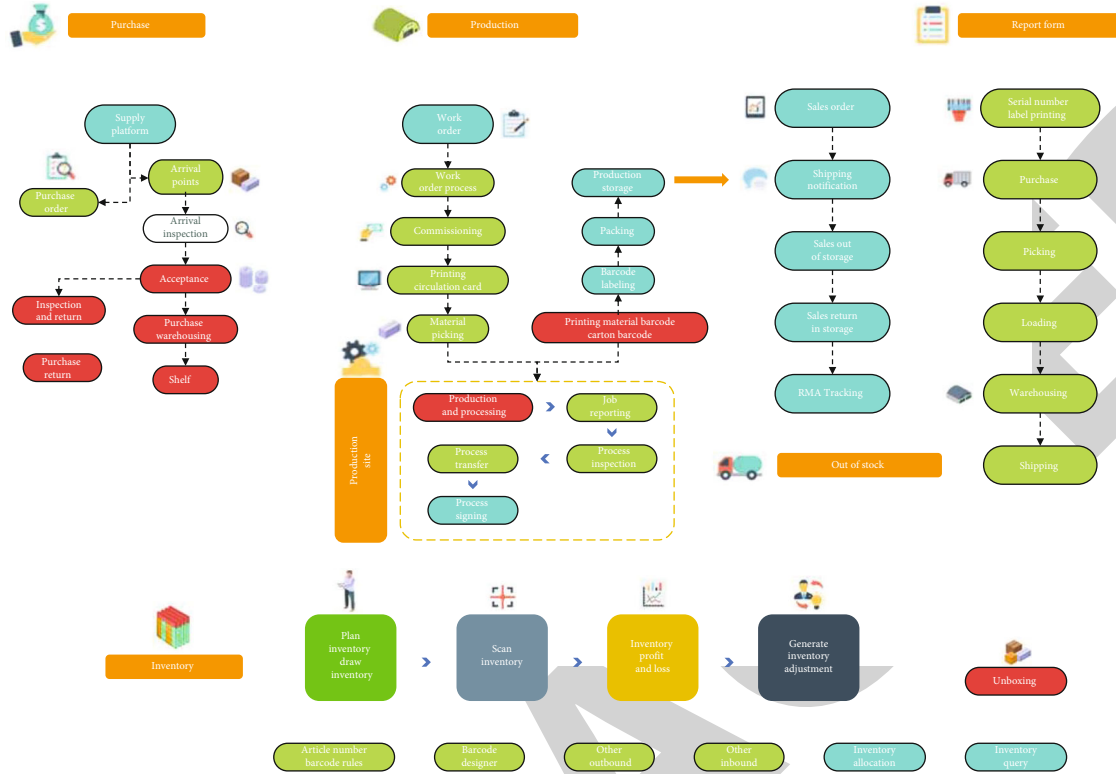
Figure 1: Warehouse logistics management and control system.

distribution points through the *K*-means algorithm and obtain the customer points in the local distribution center and its distribution range, then use the ant colony algorithm to find the optimal delivery route. Through simulation experiments, it is known that the optimal distribution path length calculated by this scheme has been greatly improved [1, 2].

2. Literature Review

Tang and other studies analyze different logistics and transportation methods; the proportion of road transportation has increased, reaching 55%, and the benefits of various logistics companies have also risen steadily [3]. Feng etc. believe that the logistics industry is currently one of the fastest growing fields in various industries in my country; since 2009, its annual growth rate has reached more than 60%, the number of employees has exceeded one million, and the annual business volume has reached more than nine billion [4]. Xu et al. found that at the same time, practitioners in the logistics field have also developed from a traditional logistics company to a stage where multiple components coexist, and financial companies and e-commerce companies began to get involved in the logistics industry [5]. Shiram et al. believe that financial companies control the flow of funds, although they have not really started to engage in logistics business, but its development potential is huge [6]. Chen et al. discovered that logistics networks, such as JD.com and Amazon, have built their own logistics channels; Taobao, Tmall, etc. are all cooperating with traditional express logistics companies to realize the transportation of goods [7]. Huang et al. believe that traditional express logistics companies, in addi-

tion to using their rich experience, in addition to the advantages of a mature logistics distribution network, are currently expanding into the field of e-commerce; for example, SF Express has built its own online shopping platform "SF Optimal" [8]. Guo and Xiao believe that, on the whole, competition in the logistics industry will be more intense in the future and different logistics companies will use their own advantages to grab market share; in order to be able to win in the competition, we must start with two aspects: improving service quality and reducing operating costs, in order to further improve the core competitiveness of enterprises [9]. Liu et al. believe that foreign e-commerce systems are relatively mature, forming an integrated business process from commodity display, online transactions, logistics, and distribution [10]. Cao et al. report that at present, the logistics field in the United States, Europe, and other regions is still dominated by third-party logistics, and it is still in the development period, but the fourth-party logistics has begun to sprout [11].

Aiming at the research of logistics company's distribution center site selection and route planning plan improvement, the authors combine theoretical methods with actual application requirements; the improved algorithm proposed can effectively improve the optimization degree of the final scheme and has certain theoretical research significance.

3. Clustering Algorithm

Cluster analysis is based on similarity; the goal of clustering is to make the similarity of the same type of objects as large as possible. The similarity between different types of objects

is as small as possible [12]. The author chooses the K-means algorithm in the clustering algorithm to classify the sample points. The K-means algorithm is a clustering algorithm for classification according to function criteria, based on minimizing the clustering criterion function. The clustering criterion function used here is the sum of squared distances from each sample point in each category to the cluster center. For K pattern classes, the criterion function is defined as

$$J = \sum_{j=1}^{K} \sum_{i=1}^{N_j} \left\| X_{ij} - Z_j \right\|^2, \quad X_i \in S_j, \quad (1)$$

where S_j represents the j-th cluster set, its cluster center is Z_j, N_j is the number of samples included in the j-th cluster set S_j, and X_{ij} represents the i-th sample allocated to the first clustering set [13]. The clustering criterion of the K-means algorithm is as follows: the choice of cluster center Z_j should make the criterion function J extremely small; in order to satisfy this, one should

$$\frac{\partial J_j}{\partial Z_j} = 0, \quad (2)$$

$$Z_j = \frac{1}{N_j} \sum_{i=1}^{N_j} X_{ij}, \quad X \in S_j. \quad (3)$$

This formula indicates that the cluster center of class S_j should be selected as the mean of this class of samples.

The working process of the K-means algorithm first randomly selects K samples from the N pattern samples as the initial clustering centers, for all remaining samples. According to their similarity (distance) to these cluster centers, assign them to the clusters that are most similar to them (represented by the cluster centers). Then, calculate the cluster center of each new cluster (the mean value of all objects in the cluster). Repeat this process until the standard measure function starts to converge. The K-calculation steps are as follows: (1) Choose K samples as the initial cluster centers $Z_1(1), Z_2(1),\ldots, Z_k(1), K < N$. The number in parentheses indicates the number of iterative operations to find cluster centers [14, 15]. (2) Assign the remaining samples X to one of the K cluster centers according to the principle of minimum distance, namely,

$$\min \left\{ \left\| X - Z_i(k) \right\|, i = 1, 2, \cdots, k \right\} = \left\| X - Z_i(k) \right\|. \quad (4)$$

3.1. Intelligent Logistics Management System. The main purpose of intelligent logistics management system construction is to solve the current logistics enterprises in the location of the distribution center and the problems in the planning of the delivery route of the goods, improve the work efficiency of the enterprise, improve the quality of logistics services, and reduce the operating costs of logistics enterprises, so as to achieve the goal of enhancing the core competitiveness of enterprises [16]. We specifically include the following aspects: One is to establish an efficient logistics management system. The system should simplify the process of obtaining and applying logistics-related information and use efficient algorithms to obtain the results of planning calculations. The second is to establish a set of the logistics management system that can meet actual needs. The third is to establish a set of strong scalability, a logistics management system with a long life cycle [17]. The fourth is to establish an intelligent logistics management system. The system should be able to intelligently process objective data. So as to make the decision of the location of the distribution center and the planning of the goods transportation route, minimize the influence of human subjective factors as much as possible and get a more scientific and reasonable result plan.

The main data entities in the system include product order information, route information, distribution center information, and operator information; the above entities are closely related to logistics business processes; at the same time, there are authority configuration information, system parameter configuration information, etc. in the system. The data design for the main entities is as follows in Table 1.

There is more information recorded in the order data table; Table 2 shows the more important data fields, the order entity is relatively independent, and there is no field to identify specific transportation route information.

The path information is recorded in the path information data Table 3; each record corresponds to a logistics goods order, we use BookID as a foreign key to associate with orders [18–20], the path after the completion of the planning of the goods is recorded in the field Path, the ID of the operator corresponding to each node in the path is recorded in the OperatorID field, and CurPositionID records the position information of the current item.

The distribution center information table records the basic information of all current distribution centers of the logistics company; the transportation path of goods is composed of multiple distribution center nodes; when returning the current path information to the third-party information platform, based on the collection and distribution center information table, contact information and other content can be provided.

The distribution center is the goods transfer station or distribution station in the logistics network, which corresponds to the nodes in the figure. The distribution center has a variety of attributes, such as geographic location, business volume, investment cost, and traffic conditions. After all these factors are weighted by the function, the overall evaluation of the distribution center can be obtained, which can be expressed as follows:

$$\text{CDCenter}_i = f\left(a_1 x_2, a_2 x_2, \cdots a_n x_n\right). \quad (5)$$

In order to better abstract and describe the logistics network and its characteristics in reality, a mapping relationship is established between the specific logistics business network and the graph in graph theory, as shown in Figure 2.

From the above analysis, it can be seen that the intelligent planning model of logistics enterprises is composed of multiple nodes and connecting lines, which is a complicated

Table 1: Product order information data table.

The serial number	Domain name	The field type	The length of the field	Note
1	ID	Int	8	Primary key order number
2	Name	nChar	10	Product name
3	Send address	nChar	50	The delivery address
4	Receive address	nChar	50	Shipping address
5	Weight	Double	8	The weight
6	Type	nChar	6	Type of goods

Table 2: Path information data table.

The serial number	Domain name	The field type	The length of the field	Note
1	ID	Int	8	Primary key order number
2	BookID	Int	8	Product name
3	Path	nChar	50	The delivery address
4	OperatorsID	Int	8	Shipping address
5	CurPositionID	Int	8	The weight
6	Time	Datetime	8	Type of goods

Table 3: Data table of distribution center information.

The serial number	Domain name	The field type	The length of the field	Note
1	ID	Int	8	Primary key order number
2	Name	Int	12	Product name
3	Number	nChar	8	The delivery address
4	Address	Int	20	Shipping address

connected graph with directionality and weight. The nodes in the figure represent the hubs, and the weights represent the calculation results of the relevant attributes of the hubs; the connecting line represents the path connection relationship between the collection and distribution centers, and the weights on it represent information such as transportation costs and traffic conditions.

4. Realization of Intelligent Logistics Management System

4.1. System-Specific Function Development. The intelligent logistics management system includes multiple functional modules; limited by the length of the paper, the most important functional modules are selected for implementation, which mainly include order information management function, logistics path planning function, the function of site selection for distribution centers, and the function of information interaction with external systems.

Logistics order information management consists of multiple operations, including information entry, update, storage, deletion, etc. In addition to recording the basic information of the current product in the order information, the most important thing is the correct entry of the order number. In many cases, the entry of the order number is done manually, but this method is inefficient and prone to errors; at present, the courier list is printed with the serial number in the form of a bar code, or we record the number

and related information of logistics objects in the form of RFID tags; hardware reading equipment can be used to read information, which greatly improves work efficiency and at the same time improves the accuracy of information entry.

After the user logs in to the system, the system reads the database information and generates an object of the Operator class, then checks the connected device of the system through the GetInputMethod() method and gets the currently available order number input method; after creating a new order record, the system calls the SetOrderFormInfo method to fill in the attribute information of the record; finally, it saves the order information in the database.

The program flow chart of the order information management function is shown in Figure 3.

4.2. Performance Analysis. The main functions of the system are tested above, and the main performance of the system is tested in this part. The test result is shown in Figure 4.

The above figure has tested the four items of system performance; since the logistics company has multiple outlets, the system must be able to support simultaneous online operations of multiple users in this process; it is necessary to test the system's multiservice processing capabilities, mainly from the analysis of the system's response time, thanks to the concurrent operation of different users. The response of the system is as shown in Figure 5.

As shown in the figure above, when the number of simultaneous online operators increases, the time required
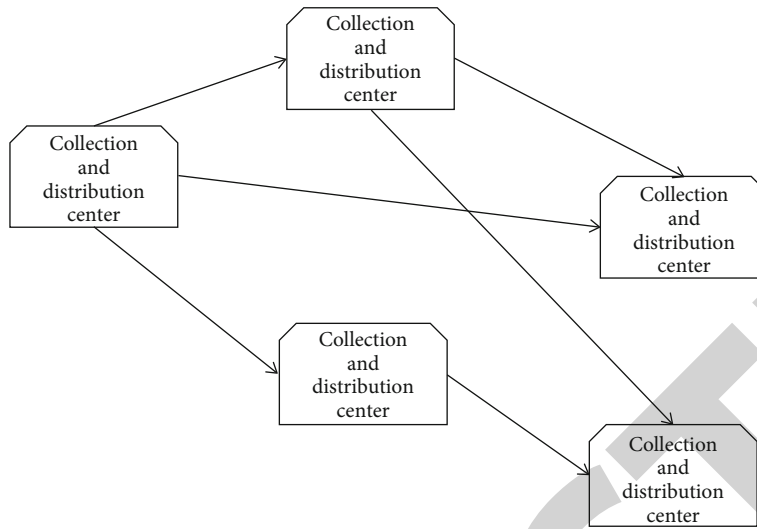
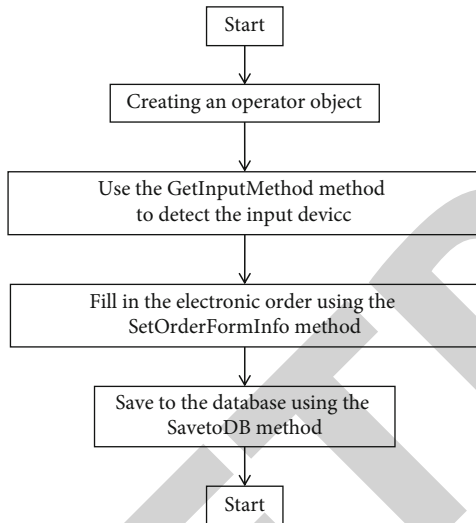Figure 2: Construction of the mapping relationship.

Figure 3: Flow chart of order management function program.

Figure 4: System performance test results.

Figure 5: The relationship between the number of users and the response time of the system.

for system response also increases accordingly; in the case of less than 2000 units, the response time can be guaranteed within 5 seconds, and when the number of users is greater than 5000 units, the response speed of the system will be very slow. At present, the number of outlets of small and medium-sized logistics companies is mostly less than 2000, so it meets the needs of use.

5. Summary

With the continuous development of e-commerce, the logistics industry, which is an essential part of e-commerce, is developing rapidly; a large number of logistics companies have been established to provide users with a full range of transportation services. The logistics industry is a complex system composed of multiple parts; its main investment is in the construction of logistics distribution centers, as well as transportation costs, how to optimize the selection of distribution centers, and the planning of transportation routes;
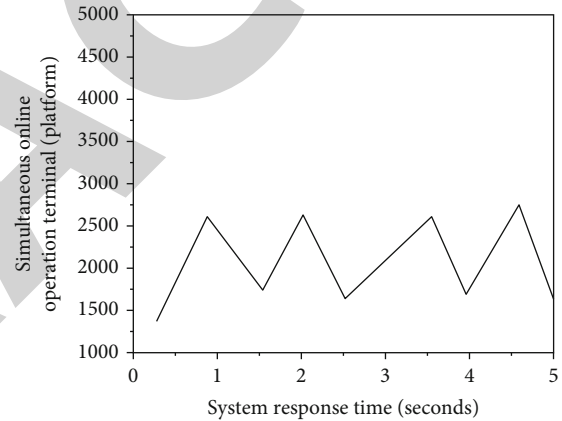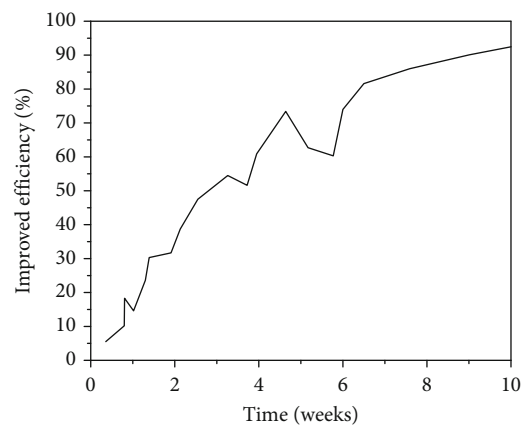
it is the main problem faced by logistics enterprises in saving investment and operating costs. In order to better abstract and describe the actual logistics network and its characteristics, a mapping relationship is established between the specific logistics business network and the graph in graph

theory by the authors. The distribution center is the goods transfer station or distribution station in the logistics network, which corresponds to the nodes in the figure. Distribution centers have a variety of attributes, such as geographic location, business volume, investment costs, and traffic conditions; after all these factors are weighted by the function, the overall evaluation of the distribution center is obtained. The intelligent planning model of a logistics enterprise is composed of multiple nodes and connecting lines, which is a complicated connected graph with directionality and weight. The nodes in the figure represent the hubs, and the weights represent the calculation results of the relevant attributes of the hubs; the connecting line represents the path connection relationship between the distribution centers, and the weights on it represent information such as transportation costs and traffic conditions. After the authors constructed a logistics intelligent planning model based on graph theory, we abstract the concrete logistics network into a graph object; based on this, the relevant theorems and processing methods in graph theory can be used to optimize processing and research on the logistics network, and the research results can be used to guide the actual logistics business process.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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