Research on Optimization of Low Carbon Logistics Distribution Path in B2C E-commerce

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Abstract: The current low-carbon economy has attracted the attention of the society and the government. Under this background, B2C e-commerce low-carbon logistics distribution has attracted the study of many scholars. According to the characteristics of B2C e-commerce distribution and low-carbon distribution, this paper establishes a distribution path optimization model, and uses the improved genetic algorithm to calculate through matlab, and finally realizes the optimization of B2C e-commerce enterprise distribution path. The B2C e-commerce distribution path optimization studied in this paper has certain theoretical and practical significance.

Introduction

As the global climate and energy continue to deteriorate, the trend toward low carbon in the world is becoming more apparent. As the logistics industry is a major energy and carbon emitter, the low-carbon logistics industry is the inevitable direction of current development. The so-called distribution vehicle routing problem is specifically that in a logistics network consisting of several distribution centers and customer points, the delivery vehicle is used to deliver all customers under certain constraints, and the vehicle is planned under this premise. The travel route, so that the objective function can be optimized, the objective function can be the least cost, the highest customer satisfaction or the shortest time. As a type of e-commerce, B2C e-commerce has many characteristics of e-commerce itself and shows different characteristics from traditional business. The openness and high efficiency of the Internet have made e-commerce not only change the production and operation activities of enterprises, but also profoundly affect the economic operation structure of the whole society. At present, many shortcomings such as poor timeliness of logistics, limited feedback channels, and inability to achieve door-to-door service have become prominent under the rapid development of e-commerce, and are gradually being valued and solved. The development bottleneck problem of e-commerce is the logistics distribution problem, which needs the support of physical logistics to continuously improve. Logistics distribution is an important part of e-commerce, and it is the guarantee for realizing e-commerce. Without the support of the evening logistics distribution system, e-commerce activities can only be discussed on paper.

Description and Model of the Problem

Model description. The basic idea of the B2C e-commerce enterprise logistics distribution path optimization model can be described as follows: According to the B2c e-commerce enterprise's commodity demand and its geographical location in a certain period of time, a mathematical model capable of solving the optimal distribution path is established. In order to facilitate the establishment of the model, the actual logistics distribution is represented by an incomplete undirected graph composed of two types of nodes: the distribution center and the customer, and the following basic assumptions are made: The delivery vehicle model of the delivery vehicle is uniform; Each customer only accepts the delivery service of one delivery vehicle; All delivery vehicles return to the distribution center after completing the delivery service; The delivery service

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must be completed within the time window constraints; The load of the delivery vehicle cannot exceed its maximum load limit.

B2C E-commerce Distribution Path Optimization Model Considering Carbon Emissions. In order to facilitate the construction of the model, this paper simplifies the B2C e-commerce low-carbon distribution path optimization problem considering carbon emissions: all customers' locations and demand for goods are known; if the customer does not propose the delivery time The scope requirement sets a time window constraint for the customer's delivery; there is only one distribution center.

$$MinF = \sum_{k=1}^{K} BZ_k + \sum_{i=0}^{N}\sum_{j=0}^{N}\sum_{k=1}^{K} X_{ijk}\left\{C_1 d_{ij}[1+h_{ij}(1+w_{ij})+r_{ij}]+C_{ij}\right\} + \sum_{i=1}^{N} PT_i$$

$$PT_i = \max\left\{Pe(b_i - T_i), 0, Pl(T_i - a_i)\right\} \quad i, j = 1, 2, \cdots\cdots, N$$

$$\mathrm{C}_{ij} = \mathrm{C}_2 * (P_{ij} - d_{ij}^{*} P_0) + J * P_{ij} \quad i, j = 1, 2, \cdots\cdots, N$$

$$\sum_{i=0}^{N}\sum_{j=0}^{N} x_{ijk} = 1 \qquad k = 1, 2, \cdots\cdots, K$$

$$\sum_{i=0}^{N} X_{iok} = \sum_{j=0}^{N} X_{ojk} \quad k = 1, 2, \cdots\cdots, K$$

$$\sum_{i=0}^{N} X_{ipk} = \sum_{j=0}^{N} X_{pjk} \quad k = 1, 2, \cdots\cdots, K; \mathrm{p}=1, 2, \cdots\cdots, N$$

$$T_{ijk} = \frac{d_{ij}[1+h_{ij}(1+w_{ij})+r_{ij}]}{v_0} \quad i, j = 1, 2, \cdots\cdots, N$$

$$T_j = T_i + T_{ijk} \quad i, j = 1, 2, \cdots\cdots, N; k = 1, 2, \cdots\cdots, K$$

$$x_{ijk} = 1 \text{ or } 0 \quad i, j = 1, 2, \cdots\cdots, N; k = 1, 2, \cdots\cdots, K$$

$$Z_k = 1 \text{ or } 0 \quad k = 1, 2, \cdots\cdots, K$$

Case Analysis

This paper takes Tianjin H E-commerce Company as an example to analyze the example. Founded in 2013, H E-Commerce specializes in department store supplies and snack foods. The company has a total of 10 delivery vehicles of the same model with a maximum payload of 900kg and the number is set to T1-T10. The fixed cost of each delivery vehicle is 100 yuan, the transportation cost of the vehicle at economic speed is 2 yuan / km, and the carbon emission cost is 0.5 yuan / km. The penalty factor for the delivery vehicle arriving at the customer's point in advance is set to 8, and delayed delivery is not allowed. Each delivery time is from 8:00AM to 17:30PM, and all delivery vehicles need to rest for one hour at noon. This article takes a certain day of distribution as an example. Company H needs to provide delivery services for 26 customers. The coordinates of the customer and distribution center are shown in Figure 1.

Table 1 Individual customer orders and locations

Customer Number	coordinate(km)	Demand (kg)	Time Window [ET_i, ET_i^a, LT_i^a, LT_i]
1	(43.2,41.8)	102	[8:00，9:30，11:30，12:00]
2	(60.3,24.2)	80	[10:00，11:30，13:00，15:00]
3	(5.8,40.5)	68	[9:30，11:00，12:30，14:00]
4	(35,21.5)	81	[7:30，8:30，10:00，11:00]
5	(55.3,65.3)	117	[13:00，14:00，15:00,16:00]
6	(53.8,8.7)	89	[9:00，10:30，12:00，13:30]
7	(55.2,51)	93	[8:00，8:30，10:00，13:00]
8	(25.3,45)	101	[8:30，9:00，11:00，13:00]
9	(11.2,22.8)	83	[8:30，9:00，12:00，14:00]
10	(34.2,63.7)	59	[9:30，11:00，14:00，17:00]
11	(12.5,6.2)	89	[10:30，11:00，15:30，16:00]

For the improved genetic algorithm proposed in this paper, code programming is performed using MATLAB 2016a software. In the process in order to ensure the accuracy of the algorithm to obtain a better satisfactory solution, the algorithm performs 10 operations. The optimal result appears in the sixth time. The optimal solution is shown in Table 2.

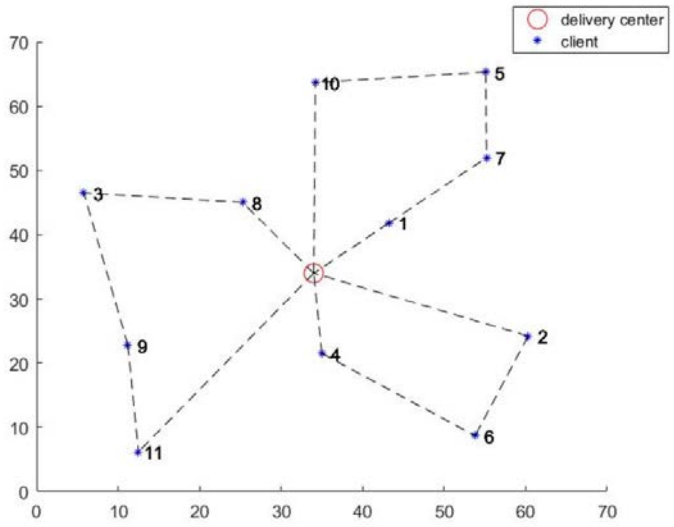

Figure 1. Path optimization diagram

Table 2. Each sub-path and related costs

Delivery path	Fixed cost	transportation cost	Time window cost	Low carbon cost	total cost
Subpath 1	100	325.76	90	52.35	568.11
Subpath 2	100	275.73	30	38.91	444.64
Subpath 3	100	289.45	30	42.56	462.01
Summary	300	1007.76	150	133.82	1474.76

Conclusion

Logistics distribution has become one of the bottlenecks restricting the development of e-commerce. Therefore, how to optimize and improve the logistics distribution system is an urgent problem for e-commerce enterprises. This paper establishes a logistics distribution route optimization model based on B2c e-commerce enterprise, and solves the model by improving genetic algorithm. The simulation results show the feasibility and effectiveness of the model and algorithm. The model in this paper is applicable to the goods distribution service that the enterprise conducts fixed-point quantitative measurement for customers in a certain period of time. With the further promotion and popularization of e-commerce, it will be more practical for enterprises to implement time-limited delivery to customers.

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