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An Information Management Framework for Consumers to Use the Shared Express Packages

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Abstract: *This paper proposes an information management framework for consumers to use the shared express packages. This framework designs the fundamental functions of the information management system, and gives the key categories of the managed information. The fundamental functions of the information management system include: user registration, user login, logistics information query and so on. The key categories of the managed information include: use flow information, package return information, bonus points information and so on. The information management framework proposed in this paper not only involves the use of shared express packages from merchants to consumers, but also involves the recycling of shared express packages from consumers to the receiving cabinets. This framework realizes the usage and recovery of the shared express packages, which can save the logistics packaging cost and reduce the energy waste. It is a beneficial practice for the development of recycling economy.*

Keywords: *information management, management system, express packages, recycling economy*

1. Introduction

In recent years, China's express business has shown explosive growth. According to the statistics of the State Post Office, the volume of China's express business increased from 31.2 billion in 2016 to 83.3 billion in 2020 [1]. The development trend of China's express industry has attracted worldwide attention. According to the “2020 Annual Express Market Supervision Report” (released by the State Post Office), China's express business has exceeded 80 billion in 2020, accounting for more than half of the world in total [2]. The volume of express business has been ranked the first place in the world for eight consecutive years. In 2022, the express industry continues to grow rapidly: the annual express volume will exceed 100 billion, and the daily average volume will exceed 270 million, with a year-on-year growth of 20% [3].

It is urgent to solve the problem of resource waste and environmental pollution caused by the express packaging [4]. As an efficient means, the green packaging system should be explored. Not long ago, five departments including the State Post Office, the National Development and Reform Commission, the Ministry of Science and Technology, the Ministry of Industry and Information Technology, and the Ministry of Environmental Protection jointly issued the “Guiding Opinions on Promoting the Green Packaging Work in the Express Industry in a Coordinated Way”, which defined the goal of the green packaging work in the express industry during the "Fourteenth Five Year Plan" period. That is, by 2023, the application proportion of degradable packaging materials should be increased to 60%, and an integral recycling system for express packages should be basically built.

With the policy guidance for promoting the recycling of logistics packages, it is a general trend to develop shared express packages, which can be used repeatedly and be made of environmentally friendly materials. It is obvious that the shared express package is a kind of green package, which helps to promote the social development, realize the optimal allocation of resources in the field of logistics. Besides, the shared express package can efficiently assist the enterprises to reduce costs and increase efficiency, and finally achieve "sharing target" in the real sense. In recent years, some logistics companies have designed and manufactured shared express packages, and tried to put them into operation in the society [5-6]. However, the effect is not ideal and the whole process information management is lacking.

Considering that the information technology and its application system have played an important

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role in serving the production and life of the humans, to design and use the information management system for people to use the shared express packages more feasibly, is a critical problem that needs to be studied and solved.

2. Fundamental functions

The management framework is based on an information system, which servers the consumers with ten fundamental functions to use the shared express packages. These functions are: user registration, user login, logistics information query, package return, bonus points collection, bonus points query, history record query, bonus point exchange, customer service consultation and big data storage.

In terms of software design for the system, the above functions can be developed and implemented based on the Browser-Server software design pattern [7], so that desktop users can access the various functions of the information system through the browser. It can also be developed and implemented based on the App-Server software design mode [8]. The mobile users can take use of the various system functions by logging in to the app.

In terms of hardware design for the system, the above functions need to be supported by the shared express packages and recycling cabinets. Each shared express package should be provided with an independent two-dimensional code, which is used to identify the basic information and logistics information of the package. The recycling cabinet should be equipped with a smart central control screen to control the opening and closing of the delivery window.

Based on the fundamental functions of the above information system, the management for the whole processes of using the shared express packages can be realized. And the key information needs to be managed are categoried in 6 aspects as following: use flow information, package return information, bonus points information, customer group information, receiving process information and package recycling rate information.

3. Information management

3.1 Use flow information

Consumers, merchants and expressmen can register their accounts through the user registration function. After registering, consumers can use the shared express packages and obtain the bonus points. Registered users can log in to the home page of the information system through the user login function, and then query the logistics information on the “Logistics Information Query Page”.

The use flow of the shared express packages is designed as follows:

1) When the consumer places an order on the e-commerce shopping platform, the special remarks should be added indicating that the shared express package need to be used;

2) When delivering the goods, the merchant firstly loads the goods into the shared express package, and then scans the 2D code on the package, and finally inputs the goods information, consumer information and the package information into the information system;

3) In the process of goods collection and transferring, the expressman scans the 2D code on the shared packages and supplements the logistics information in time. When consumers query the logistics information on the information system, the “Logistics Information Query Page” displays the status as "Transportation in Progress";

4) After the goods are delivered to the area where the consumers are located, "Delivered" will appear on the “Logistics Information Query Page”, which triggers to remind the consumers this message in time. After receiving the reminder, the consumer scans the code to fetch the goods out of the warehouse and confirms the receipt. At this time, the “Package Return Page” displays the status of the shared express package as "Waiting for Return", and the "Return" button is then set active;

5) After taking out the goods, consumers can click "Return" on the "Package Return Page" of the information system. After the consumer clicks "Return", the system will display the words "Please confirm whether all the goods have been taken out". After the consumer clicks "Yes", the "Package Return Page" will automatically display the nearby recycling bin map. After the recycling bin map is displayed, the system will remind the consumer to return the shared express package within the

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specified time;

6) When return the package for reuse, the consumer scans the 2D code on the shared package at the code scanning area of the recycling cabinet. After scanning, the package can be put into the recycling cabinet. At this time, the "Package Return Page" on the information system will be automatically updated to the "Returned" status, and the words "Successfully returned, XXX points have been obtained, welcome to use next time" will appear.

3.2 Package return information

According to the actual actions of consumers' shopping on the e-commerce platform, three types of package return scenarios are designed, and the corresponding management methods are given:

1) If the consumer fails to return the shared express package in time within the specified time, the "Package Return Page" of the information system will give a warning and the bonus points will be deducted. What's more, if the overdue times are exceed a threshold, all bonus points will be cleared, and the consumer is prohibited from using the shared express package again within the set time;

2) If the consumer is unable to return the shared express package within the time due to special circumstances, he/she can select "Unable to Return" in the "Package Return Page" and pay the cost of the shared package in full, without affecting the bonus points and credit;

3) Consumers who choose to use the shared express package and return the package within the specified time will be rewarded with the set bonus points. The points can be obtained in the "Points Collection Page" on the information system. If it is detected that the consumer has not fetched the points within the set time, the information system will remind the consumer to get the points in time.

Consumers can query their bonus points on the "Points Query Page", and their violation records on the "Use Record Query Page". In particular, consumers can jump to the e-commerce shopping platform at the "Points Redemption Page" to exchange their bonus points for coupons or cash vouchers on the shopping festival. When consumers have questions, they can use the customer service through the "Customer Service Consultation Page", and the service-man will answer their questions. If consumers cannot give the questions by typing, they can call the customer service through "Telephone Consultation". By default, the customer service will answer questions online by typing.

3.3 Bonus points information

In order to reward or punish the consumers using the shared express packages, a consumption credit mechanism is designed to guide the consumers' behavior. If consumers continuously use the shared express package, the points they get shall be calculated according to the following function:

$$S_n = nm + \sum vn_i(n_i - 1)/2$$
$$n = \sum n_i, i = 1, 2, 3, \ldots$$

where m is the low carbon credit for every usage of shared express package, v is the increased credit with continuous usage, and n_i is the number of times within the ith continuous usage cycle.

When consumers use the shared express packages and return them on time, their bonus points are calculated as follows:

$$Q_{n,t} = nm + \sum vn_i(n_i - 1)/2 + \sqrt{t}\,r$$
$$n = \sum n_i, i = 1, 2, 3, \ldots$$

where r is the reward points for recovery, and t is the number of returns.

If consumers use the shared express packages but return them after the deadline, the bonus points they get will be calculated as follows:

$$L_{n,t,d} = nm + \sum vn_i(n_i - 1)/2 + \sqrt{t}\,r - pd$$
$$n = \sum n_i, i = 1, 2, 3, \ldots$$

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where p is the points to be deducted for overdue returns, and d is the number of overdue returns.

3.4 Consumer group information

The information system collects and analyzes user data on a one-year cycle. Based on the usage of the information system, users are automatically divided into three categories, as follows:

1) New users: original users when the information system is put into use in the first year, or users whose accumulated bonus points do not exceed 50;

2) General users: users whose accumulated bonus points are 50-100 from the second year after the information system is put into use;

3) Loyal users: users who have accumulated more than 100 bonus points since the second year when the information system is put into use;

According to the usage behavior of the shared packages, the user's historical data is managed in three various ways, as follows:

1) New user data area: For new users (except the ones in the first year), the historical data will be saved in the database for one year. If the user uses the shared packages again in one year, the user's historical data will not be cleared. If the bonus points in one year meets the evaluation standards of the other two types, they will be promoted to general users or loyal users in the next year. If their usage behaviors are maintained, they will continue to be the new user in the next year. If their current usage behaviors last more than one year, their historical data other than login information will be deposited in the historical data area;

2) General user data area: The user's historical data will be retained for two years from the second year after the information system is put into use. If the user's activity increases in two years, that is, the cumulative points of one year is more than 100, then the user will be upgraded to a loyal user. If the user's activity decreases, that is, the cumulative points of one year is less than 50, then the user will be downgraded to a new user. If the user's activity increases in the second year, the user will be upgraded gradually according to the regulations of the first year, If the user has been downgraded to a new user in the second year, and the activity is still low in the third year, the user's data will be deposited in the historical data area;

3) Loyal user data area: From the second year after the information system is put into use, the user's historical data will be retained for three years. If the activity of one-year decreases, the user will be downgraded by the way of the general users. If the user's activity is always good every year, the information system will give more benefits to the loyal users. If the user's activity conforms to the new user’s standard in the second year and still not high in the third year, its historical data, except for the login information, will be deposited in the historical data area.

3.5 Receiving process information

A partition board is arranged inside the recycling cabinet to divide the space into bag recycling area and box recycling area. The front end of the cabinet in each recycling area is provided with a delivery window, and each delivery window is also provided with a baffle. Each baffle is connected with a drive device, which can drive the baffle to open and close the delivery window.

The upper end of each recycling area is provided with a night camera device corresponding to the position of the delivery window. The night camera device can capture the shared express package returned into the delivery window. Besides, the side of each recycling area is provided with an electric cabinet door that can be automatically opened and closed.

The front end of the recycling cabinet is also provided with an electronic display screen, the upper end of which is provided with a code scanning device, and the lower end of the display screen is provided with a cabinet door switch. Besides, a voice player is specially set for interacting with the users. The driver at the delivery window can open and close the window according to the instructions from the electronic display screen.

3.6 Recycling rate information

The information system calculates the recovery rate and utilization rate of the shared express

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packages according to the collected usage data from the recycling cabinet, as follows:

Take one month as the analysis cycle, the total number of the shared express packages successfully returned in this month is firstly calculated, and then uploaded to the database. The database system will analyze the recovery rate of the shared express packages according to the release quantity and the total recovery amount.

According to the number of times the shared express package received by the recycling cabinet, the database system can obtain the number of times the shared express packages are actually used. The technicians are then arranged to carry out the maintenance work according to the standards of the package's use life. The degree of damage of the packages is evaluated according to the usage regulations, with the scrap rate set to 3%, the shared express packages are then comprehensively estimated whether can be continually used. If not, the usage rate of the shared package is determined by dividing the actual usage times by the expected usage times of the packages.

4. Conclusions

(1) The information management framework in this paper realizes the usage and recovery of the shared express packages, which can save the logistics packaging costs and reduce the energy waste. Consumers can view the logistics information and usage information of the shared express packages at any time through the information system. It is a beneficial practice for the development of recycling economy.

(2) The information management framework of this paper provides a reward and punishment mechanism for consumers to use the shared express packages. Continuous use and timely return of the shared express packages help the consumers to obtain appreciable bonus points, which can be used for online shopping. In case of overdue return or low usage, the bonus points can be reduced, which helps to effectively distinguish the users, and save the costs for user maintenance.

(3) The information management framework in this paper classifies the users into several groups according to their activeness and credits, which contributes to deposit the users' data more rationally. In addition, based on the storage information of the package recycling cabinet, the utilization rate and recovery rate of the shared express packages can be easily calculated. It is convenient for making use of the big data to improve the service efficiency and product quality.

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