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# Application of QR Code Technology in the Design of User Information Privacy Protection Logistics System

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***Abstract:*** *This paper takes the protection of user privacy information in express logistics industry as the main research object, and designs a scheme to protect user privacy by using RFID technology and multi-layer encryption technology. The scheme can achieve the dual privacy protection for the internal and external of the logistics company, and ensure that the person responsible for the disclosure of privacy information can be reviewed.*

***Keywords:*** *QR code, privacy protection, logistics system*

## 1. Introduction

With the rapid development of the Internet and the promotion and application of e-commerce, the logistics industry has achieved unprecedented rapid development. It provides logistics guarantee for e-commerce, creates huge business opportunities for businesses, and also provides convenience for consumers to spend at home. E-commerce provides many conveniences such as paperless transaction, low cost, fast and so on. Many express companies provide delivery services such as "limited time delivery", "next day delivery", "speed delivery" and "night delivery". The relationship between logistics distribution and e-commerce has become increasingly inseparable. However, with the rapid development of the logistics industry, there are some new hidden dangers, especially the problem of user privacy leakage caused by the rapid development of the logistics industry[1]. Therefore, the design of logistics personal information privacy protection scheme is imminent, in order to effectively protect the security of personal privacy information. This paper puts forward the design of personal information privacy protection logistics system based on QR code technology.

## 2. Current situation of user information leakage in logistics industry

In the logistics information system, in order to facilitate the realization of receiving, distribution and sending, the express bill contains a lot of user personal information, and lists the logistics personal information that some logistics express enterprises need to fill in. In the whole process of logistics transfer, because the information is plaintext visible, it is bound to cause the problem of personal information leakage. Logistics company express delivery service process is shown in Figure 1.

At present, the problem of personal privacy leakage in logistics industry is very serious. Personal information on the logistics waybill, including name, address, telephone number and other information, is being sold on a large scale. A large number of personal information fall into the hands of criminals, giving them the opportunity to cheat by using personal information. Many of the recipients whose information is leaked suffer greatly. They suffer from the harassment of junk information, or they suffer from being cheated[2]. In some websites, the express bill number information is clearly marked with price, and is attached with services such as "generate bottom bill", and even leads to burglary cases due to the leakage of express bill number information.

Yunda express and Jingdong express have also tried to use two-dimensional code technology to separate information. In the process of logistics transfer, the staff can obtain text information by holding a two-dimensional code scanner, but all the clear text information of the express bill is still obtained by scanning, and the problem of personal information leakage has not been completely solved. There are two main reasons[3]: (1) logistics enterprises do not pay enough attention to the protection of users' personal information; (2) in the process of logistics transfer, it mainly depends on human resources, and needs to display enough information to complete the business processes of receiving,

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distribution and sending.

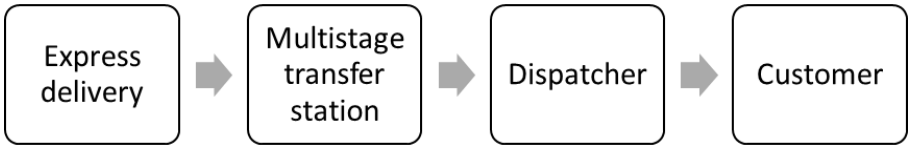


*Figure.1 Express delivery service process of logistics company*

## 3. The importance of strengthening the information protection of logistics users

In the era of big data, the protection of personal privacy is urgent. Privacy is sensitive information that an individual is unwilling to expose and disclose. Personal information is all the information that can identify and represent an individual. It covers a wide range of contents, including not only the individual's physiological and identity characteristics, but also the individual's activities and life trajectory, consumption and financial status in the information age[4]. Even the individual's behavior, hobbies and religious beliefs can be identified as an individual Information.

Once the user does not know, personal information is shared or personal privacy is leaked, which will bring certain risks, not only affect personal life, but also increase uncertainty for social stability. In addition, due to the non-standard operation and management of the logistics industry, the mixed employees and the lack of effective audit on the employees, some logistics express industry enter the industry with other purposes, collect and sell the personal information of consumers through the convenience of their jobs. Especially in the process of transportation, the whole mail information runs through all links, so it is difficult to investigate and deal with such cases.

Consumers' awareness of personal privacy protection is relatively weak. On the one hand, many new consumers come from rural areas in recent years, and their ideas are relatively conservative. They lack a comprehensive and objective understanding of the Internet and the Internet of things, and more equate it with the post office and postal business. They try to fill in the waybill in a detailed and perfect way, and consider that they can return the original in case of other problems. However, once these complete information is targeted by criminals, it is easy to get rid of Become the source of network information trafficking. On the other hand, most consumers have limited education and know little about personal privacy and related legal issues. Even if information is stolen or sold, they are not willing to stand out to protect their legitimate rights and interests through legal channels. They are more likely to take a default attitude, and their awareness of personal privacy protection is very weak.

## 4. Introduction of QR code technology

The two-dimensional code records the data symbol information with the black-and-white graphics which are distributed in the plane according to a certain rule. In the code compilation, the concept of "0" and "1" bit stream, which constitute the internal logic basis of the computer, is skillfully used to express the numerical information of the text with several binary corresponding geometric shapes, which are input through the image input device or photoelectric device Scanning equipment can read automatically to realize automatic information processing. It has some common features of bar code technology: each code system has its own specific character set; each character has a certain width; it has a certain verification function, etc. At the same time, it also has the function of automatic recognition of different information and processing of graphics rotation. Two dimensional code can express information in both horizontal and vertical directions at the same time, so it can express a lot of information in a small area[5].

Compared with one-dimensional code, two-dimensional code has the advantages of large information capacity, strong error correction ability and fast reading speed. At present, it has been widely used in e-commerce, social platforms, etc. in the field of logistics, two-dimensional code is also used in product traceability, anti fleeing and other aspects. Due to its strong advantages, two-dimensional code will have more development space in the future.

As a kind of coding graphics different from traditional codewords, two-dimensional code brings different information transmission and storage solutions. Compared with other coding methods, two-dimensional code has the advantages of high capacity, high anti-interference, practical and convenient.

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Once it comes out, it has been studied and concerned by experts and scholars in the information field. QR code is a widely used two-dimensional code, which mainly exists in paper orders and electronic face sheets in logistics system. Therefore, the current bar code on the express face sheet is mainly QR code[6].

Although the two-dimensional code has strong robustness, it can well meet the characteristics of express face sheet which is easy to be stained, and it is easy to read, which can improve the accuracy and efficiency of express transportation. However, the consequence of using two-dimensional code directly on the express face sheet is that the user's personal information is directly displayed on the express face sheet in plaintext. Anyone can easily obtain the user's personal information contained in the two-dimensional code through the two-dimensional code identification device.

## 5. Privacy protection scheme of logistics system

### *5.1 Safety models and assumptions*

In order to protect user privacy, it is necessary to classify the recipient information into plaintext information and ciphertext information. Ciphertext information is important privacy information including the recipient's name, detailed address and contact information, and it is also the key information to be protected in the privacy protection scheme of the logistics system. The scheme encodes plaintext information into carrier QR code, and uses information hiding technology to embed ciphertext information into carrier QR code to generate carrier QR code[7].

The logistics system using this scheme includes four modules: order submission module, logistics distribution module, logistics transfer module and trusted Ren cloud platform. The distribution staff and transfer station complete the distribution and transfer tasks according to the plaintext information obtained by scanning QR code. The actual operation of scanning the encrypted QR code and notifying the recipient to pick up is performed by the trusted cloud platform. It is worth noting that in the privacy protection scheme of the whole logistics system, only trusted cloud platform can extract the recipient's ciphertext information in the encrypted QR code, and the recipient's privacy information is well protected.

In this paper, we mainly consider the following scenarios: suppose that the logistics company is equipped with a secure and reliable remote server, and users input their order information into the database of the server by placing an order online. In addition, we also assume that each employee participating in logistics transshipment is equipped with a set of keys based on the standard of asymmetric encryption system. Each employee is equipped with a unique RFID reading and writing device, and each device has a unique device ID, which is only held by employees and remote servers. On this basis, we assume that internal staff will not collude, and any staff will strictly guarantee the privacy of their known information.

### *5.2 User privacy protection scheme based on RFID and multi-layer encryption mechanism*

The design scheme of this paper mainly includes the following four processes shows in Figure 2:

(1) Information split. The remote server divides the user address data used for forwarding into multiple address levels according to the destination transfer center and destination address standard. The main purpose of information splitting is to achieve the fragmentation of address information. Through the following multi-layer encryption mechanism, the address information can be fragmented and visible in the process of express delivery.

(2) Employee selection. The remote server needs to select the employees in the corresponding region in the database according to the split results to be responsible for the current delivery of the parcel. After the employee selection is completed, the server informs the selected person to process the dispatched express delivery and reads the public key of the selected employee.

(3) Information is encrypted in multiple layers. The server will use the public key of the corresponding personnel to encrypt the fragmented address information in a multi-layer manner, and the encryption order is opposite to the order of address information splitting. This process is repeated at the level of address splitting until all address information is encrypted. The three-layer structure respectively represents the detailed address information, the node address information and the District address information.

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(4) Information reading and logistics transfer. The server will keep track of the logistics status of express delivery. Employees will use their devices to read the encrypted information, and then decrypt them with their private key to obtain the address of the next level in the process of transfer. The employee then removes the information at its current level and writes the remaining ciphertext back into the RFID tag. This process will continue until the courier at the detailed address level completes the delivery[8].

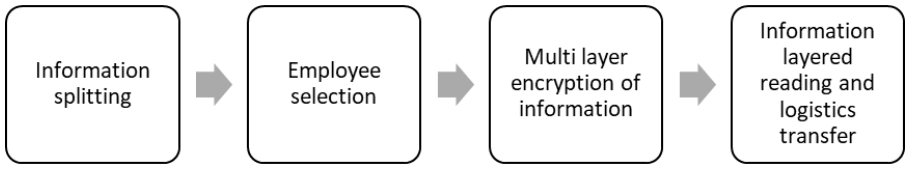


*Figure.2 User privacy protection scheme based on RFID and multi-layer encryption mechanism*

### *5.3 Safety analysis*

Our plan can effectively prevent internal and external personnel from obtaining user information. This is mainly reflected in the following two aspects[9]:

(1) We use RFID tags as the information storage carrier, which improves the threshold of external personnel to read information; (2) we fragmented the information and implemented a multi-layer encryption mechanism.

Each layer can only obtain the user information of its corresponding level, which only includes the next transfer address of a specific express delivery, which is almost worthless in the scene of huge number of express delivery. And in the lowest level of the delivery process, we advocate the use of express cabinets as the final delivery address.

## 6. Conclusion

This paper proposes a privacy protection scheme of logistics system based on two-dimensional code and information hiding. The privacy information of users is embedded in the two-dimensional code on the express surface sheet by using information hiding technology to control the access rights of privacy information. Compared with the existing protection mechanism, the scheme can significantly improve the level of user data protection in logistics industry, and has strong practicability and innovation.

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