Two-dimensional Barcode Technology Based on the Internet of Things applied in Overseas Warehouses of Cross-border E-commerce

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Abstract—With the advancement of technology and the development of e-commerce, cross-border e-commerce has emerged as the times require, and two-dimensional barcodes have become an important technology in the overseas warehouse management mode of cross-border e-commerce. The purpose of this paper is to study the application of two-dimensional barcode technology in cross-border e-commerce overseas warehouses based on the Internet of Things. After reading and referring to a large number of materials, the brief development history, basic technical architecture, main features and prospects of the application of QR code identification technology in the Internet of Things and automatic identification technology are studied in detail. How code identification technology works in the IoT supply chain and details its linkages. At the same time, the application of the automatic identification technology of the Internet of Things in the overseas warehouse of cross-border e-commerce is analyzed. The experimental results show that QR code recognition can be well applied to overseas warehouses of cross-border e-commerce

Keywords- Internet of Things Technology; 2D Barcode; Cross-border E-commerce; Overseas Warehouse

1.Introduction

With the latest updates in information technology and the reduction in the cost of hardware and storage devices, QR code technology has grown significantly and implementation costs have continued to decline [1]. It has many advantages such as large storage capacity, high data density, fast recording speed, strong error correction ability, extremely low error rate, and information encryption [2]. In particular, two-dimensional barcodes can store more detailed information of items. Therefore, the use of two-dimensional barcode technology to replace one-dimensional barcode technology has become an inevitable trend in the development of information technology [3]. In the information age, traditional control systems and tools will inevitably be replaced by advanced computer-based information management systems and the Internet, using two-dimensional barcodes combined with hybrid data processing technology. Warehouse management will also become an important factor for the success of cross-border e-commerce [4].

Information about each product can be recorded by calculating the remaining quantity of each product in the store or by scanning the header barcode information. However, the task becomes increasingly difficult if multiple repositories are found, it takes a long time to move from one

product to another, and an agent is required to perform the points, Mohamed M uses a network architecture neuron combined with technical vision The reader barcode, this method can know the information of each stock product in real time [5]. It has been proposed to use imperceptible color vibrations to embed matrix barcodes into the image on the display. In this approach, Abe S describes a complex modulation protocol and recovery process, introduces potential practical application scenarios and a user study examining barcode imperceptibility and system usability to illustrate the technical capabilities [6].

This paper is divided into five parts, the first part is the research background, the importance and status of research at home and abroad; the second part is mainly the introduction of QR code in the identification technology of the Internet of Things and the research method of QR code reading; the third part is The application example of QR code technology in the automatic identification of the Internet of Things in international e-commerce cross-border stores is analyzed. Finally, the problems existing in the identification technology of the Internet of Things are discussed, and the full text is summarized.

2.Research On The Application Of Two-Dimensional Barcode Technology Based On The Internet Of Things In Overseas Warehouses Of Cross-Border E-Commerce

2.1 The Internet of Things Based on QR Code

The application of QR code in warehouse management, through the barcode reader to read the QR code on the product, can quickly and accurately enter and extract the information of a single item, which saves the intermediate link of manual entry and reading , saving time and effort [7].

The specific method is: establish the corresponding product coding library. Each product should choose a unique QR code to facilitate accurate and fast data entry and reading. For each system, create a code base to improve the performance of the control system, such as product types, and add code for each product type to create a product code base. When human-computer interaction is required to enter such goods, the inventory of goods, the delivery and storage of goods, and the distribution of goods can be completed simply by checking the corresponding QR code. This can reduce the labor intensity of operators, eliminate errors caused by human factors, and improve the accuracy of reading information [8]. The use of two-dimensional code to manage inventory products is low cost, time-saving and labor-saving. In this way, the warehouse management system of the Internet of Things is improved, forming a close connection between "things" and "networks" [9].

2.2 2D Barcode Technology

Two-dimensional code, also known as two-dimensional barcode, refers to the data input in the form of a symbol that distributes black and white images on a single plane (two-dimensional direction) with a specific geometric pattern according to certain rules; the computer intuitively uses Stream 0 and 1 The basic principle of using multiple binary compatible geometric figures to represent textual and numerical information and read the information through machine image input or automatic photoelectric scanners [10]. A scanning device and a decoding device are required, the scanner emits a light source, the light source is reflected by black and white dots,

and the corresponding photoelectric signal is converted into an electrical signal, which is then interpreted by the decoder into corresponding information [11].

2.3   QR Code Reader

QR code image recognition should first fully consider the characteristics of the barcode image, make a corresponding image processing scheme, try to reduce the influence of uneven illumination, and adjust it through a large number of experiments [12]. In addition, the speed of recognition should also be considered. The basic idea of the 2D algorithmic code is to first capture the image path and then copy the grayscale input image to maximize the effect of negative light. Then use the SOBEL edge detection method and prediction algorithm to calculate the total horizontal and vertical points, and finally use the peak field to divide the part of the two-dimensional code to obtain the image corresponding to each unit, and obtain the identified two-dimensional code that we know. Label the matrix and convert the matrix to a 1D byte stream for conversion.

Two-dimensional code is a kind of graphic encoding, and double-code encoding is the process of converting encoded information into digital information that can be recognized by a computer with the help of special tools. From a system-wide perspective and function, a code reading system consists of three parts: system scanning, display templates, and conversion. The scanning system is composed of an optical system and a detector, that is, a photoelectric conversion device, which completes the optical monitoring of the barcode symbol, and converts the visual display of the barcode image into an electronic signal through the photoelectric tracker. The Signal Model component consists of Signal Processing, Processing, and Waveforms. The optical code bar signal is processed into the maximum rectangular wavelength signal. The conversion room is generally a built-in microprocessor converter, whose job is to determine the rectangular bar code mark and output it to the data center in the bar code application system through the visual circuit.

3.Investigation And Research On The Application Of Two-Dimensional Barcode Technology Based On The Internet Of Things In Overseas Warehouses Of Cross-Border E-Commerce

3.1   Application Background

TD's cross-border e-commerce B2C business department is in the context of the rapid development of cross-border e-commerce, the company began to enter the three major e-commerce platforms of AliExpress, ebay and Amazon in January 2013 to promote products. The company displays its products on major e-commerce platforms and sets prices. Customers place orders and pay directly on the e-commerce platform, and negotiate with customers to determine the logistics method and deliver them to customers, so as to gain profits.

3.2   System Architecture

The system adopts C/S system (Client/Server, client/server), mainly client application system and server management system. Client Application, User Interface (Client), Aggregate Display and Marketing Strategy, Collecting User Queries and Sending Requests to Data Services, Server Manager, Data Management (Server), Sending Data to Clients and Sending Client Data from

Performing Calculations The results are presented to the user. Customers should also provide comprehensive security and maintain data stability and allow multiple customers to access the same database simultaneously.

3.3 Extract QR Code Information

The QR barcode positioning method in QR code recognition is generally based on grayscale images, so the image for positioning needs to be grayscale images. In the component method, R, G, and B in the brightness of the color image are respectively used as three grayscale values, and one of the most suitable values is selected as the grayscale value of the grayscale image according to the application scene.

$$f1(i,j) = R(i,j), f2(i,j) = G(i,j), f3(i,j) = B(i,j) \quad (1)$$

In the image processing stage, the most important step is to extract each valid QR code word unit information from the image. Based on the idea of statistics, the color information in each information block can be counted, the threshold of the color calibration can be set, and the difference in the edge sawtooth can be ignored by the threshold setting, so as to obtain the QR code of each codeword unit. information.

The upper left detection area is analyzed by the corrected QR code graphic. Starting from the left vertex of the dark area in the center of the detection area at the upper left position, scan to the left to the left border of the QR code to obtain the length L1 of the line segment, scan line by line to obtain the length of the line segment L2, L3... To the lower left vertex of the dark area in the center of the upper left detection area. Calculate the width of the QR code word unit:

$$L = \sum_{i=1}^{n} li/(n \times 2) \quad (2)$$

Since the QR code subunits are square, the width and height of the QR code word units are consistent, so the entire two-dimensional code area can be divided into a sampling grid according to the above-mentioned size L.

4. Analysis And Research On The Application Of Two-Dimensional Barcode Technology Based On The Internet Of Things In Overseas Warehouses Of Cross-Border E-Commerce

4.1 System Business Process

The business process of the application of automatic identification technology in the warehousing management system generally includes three main links: goods warehousing, goods warehousing, and material inventory, as well as warehouse managers logging in to the system, viewing various results and printing barcodes for item information, and so on .

The business process of goods warehousing includes checking the supply list, printing and pasting the QR code label of the goods, checking the type and quantity of the goods in the warehouse, and putting the goods in the warehouse and putting them on the shelves. The cross-functional diagram of the goods inbound is shown in Figure 1:
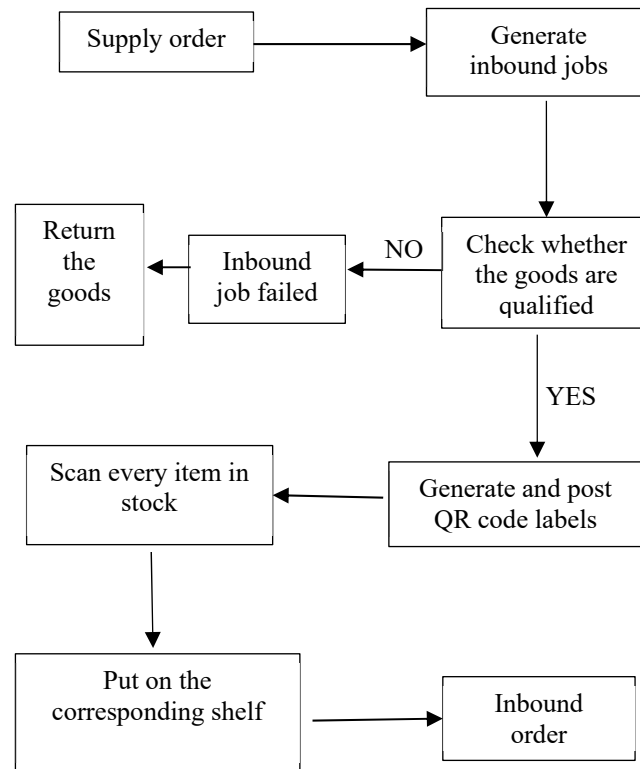
Figure 1. Cross-functional diagram of goods inbound

After the goods supplied by the supplier arrive at the warehouse, the supplier will provide the warehouse administrator with a supply order. The administrator scans the QR code label on the supplier's supply order and checks it with the supply order in the system to confirm whether the goods need to be stored in this warehouse. If it is not stored in this warehouse, report to the system and apply for transferring the goods to other warehouses. After checking the delivery order, the system will print out the QR code label of each item. Warehouse staff will sort the goods, post QR code labels, and check the incoming goods one by one. When the goods information does not match the goods information in the warehousing document, you need to report the problem to the system, and the system will contact the supplier to solve the problem of the goods. During storage, the handheld terminal will report to the system that the goods are in storage, the server will return the storage location of the goods to the handheld terminal, and the operator will place the goods on the shelves assigned to it according to the system's assignment results. When the operator supervises that all the goods are put into storage, they will report to the system that the storage is completed, and the system will mark the storage operation as complete.

The business process of the goods out of the warehouse includes the transmission of the order form, the inquiry of the goods inventory, the inquiry of the goods storage location, the inventory inspection of the goods and the goods, the goods out of the warehouse, and the registration of the

delivery truck. The business process of the goods out of the warehouse includes the transmission of the order form, the inquiry of the goods inventory, the inquiry of the goods storage location, the inventory inspection of the goods and the goods, the goods out of the warehouse, and the registration of the delivery truck.

4.2 QR Code Scanning Module

The QR code generation module mainly completes the collection of item information and encodes it into a QR code and then prints the QR code, so that the material sticker can be marked. The carrier of the information circulation of the inbound and outbound management system is the bar code, so the accuracy of the bar code information is the premise of the application of the inbound and outbound management system. In the warehousing and warehousing system, operations such as warehousing, warehousing, inventory, material confirmation, and employee login are all completed by scanning the QR code information. If the barcode information encoding and decoding information is inaccurate, the system will be directly unavailable.

The main process of warehouse management includes outbound, inbound, and inventory tasks. Because the operations of outbound, inbound, and inventory are similar, only the outbound process is introduced here. The operation of the outbound business mainly relies on the handheld terminal equipment. The outbound content is shown in Figure 2. When the goods are out of the warehouse, they are loaded while scanning. If the data is correct, it is confirmed that the outbound operation is completed, and the corresponding outbound order is uploaded to the server. After the handheld terminal completes the corresponding operation, the corresponding operation results of outbound, inbound, and inventory can be viewed in the background management, as shown in Table 1.

Table 1 Outbound Operation Results

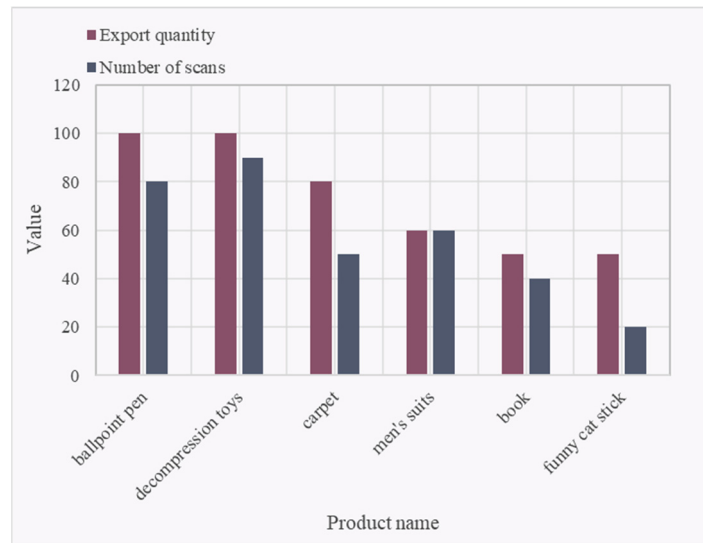| Item number	Product name	Export quantity	Number of scans
0B432	ballpoint pen	100	80
0B423	decompression toys	100	90
0B665	carpet	80	50
0B544	men's suits	60	60
0B227	book	50	40
0B736	funny cat stick	50	20

Figure 2. Outbound operation results

5.Conclusions

In recent years, the government has repeatedly stated that it will strongly support the development of cross-border e-commerce, so cross-border e-commerce companies have huge growth opportunities. In this case, the choice of overseas warehouse management technology becomes more and more important. This paper studies the image recognition technology of code, analyzes the software realization method of code recognition system, and has a deep understanding, and implements the basic frame of code recognition system by language. The realization of the code recognition algorithm has practical significance, it can be used in other application systems of various codes, and can also be expanded according to different actual requirements in engineering applications. The developed applications can basically meet the needs of practical applications in response time.

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