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The Application and Impact of RFID Technology in the Garment Industry

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Abstract: At present, asset inventory is still a tedious and difficult work, especially for the garment industry, which has a wide variety of inventory and is difficult to manage. However, in the digital era, the development of the Internet of Things has brought new developments to asset management technology. RFID technology as the core technology of the Internet of Things, has played an indispensable role. The emergence of RFID tags, readers, software applications has brought about many unprecedented changes. UNIQLO and HLA GROUP earlier recognized the possibility of RFID technology in the clothing industry and carried out exploration and achieved certain results. This paper analyzes the application of RFID technology by UNIQLO and HLA GROUP through literature analysis and case analysis, explores the general application mode of RFID technology in the garment industry, and puts forward suggestions for improving the application of this technology, to promote the development and application of RFID technology in the garment industry.

Keywords: RFID technology, garment industry, UNIQLO, HLA GROUP

1. Introduction

Technologies such as big data and the Internet of Things are developing rapidly in the digital era, and many industries are also facing new opportunities and challenges. How to seize the tide of the digital age and realize the upgrading of industrial wisdom has become an urgent problem for all industries. China is the largest developing country in the world and has attracted much attention from other countries. Therefore, this paper chooses Chinese enterprises as the research object, hoping to inspire other industries and other countries. RFID technology can use radio to read and write, radio frequency identification distance is far, its application in the clothing retail industry can reduce manpower and improve efficiency. UNIQLO, as a Japanese fast fashion giant, has introduced RFID electronic tag technology. Customers can use the RFID electronic tag installed on the clothes label to view the relevant information about the product and complete the independent checkout. For companies that use RFID, it can also save more labor and inventory costs and improve the efficiency of inventory management. HLA GROUP, as a leader in Chinese men's wear, began to build an RFID system as early as 2014, and officially put "clothes networking" into operation in 2015, walking in the forefront of the industry. At present, few clothing brands and stores have introduced RFID technology. This paper will study UNIQLO and HLA GROUP, two major brands that have introduced the technology,

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to analyze the impact of the application of RFID technology on the company's business and find a better way to promote RFID technology.

Through the research of RFID technology and application, the impact on the company's business is obtained, and suggestions are put forward to improve the application of this technology to promote the combination of RFID technology and the company's business. Through the use of literature analysis and case analysis, this paper introduces the relevant concepts of RFID technology, and analyzes its application in the production and sales of UNIQLO and HLA GROUP.

Although RFID technology has obvious advantages in production informatization, the RFID application of global clothing manufacturers is still immature, and in a small number of application cases, electronic tags are only used to replace paper work orders to store information, and the advantages of RFID technology are not really played. The application of RFID technology to the clothing production process has considerable technical difficulties, and China's research in this field started late, more stayed in the system architecture and software level of research, lack of industrial RFID reader, middleware, real-time information transmission and data processing and other underlying key technologies research and breakthrough. In view of the application needs of RFID technology in clothing production informatization, relying on the national 863 project funding, Beijing Sanbo Zhongzi Technology Co., Ltd. focuses on the applicability and application of RFID in clothing production process and key technologies, and builds an RFID-based clothing production informatization management system to solve the problems existing in the traditional clothing production process management.

2. RFID Technology Related Introduction

2.1. The concept of Internet of Things

The Internet of Things is based on the Internet to realize the connection between things and things and between things and people. Through various devices and technologies, such as sensors, positioning systems, etc., the location and status of objects are collected to realize the perception, identification and management of items and processes [1]. The Internet of Things refers to the connection of physical devices to the Internet, the sharing of data, and the connection of the network digital world and the real physical world. In the 1980s, people had the idea of physically adding sensors to make it smart, but because the technology was still relatively backward at the time, this idea was difficult to achieve. The term Internet of Things was coined in 1999, but it took another two decades for the technology to take shape . Nowadays, technology is more and more developed, technology continues to improve, the cost of realizing the "Internet of everything" is getting lower and lower, and the Internet of Things slowly enters our lives and changes our lives. The Internet of Things was initially used most in business and manufacturing scenarios, and now our life scenarios are also full of smart devices.

2.2. The Concept of RFID Technology and Its Development Process

RFID technology is short for radio frequency identification technology. RFID technology uses radio waves to quickly exchange and store information, meaning the reader does not need to touch the tag[2].

RFID technology can be traced back to World War II, when the new technology radar is considered to be the earliest RFID technology. In the 1990s, RFID technology was widely used in road toll systems. At the beginning of the 21st century, RFID technology was applied in more fields, and the corresponding standards were established. At present, the United States, the United Kingdom, Germany, Switzerland, Japan and other countries have relatively mature RFID products. Although China is still relatively backward in the development of the RFID industry, it has not mastered the

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core technology of products and formed a mature RFID industry chain. However, in recent years, there has been great development, and it has been applied in many fields, including medical treatment, aviation, identity identification, fixed assets inventory, and so on.

2.3. Advantages and Disadvantages of RFID Technology

2.3.1. Advantages

The carrier of RFID technology is usually able to prevent interference, tolerate high temperatures, have strong stability, and adapt to a variety of use scenarios. RFID storage information is large, long service life, update information speed, can effectively save manpower, material and financial resources, improve work efficiency[3]. RFID technology has good security, is not easy to be tampered with, and meets the needs of current social development. RFID is not affected by shape and size when reading, and electronic tags can be applied to products in various forms, with a wide range of applications. The information in the RFID tag can be updated, that is, it can be reused and meets the requirements of social sustainable development. The reader can identify multiple RFID tags at the same time, improving the efficiency of inventory. The data of RFID tags is stored in the chip and is highly pollution-resistant, which is not easily damaged compared with traditional paper tags. The signal sent by RFID has penetration, and the information can be read even when it is covered .

2.3.2. Disadvantages

RFID technology has appeared for a short time, and its maturity is not high enough. The cost of RFID electronic tags is high, and the meager profits are not enough to support the use of small and medium-sized enterprises, reducing the popularity of RFID technology. Electronic tags close to the reader will unconditionally automatically send information, there is a risk of leakage of personal privacy[4]. The operation of RFID is also affected by the environment. There is no unified standard for RFID technology in the world, and the development and application of products are confused .

3. RFID Technology in the Clothing Industry Application Analysis

3.1. RFID Tags in Clothing Tags

RFID tags are divided into low frequency RFID tags, high frequency RFID tags, and ultra-high frequency RFID tags. Uhf (ultra-high frequency) RFID tags are the most used in various industries, and it has several advantages: longer reading distance, stronger security, identification of high-speed moving objects, synchronous recognition of multiple objects, reusable and large data memory. The tags used in the clothing industry are UHF RFID tags. The introduction of RFID in the apparel industry covers the entire process, from the production link in the factory to the storage link in the warehouse, and then to the retail link in the market. RFID technology can collect data from all aspects to ensure that enterprises get accurate data in a timely manner in order to manage and control the number of inventory. Especially for fashion FMCG (Fast-Moving Consumer Goods) brands, which have high requirements for the mobility of goods, the use of RFID technology can greatly improve management efficiency.

3.2. The Application and Impact of RFID in UNIQLO

At the beginning of 2017, UNIQLO began to implement RFID tag reform in all its stores worldwide, becoming the first Japanese retailer to use electronic tags globally. UNIQLO's parent company, Fast Retailing Group, has made high-profile publicity of the matter, attracting the attention of consumers.

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The RFID technology introduced by UNIQLO includes RFID tag, RFID fitting mirror, RFID shopping cart, RFID self-checkout and so on [5].

The RFID chip is placed in the clothing tag, a small electronic tag that stores various information about the product, such as the color, size, price, and so on. UNIQLO also added RFID tips to the tag, and many consumers took apart the tag after purchase. This practice attracts the attention of customers, arouses the curiosity of the public, thus triggering a heated discussion, and plays a promotional effect on the brand.

Some stores have also introduced RFID fitting mirrors, where customers stand in front of the fitting mirror with their clothes, and the fitting mirror quickly reads the information inside the tag and displays it on the mirror. In addition to the size, style and fabric, it will also show the pants, hats and other items that go with the dress, and customers can also view reviews from other buyers. The introduction of this device has changed UNIQLO's traditional sales model to a certain extent. Fashion fast selling brands are different from other clothing stores, such as UNIQLO, the customer flow of such brands is much larger than other clothing stores, and the shopper can not take care of every customer, select and match clothes for them, and RFID fitting mirrors can replace this work and give customers a better shopping experience.

After the customer completes the purchase, the goods are randomly placed on the RFID self-checkout machine, then it can quickly identify the number of goods, the number of yards, prices and other information and displayed on the screen. The customer can brush the payment code to pay. This process is simple and fast, can replace the cashier's work and save personnel wages. This is much more convenient than the supermarket self-checkout, customers do not need to scan the barcode of every item, and the store does not have to worry about missing items or underpaying. The introduction of RFID tags and RFID self-checkout machines has greatly improved shopping efficiency, saved labor costs, and made sales data more accurate and clear.

With the introduction of RFID technology, the commodity inventory data system can be updated in real time. Data is shared across physical stores and storage warehouses. When the goods are sold out, the staff can replenish the goods in time or transfer the goods from other warehouses. Decision-makers can also use sales data to understand consumer preferences and market demand and adjust strategies in time. UNIQLO has also established an automated warehouse, which greatly reduces the workload of the warehouse, saves a lot of labor costs, and improves storage efficiency.

3.3. The Application and Impact of RFID in HLA GROUP

HLA GROUP, as a pioneer brand in China's menswear industry, recognized the advantages of RFID technology early and seized the opportunity to walk in the forefront of technology application. HLA GROUP began to build the "RFID pipelined reading system" in 2014, using channel machines to pipelined reading RFID chip information [6]. The process of this model is to provide information about the goods to selected RFID tag suppliers, and these produced tags are tied to the clothing. Each piece of clothing enters the supply chain of HLA GROUP after tying the RFID tag and enters the RFID scanning channel machine along the conveyor line. The channel machine scans the RFID tag of the clothing and automatically compares the receivable quantity of the clothing with the actual quantity. If the quantity does not match, the manual unpacking inspection is carried out. The RFID scanning channel function reads a standard box of clothing information every 8 seconds without opening the box, and the number of scanned clothing pieces is up to 300. The scanning speed and accuracy are up to the international advanced level [7]. With the help of RFID technology, the annual turnover of clothing in HLA GROUP Logistics Park has reached nearly 500 million pieces, and it can complete the distribution of more than 1,000 stores every day and ensure that 5,000 stores automatically distribute goods twice a week. At the same time, compared with the previous flat warehouse required at least 600 people, the intelligent warehouse only needs to be equipped with 100

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people, which greatly saves the labor cost of HLA GROUP. Regional stores can scan product information directly through RFID handheld PDA to check whether the quantity of goods, style, color, size, and other information matches the predetermined amount, to achieve rapid inventory of clothing goods, greatly reducing the inventory burden of store personnel, after receiving clothing products. The application of HLA GROUP RFID channel machine can read clothing RFID information and realize batch scanning, real-time uploading, comparison, and classification of clothing commodity information in boxes. The labor cost was greatly reduced, after the system was put into operation, and the staff equipped with the operation line was only 1/3 of the previous number of workers. At the same time, the efficiency of receiving and shipping was greatly improved, and the work performance of each staff member was increased to 5 to 14 times of the original, which made an important contribution to the optimization of supply chain management of HLA GROUP [8]. After the application of RFID technology, HLA GROUP has reduced a lot of repetitive labor, liberated managers from tedious work, greatly reduced management costs, and improved the financial situation of HLA GROUP [9].

In addition, RFID technology can also be used to prevent theft. Compared to EAS systems commonly used in the market, RFID technology can be used for covert installation, and different alarms can be set according to the value of the cargo. RFID technology can also make the way for consumers to buy more convenient. An RFID reader is installed in the store, and consumers can query relevant information about their selected products by brushing RFID tags, such as other colors of the same style, prices, and related discounts, and can also understand the sales of their favorite products in real time [10].

4. Conclusion

Whether it is UNIQLO or HLA GROUP, the economic benefits brought by their introduction of RFID technology are significant. The scale of fashion fast selling clothing brands is large enough and the traffic is large enough, so the cost of introducing RFID technology is completely affordable and will have higher profits. For other ordinary clothing brands, although the introduction of RFID technology can improve work efficiency and save personnel wage costs, the cost is too expensive, and the profit may not be more than before the introduction of the technology, or even enough to make a profit. At present, the cost of RFID technology is the biggest factor hindering its popularity in the market, so developing new ways to reduce the cost of using RFID technology is an effective way to promote the technology. According to the data, although its cost is still high, it is declining, and it is predicted that in the future, more and more enterprises will use RFID in the market.

There are many other applications of RFID technology, such as airports use it to track customers' luggage, reducing the possibility of lost luggage, shorten the time to locate the luggage. RFID technology is also used in hospitals, where the patient wears an RFID tag on the wrist band to record the patient's situation and reduce various human errors. There are also newborn babies who are bound to their mothers, effectively preventing the situation of switching children. Additionally, the hospital also uses RFID technology for the inventory of fixed assets and drugs. Generally, hospitals have a lot of medical devices and a variety of drugs with different efficacy, inventory and search are very time-consuming and energy, and the introduction of RFID technology can greatly improve the efficiency of inventory. The research on RFID technology is continuing, and new scenarios for its application are also being unlocked, and I believe that in the future, RFID technology can shine in more fields.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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