Construction of DBMS for the Warehouse of Textile Enterprise Based on RFID Technology

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Abstract. The complex production processes and intermediate products make it difficult to use traditional DBMS (Database Management System) to precision manage the materials and products in the warehouse of the textile enterprise. To overcome the shortcomings of traditional DBMS, RFID (Radio Frequency Identification) technology is proposed to construct the management system for textile enterprise. The RFID tag and handheld RFID reader/writer used in the system are first introduced. Then the frame and function of the system are discussed with detail. The development requirements of the main modules in the system and the advantages of the new system are explained at last.

Keywords: Textile enterprise, Warehouse management, Radio frequency, Reader/writer.

1   Introduction

The production processes beginning with procurement of raw materials, including opening and cleaning, roving, spinning, weaving, are very complex in the textile enterprise. It needs to manage the raw material, semi-finished production and final products in the storage, such as cotton, yarn and fabric. In the traditional textile enterprise, the trained worker registers the materials and products everyday to roughly manage the warehouse. With the development of computer technology, some textile enterprises begin to establish DBMS for managing the storage. However, it stills can not satisfy the need of the enterprises as the information should be manually input into DBMS with keyboard.

From the discussion, it can be seen that the existing management methods for materials and products can not meet the automation production requirement of textile enterprise. To solve this problem, a new DBMS is proposed based on RFID technology in the paper, which will realize the automation management for the textile warehouse.

2   RFID Technology

RFID is short for radio frequency identification, and it is a non-contact automatic identification technology, which was developed in 1980s [1-2]. The RFID is based on the technology of radio communications, and combines the technologies of intelligent control, identification and network. Recently, the technology becomes mature and is applied in many industries, especially for the system management.

RFID is a revolutionary breakthrough ERP (enterprise resource planning) and SCM (supply chain management) systems. Its precise management reaches out into the business activities of every aspect of production, storage, transportation, distribution, retail and other aspects of management. It makes the management become convenient which can not imagine in the past.

It is hard to track single material or product in the past, but with the help of RFID, precise management of every aspect and every component can be easily realized. The management of the quality control, automation management and product lift cycle become very effective and convenient.

A typical RFID system is consisted by RFID tags, RFID reader/writer and management system [3-4]. The encoded data stored in the RFID is used to label the objects. The information data is transmitted between the RFID tags and the reader/writer with radio frequency signals. Compared with the bar code, the advantages of RFID are listed as follows:

(1)The electronic information can be transmitted from five-meter distance;

(2)The electronic information can be read within the range of electromagnetic wave even there are obstacles;

(3)A number of RFID tags can be identified in one time;

(4)The information in the RFID tag can be rewritten;

(5)The memory capacity of RFID tag is sufficient for storing the information of the labeled objects;

(6) The RFID tag has the ability for anti-pollution and damage;

(7) The RFID tag can use encryption technology to protect information.

The DBMS proposed in this paper used non-contact two-way data communication to indentify and register the raw materials, semi-products and the final products with RFID technology. The database technology is adopted to manage the information in the textile enterprise. The flow information of materials and products can be monitored with the share data real-time.

3   Hardware of the System

The hardware of system includes RFID tags and handheld RFID readers/writers. The two kinds of hardware are discussed briefly in the follow paragraph.

3.1   RFID Tag

The RFID tags are installed in the bags to label the material, semi-product and final-

product in the textile enterprise. The corresponding information is then encoded into some RFID data and written into the RFID tags with RFID writer [5-6].
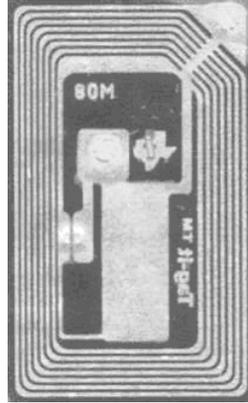

Fig. 1 RFID tags

Handheld RFID readers are used to read the tags through the various aspects and processed to track the materials and products. It is convenient to find, check and compare the information. The workers can know the information of the materials and products by organizing the data through the DBMS. When searching of raw materials and products, the workers just take the RFID reader to scan through the relevant regions and can easily find out the needed things.

The used RFID tag is shown in Figure 1. The type of the tag is DU9021 and the frequency is 80-90MHz. The memory capacity is 96 bits. The information stored in the tag can be read within 0.5 meter and about 30-50 tags can be read in one second.

3.1   Handheld RFID Reader/Writer

In the production processes, the trained workers use the handheld RFID reader/writer shown in Figure 2 to read, register and write the electronic information of the material and product.
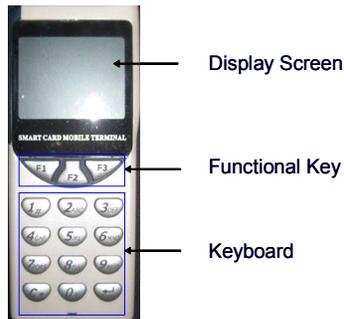

Fig. 2 Handheld RFID reader/writer

It can be used for checking or finding certain material or product. The program of the RFID reader/writer is simple and each function is set a corresponding fast operation key. The workers can use the reader/writer after a little training.

It is hard to confirm the information is obtained because of the noise in the textile enterprise. To overcome this, a red LED is installed on the side of the reader/writer. When the information stored in the RFID tag is read out by the reader, the LED gives red light. Figure 3 shows the side of reader/writer after modification. With the help of the LED, it is convenient for the workers to confirm that the RFID codes stored in the tag is successfully read out or the codes are successfully written into the tags.

Fig. 3 One side of RFID reader/writer after modification

4   System Structure and Functions

4.1   System Structure

A new warehouse management system for textile enterprise is established with RFID technology. The designed system includes the electronic tag reading system and database management software. The architecture of system is shown in Figure 4.

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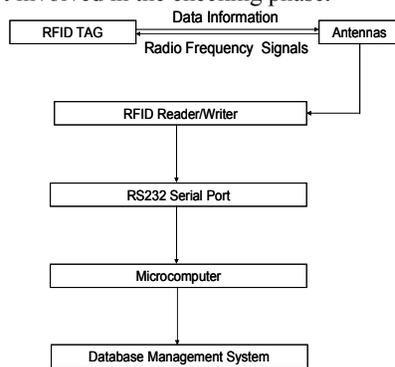

Figure 4 Diagram of system structure

The electronic tag reading system is composed by three parts, RFID tag, RFID reader/writer (including the antenna) and the microcomputer. The RFID tag is installed in the bags of the materials and products. The information of the materials and products is then encoded into RFID codes which are stored into the tags by the RFID writer. The codes can be used to label the material and product. The RFID reader uses an external antenna to form an effective region to identify raw materials and products with electronic tags. The RFID reader/writer communicates with the microcomputer by RS232 serial port. Through the middleware, the RFID code in the tags can be automatically read out.

The database management system software is composed by the modules of storage management, stock-out operation and inventory management. It realizes the management of raw material and products. It can be also used to track some needed information.

4.2   System Function

In the production process, the workers use the RFID readers/writers to register the information of the materials and products into the RFID tags with RFID codes. When the materials or products are stocked in or out the warehouse, the workers use the handheld RFID reader/writer to read the codes and write the new codes into the tag. The operation realizes the information update real-time. At the same time, the update information is stored in the memory of the handheld reader/writer.

Every day, before leaving the work, some specialized worker use the developed system to check and manage the material and product in the warehouse. The update information of the materials and products stored in the reader/writer are uploaded into the DBMS through the RS232 serial port. The worker then can use the DBMS to check and manage the existed things in the warehouse. The result can be printed and sent to certain administrative personnel.

5   Requirement of Main Modules

The proposed system combines the software and hardware to achieve the desired functions. The reading and writing of the RFID codes of the tags is realized by the RFID reader/writer. The management of the materials and products is carried out by the DBMS installed the micro- computer.

The need of recognition speed puts forward higher requirements for the developing the software in the microcomputer. The main demands are explained as follows:

(1)Real-time; The information stored in the RFID tags should be read or written by RFID the reader/writer real-time, and the update information should upload into the system real-time. When reading a number of tags in one time, it needs to process the data in real time, otherwise, some data maybe lost.

(2)Reliable; The information stored in the tags should be corrected read every time and the writer should correctly update the new codes into the tags.

(3)Universal; The DBMS is written for a particular purpose. We should make the system can be facilitate used for other situations with make too many changes. We

just need to modify certain module in new situation.

Borland C++ Builder 6.0 is used as the tool to construct the software in the platform of Microsoft Windows XP SP3. The database platform is Microsoft Access 2003.

6 Conclusions

The RFID technology is use to establish a DBMS for textile enterprise. By analyzing the need of the enterprise, a practical system is proposed. Compared with traditional management method, the new system based on RFID has followed advantages:

(1) Non-contact identification technology;

(2) Multi-tag identification technology improving data collection efficiency;

(3) The RFID tags can be affixed in any location;

(4)Facilitate to find or check the information of the materials and products real-time;

(5)Managing the warehouse information in real time and improving production efficiency.

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