

Library's Smart Bookshelf and Book Positioning System Based on ultra-high frequency RFID Technology

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Abstract: The application of the smart shelves is the comprehensive application of RFID technology. The library of ultra-high frequency RFID technology is a set of high-performance real-time management system. This paper discusses the purpose, working principle, system function and use method of intelligent frame book positioning system.

Introduction

With the progress of society and science and technology, the library has become an indispensable part of modern civilization. As the traditional library existence retrieval system cannot accurately provide the book location information, resulting in books and other problems, so that the book search efficiency is very low. To solve the above problems, can be used in recent years the rapid rise of the "Internet of Things" and ultra-high frequency technology, design smart bookshelves and intelligent book positioning system. As early as the 1990s, the National Library of Singapore applied RFID technology to the construction of intelligent libraries. However, the technology used in smart libraries has been dominated by high-frequency RFID, which cannot make location of the precise positioning. Compared to high-frequency RFID technology, The ultra-high frequency RFID technology have some other advantages: the read and write distance is farther, the read speed is faster ,the number of labels are more and so on.

The purpose of smart bookshelves and book positioning system

Intelligent book positioning system is built up by the use of ultra-high frequency RFID technology, with book labels, bookshelf labels, readers, computers and base stations. It designs the intelligent bookshelves and completes the whole system mainly by the coding principle and the localization algorithm. It solves the question which cannot accurately provide the book location information. The reader can not only accurately obtain the true location of the library collection, but also find the required books quickly and accurately improve the library inventory efficiency and reduce the library manpower needs.

The innovation of this paper is the ultra-high frequency RFID technology and positioning algorithm, and which apply the technology in book positioning management system. The key technology of this system lies in ultra-high frequency RFID technology, book positioning principle and algorithm.

The technical indicators of the system are as follows : (1) operating frequency between 902 - 928 MHz of the ultra-high frequency reader ; (2) The average reading time of each word is 6ms, (3)

the write time is 50ms, (4)it can read 30 electronic tags once in batches .

The working principle of smart bookshelf system and book positioning system

Intelligent book positioning rely ultra-high frequency RFID electronic tags, readers, make each book and retrieval system connected, and then exchange the information , finally through the book positioning algorithm to achieve the intelligent identification, positioning and management of the book. The label is suitable for the management of books and literature, which brings new opportunities for the development of the library industry.

Compared with bar code technology, high frequency RFID technology has more advances. The uses of ultra-high frequency technology are not easy to constraint read and write distance, it is more suitable for the circulation of books and literature management. Coding principle and positioning algorithm cleverly completed the actual location of the book information extraction. The whole system provides a space for a more intelligent book management of the document.

The working principle of smart bookshelf system and book positioning system is as follows:(1)The electronic tag ID length of the system is 24-bit hexadecimal number, The electronic tag code uses the top 10 bits and the first bit is the identification bit.0 indicates the shelf label,1 indicates the book label. The remaining nine bits contain the floor, shelves and column number and other information. The reader can read all the labels at the layer, and find the shelf label from the identification bit and read out the location information, which have the positioning function.

The main components of the whole system contain the intelligent book location retrieval system developed by C + + language according to the localization algorithm ,the computers those equipped with the system, base station, ultra-high frequency RFID reader ,the bookshelf label used to identify the position of the shelf layer. The ultra-high frequency RFID module is the core of the entire smart bookshelf, which consist electronic tags, readers and computer components. Electronic tags consist of the coupling components and chips; each label is unique, using the label for the 915MHz UHF electronic tags;

The reader transmits the electromagnetic wave to the read and write area through the antenna, the electronic label receives the electromagnetic wave and generates the signal and transmits it through the antenna to the reader; the reader then sends the information received from its antenna through the intermediate software to Computer, computer through the program to collect the ID number for processing.

First, people in the search system enter the book, the station will issue a search command, the reader began to search and stay for a few seconds, and search the corresponding electronic tag number: If found, it can return the location of the book Information; otherwise it will call the other layer reader to continue to retrieve, till find the actual location of the book information. The whole system has a very broad application prospects. Library administrators can use this system to achieve the rapid inventory and the whole frame; this has a very real significance for the library's highly intelligent management.

The functions of smart bookshelves and book positioning system

1. Smart bookshelf system achieve monitor books in time.

The smart bookshelf system implements cluster deployment through TCP / IP, which requires real-time data communication with the library management software system and is controlled by the library management system. The ultra-high frequency modules send large number of book label information to the library management system after collecting book label information. The smart

shelves are equipped with ultra-high frequency reader antennas that can track books on library bookshelves. These bookshelves can read information from library books, which are marked with high-frequency RFID tags that provide accurate location information for books.

2. Smart bookshelf system achieve the collection of books inventory, positioning and quick query.

Library and book positioning system based on the ultra-high frequency technology can complete the book inventory work, generate the list of exit books, and provide the data to the library automation system, to achieve the loss books list. The system can automatically change the status of the item according to the missing list, and it can complete the book positioning work according to the set condition, and establish the position relation of each book and the shelf. Readers in the OPAC interface enter the search conditions can quickly and accurately provide real-time information about books location. OPAC query process can not only support two or more library system to query by title, author, keywords, the classification of the classification number, claim number, series name, ISBN and other keywords, but also support query book location, book positioning and intelligent path prompts, three-dimensional graphics effects.

3. Smart bookshelf system achieve multimedia virtual bookcase query and electronic resources display function.

Smart bookshelf system provides multimedia virtual bookcase query and electronic resources display by equipped with LCD touch screen. Readers through the display can query the actual location of the book; Librarians can query and track the book situation through the display.

4. Smart bookshelf system achieve the reader reading habits statistical analysis.

Smart shelves antenna hid the fixture and wiring in the shelves by a hidden fixed way, nothing can be seen from the surface. This fixation is very simple, easy to install and post-maintenance. The statistical analysis ability of data is based on a certain library mathematical model to analyze the reader's reading habits.

5. Smart bookshelf system achieve seamless integration with the library ultra-high frequency system.

Library ultra-high frequency systems use multiple RFID system equipment and integrate library systems, smart shelving systems, ultra-high frequency application software systems, and other related systems. ultra-high frequency applications and management platform can manage and monitor the various terminal equipment of the ultra-high frequency system, view the status of the equipment and application system, generate historical reports and make statistics. The ultra-high frequency extension application project meet the needs of the library collection management and circulation business, complete literature frame information collection, literature utilization statistics, literature submission, literature inventory, literature frame navigation and others.

Usage of smart bookshelves and book positioning systems

The reader enters the book title in the search interface, and the system according to the predefined algorithm to call the reader to find the book, and feeds its position information back to the search interface.

Features and advantages: The intelligent book positioning system based on ultra-high frequency technology fundamentally realizes the accurate positioning and intelligent searching of books. The system can accurately locate the actual location of the book, whose positioning accuracy can be to the shelf layer. Even if there are misplaced books, the reader can easily find, greatly improving the efficiency of the book search. Compared with the existing high-frequency RFID technology, the advantages of ultra-high frequency technology are as follows: faster reading speed

farther read and write distance, larger read and write amount, lower tag cost and other.

Adaptation scope and promotion prospects: the system can be widely used in libraries, archives and other places, in order to achieve a high degree of intelligent management of books and documents laid the foundation.

Market analysis and economic forecast: At present, most of the library management at home and abroad still remains in the non-intelligent stage, so the system has a broad market space. Although the current cost is slightly higher, but compared to the system to save manpower, time costs, the technology has a great potential value. With the continuous development of ultra-high frequency technology, the cost will be greatly reduced.

The ultra-high frequency RFID technology is a popular research topic in library circles both at home and abroad in recent years. It has been put into use in libraries in the United States, Europe, Singapore National Library, Taiwan and many colleges and universities in China; it also has achieved good results. The ultra-high frequency RFID technology can improve efficiency of the library circulation management and collection management; on the other hand, it brings new opportunities development for the library industry. The application of smart bookshelves reflects the library's true sense of serving the readers, providing readers with convenient service purposes, and also provides a more efficient way to improve the efficiency of library management and reduce the cost of library management.

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