RESEARCH ON INTELLIGENCE TREND OF ENTERPRISE LIBRARY BASED ON PERVASIVE COMPUTING

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Abstract: This paper describes pervasive computing, library intelligent space base on pervasive computing, then introduces library information systems based RFID. In the library management system, it uses advanced RFID technology to optimize and integrate the libraries' collection of resources and management mode. This library system realizes automation and intelligent of library management, maximizes the effectiveness of collection, and improves the library's current management mode, and receives the highest reader service efficiency. Library management becomes more and more intelligent.

1 INTRODUCTION

With the development of companies information technology and people thirst for knowledge, companies begin to have their own libraries. Enterprise Library as a documentation and information center is academic institutions of enterprise for learning and scientific research services, so when design library, it is necessary to meet the needs of collection and also to meet service needs. With entering 2lth century, the combination of smart space and the library information system become more closely. Information era makes the library service model begin to innovate and be more and more intelligent. Library based on pervasive computing is built on three features those are the digital library resources, network services and characteristic technology. All libraries want to be intelligent library. It is clear that the existing bar code-based automatic identification system has been unable to meet the needs of intelligent, while RFID technology meets these needs very well, so it begins to emerge in the library automated management. Using RFID technology can drive reader service quality and documentation management level from the content and form, and make libraries intelligent. Intelligent library management system based on RFID can greatly enhance library efficiency.

2 PERVASIVE COMPUTING

Pervasive computing is a new computing model, which is different from mainframe computing or desktop computing. In 1991, Mr. Mark Weiser said that using pervasive computing aims to enable computers are available throughout the physical environment, while users are not aware of the existence of the computer. Pervasive computing is not to develop new computing equipment, but to develop a new calculation model and the corresponding human-computer interaction way. With this interactive model, computing equipment and technology being used in the user tasks of daily life makes users can get the computing services without needing to be aware of the existence of computers, which maybe make the users distraction, at the same time, make the attention return to the task.

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Pervasive computing has two essential characteristics: ① Integration of cyberspace and physical space. The pervasive computing model of cyberspace and physical space will be integrated. (Satyanamyanan M， 2001) On the one hand, the matters in physical space and the object in cyberspace will be bound in various forms. On the other hand, the computer system will fully recognize and utilize a variety of context information in the physical space, and then show different actions. ② Calculation is transparent to the humans. That is, people do not need to go out first and find the computer. The computer's point of interaction should be embedded or removable; Secondly, computers should have the initiative to provide services, not just passively waiting for orders; The last, various modules require that organization and coordination process should be more autonomy in the provision of services.

3 BUILD A PERVASIVE COMPUTING ENVIRONMENT FOR THE LIBRARY

People need information interaction and information services during the processing of specific task, and eager to get information services at anytime and anywhere to realize “ubiquitous information services” in pervasive computing environment. Therefore, libraries need to create a pervasive computing environment and integrate into the whole process of user's current task and understand the before and after relation of information need and information exchange. Then, they need to establish context information of user’s tasks, and provide proactive and dynamic information services based on that.

3.1 The Integration of Libraries’ Physical Space and Cyberspace

Pervasive computing makes it clear that the integration of physical space and cyberspace is to provide a seamless, transparent computing environment. Libraries want to create a pervasive computing environment and to realize the integration of libraries’ physical space and libraries’ cyberspace. Physical spaces of libraries are all entities, things and activities what people engaged in of the real world that require the libraries information services, such as the user “enter electronic reading room browser.” Libraries cyberspace includes various computers and telecommunications equipment, digital resources and information services of libraries, and also includes various information devices used by users (such as Mobile, PDA etc).The integration of physical space and cyberspace in libraries fully reflects the “ubiquitous” and interactive capabilities of pervasive computing.

In order to realize this function, we need to establish mutual corresponding relationship and interaction mechanism automatically between cyberspace object and the physical space object in libraries. Some sensor technologies (such as touch screen), tagging technology which used to identify the physical entity can be well applied, so that these physical entities become a direct entrance to access cyberspace services. Cyberspace can automatically sense change of physical state in the physical space, and also automatic understand human behavior, and on the basis of the understanding provide active information services without human intervention. This wait-service has been called as “active computing” or “implicative human-computer interaction”. When a user enters a given scene, the library cyberspace will set personalized automatically for the user. While when the user carry out a specific task, the libraries cyberspace will feel the user's specific behavior and provide personalized information service.

3.2 Fully Integrate Context in the Process of User Activity and Provide Dynamic Information Services

In the integration of physical space and cyberspace in the libraries, the libraries fully integrate into the process of the user’s activities, understand users’ needs, identify the relationship between user activity and information needs, get the physical space status and user behavior actively, then provide dynamic information services for users. The process of understanding user activity generally takes the way of “context computing”. The importance of libraries cyberspace for context understanding in the user activity lies in: The interface of the physical space is multiplayer share rather than individuals; Implicative interaction can reduce users’ distractions and make them focus on actual tasks. For different users, they input the same context may have different semantics results.

From the perspective of pervasive computing, context is information that can be used for characterizing the state of entity and the user’s

action and context calculation is when the user needs to provide information and services which is suitable for the task at that time. The context of libraries dynamic information services include: (1) Context of the scene that needs to provide information services, such as information resources which are available for teaching in the classroom. (2)The context of the user features, such as the professional background of users, users' previous research and so on. (3)The context of user action, the dynamic information needs of the user's current task.

The context information of the physical space in libraries can be obtained through a variety of sensors, existing information, users' tasks and interaction between devices or user direct setting. High and low are two level of context information. A number of low-level information can be obtained by the sensor or pre-set. High-level information such as the user's current action can be obtained by computer vision to track and identify. Then, it creates a probability model.

3.3 Library is an Intelligent Knowledge Space

Intelligent space is defined as a work space which is embedded computing and information equipment and multi-modal sensors by American National Standards Institute.It's purpose is to enable users access information easily and access to the computer services in order to separate work and work with others efficiently. The purpose of establishing intelligent knowledge space based on pervasive computing for a library is to make computing and information services integrate into the people's living space. Intelligent knowledge space of libraries should at least provide the following functional services: (1) Recognize and perceive users and their behavior information, understand and predict information needs in the process of completing the task by users. (2)Users can easily interact with a variety of information sources, including explicit and implicative interact. (3)The library should provide the user seamless connection with intelligent space using mobile devices carried at any time and any place.(4)Libraries should provide abundant information resources and proactive information services.(5) Libraries should be able to support collaborative work between the users or tasks. Based on this goal, intelligent space framework based on pervasive computing for libraries was proposed. (Xu Qiang, 2006) The intelligent libraries should be considered as an object-oriented, distributed network architecture model. It is composed by the client, server, scheduling systems, retrieval systems, library server, object libraries, and resource processing system, and adapts to a variety of different computer systems, and It supports the user through the mobile phone, PDA and other mobile computing devices which call a large number of computing resources embedded in the environment at any time in order to access to information and computing services. With the deepening of pervasive computing theory and the platform of software, the library can get involved in the applications of intelligent knowledge room, intelligent meeting, intelligent home, intelligent health care, intelligent distance education, knowledge among the community and other applications, and also can realize invisible information exchange between users at anytime and anywhere, and provide information services everywhere.

3.4 Ubiquitous Learning Environment of Libraries

An important reason of libraries creating a pervasive computing environment is to build a "ubiquitous learning environment". Rich information resources, the integration of the mobile environments and pervasive computing technology affects people's learning mode and process. The learning can be obtained at anytime and anywhere and can call "ubiquitous learning". A "ubiquitous learning environment" is an integrated learning environment, which integrates multiple layers and dimensions including physical, social, information and technology. The face of ubiquitous learning environment, the challenges of libraries is not only providing information for learners by what manners, but also whether or not this can make learners use accurate information in the right way at the right occasion. In a ubiquitous learning environment, a variety of educational institutions, workspace, community and home will be organically integrated. Intelligent knowledge space of libraries is the organic component of the ubiquitous learning environment and will help to ubiquitous learning of people.

Libraries want to become intelligent libraries, it is clear that the existing bar code-based automatic identification system has been unable to meet the needs of pervasive computing, so we need a new and non-contact automatic identification system without human intervention. RFID technology meets these needs very well, so it began to emerge in the library automation management.

4 THE APPLICATION AUTOMATIC IDENTIFICATION IN LIBRARY INFORMATION SYSTEM

Automatic identification technology is a technology which automatically obtains relevant information of objects that been identified by approaching activities between identification devices using identification device of certain the application, and provides those information for the background computer processing system completing relevant and following handling. Automatic identification technology has been widely used in many service areas since the beginning of research in the 20th century.

4.1 Advantages and Disadvantages of Bar Code Technology in Library Information System

Bar code is now widely used. Bar code technology has several advantages as following: First, input fast. Speed of bar code input is 4 times than keyboard and can achieve instant data inputs. Second, it has high reliability. Error rate of bar code technology is less than 1/1000000. Third, it has an ability of the large amount of information gathering. Two-dimensional bar code can carry thousands of characters information. Fourth, the cost of inputs is low. Bar code labels are easy to make without special requirements for equipment and materials.

Bar code technology in library management information system also has the following shortcomings: First, the use of bar code is inefficient. Bar code cannot be changed after printed. Second. A bar code reader can scan when light source irradiates bar codes. People need open the book and find the bar codes to scan bar codes in the existing processes of circulation of books. This operation process is cumbersome and inefficient. Bar codes are easy to be damaged. This will not only affect the efficiency of borrowing and returning books, but also affect the readers' satisfaction of the library (Cai Mengxin, 2006).

4.2 RFID Technology and Library Information System

4.2.1 Radio Frequency Identification Technology

Radio frequency identification technology is an automatic identification technology by the way of radio frequency for non-contact and bidirectional data communication to identify and obtain the target and relevant data. RFID technology can finish information input and hand without manual intervention, direct contact and can work in a variety of harsh environments. Rapid moving objects and multiple tags can be identified by RFID quickly and conveniently.

Using RFID technology is not simply replace bar codes, but need to change the existing management model. To create new service concepts and business models as a guide, this drives improvement of the reader service quality and document management from the content and form. RFID-based intelligent library management system can manage the location, distribution, circulation and flow of books and objects in the library, and can enhance the classification of books, markers, positioning and data collection, thus greatly improve efficiency of libraries (Radmanesh, Matthew, 2007).

4.2.2 Library Intelligent Space based on Pervasive Computing

Intelligent space technology has a very important position in the development of ubiquitous computing, and is universally regarded as a test bed that embodies the pervasive computing thought and researches key technology of pervasive computing. Library intelligent space is the essential characteristic of pervasive computing on the scale of library building, as following:

The entire space of intelligent space that is the entire library becomes a continuous three-dimensional interactive channel, at the same time embedded computing systems can fully identify and utilize the context of space. This reflects the integration of cyberspace and physical space. Another important feature of intelligent space is a nomadic service. Wireless handheld device users carried or electronic devices in physical space can take advantage of its surrounding infrastructure resources. While its' modules can also interact and collaborate with the other modules in order to allow users' get a variety of related services in local space. A third characteristic of smart spaces is that interact channel is a three-dimensional and continuous, while computing systems are hidden. People can receive computer services at anytime and anywhere without a clear sense of the existence of computing systems in space.

4.3 The Application of RFID Technology in Libraries Information System

Intelligent space is a work or living space which is embedded computing, information equipment and multi-modal sensing devices, with natural and convenient interactive interface to support the people access to computer systems services easy. Working and living in intelligent space is the process of using the computer system and process of ongoing interaction between people and computer systems. In this process, the computer is no longer just a passive executor of the operation command explicit information processing tools, but the helper of the collaboration of people to complete the task, is a human partner both parties interact in harmony with the collaborative relationship. The harmony of this interaction is mainly reflected of people using computers which will reduce the burden of the operation effectively, and interaction is entirely a spontaneous act of the people. Spontaneous means free, non-mandatory and not learning, while spontaneous interaction is that the people can interact with the computer system using the natural first category of data (such as language, gestures and writing, etc.).

The daily services in library usually involve people management and materials management. It is need to use of RFID technology as the identification method in order to realize access control and statistics a large number of readers and books, etc., and to drive reader service quality and documentation management level from the content and form. This makes modern library realize intelligent. RFID-based intelligent library management system can manage the location, distribution, circulation and flow of books and objects in library and also can enhance the classification, markers, positioning and data collection of books, even greatly improve the efficiency of library. Implementation of the RFID-based library management information system can complete many functions that bar codes cannot complete and can provide a lot of convenience for the library management. The application modules of RFID technology in libraries information system as following:

4.3.1 Self-borrowing and Returning Service of Books

Readers often need to take a long time to wait in line because a very large number of people want to borrow or return books from libraries. If we use RFID devices, such as RFID tag not only can search for bibliographic information and loan information, but also can search for the exact location of specific libraries holdings in the library. This can speed up the rate of circulation jobs, simplify borrow and return aspects, and improve quality of services in library.

4.3.2 Entrance Guard System of Libraries

For all the libraries, book theft has been a small problem. For the library it results in economic losses. While for rare books, it cannot be measured by money. The RFID technology itself is one of anti-theft technologies. It is access control system using RFID technology that makes library anti-theft system easier. It will automatically alarm if unauthorized library collection be removed from the house to remind the reader coming back to the library and completing procedures. Besides, it can trigger the camera system to prevent books and files been stolen. Combining lending card and work card of readers and managers, you can access to know the situation of who come in and come out, calculates these numbers to provide accurate data for improving the work mechanism.

4.3.3 Simplify Intensity of Library Management System

RFID transfers signals by radio wave. It can read a few RFID tag data at a time and simplify inventory work. Sensor using radio waves make the library work become extremely easy. Disorder and book find difficult problems have been resolved.

5 CONCLUSIONS

Use of advanced technology can optimize and integrate of the library's collection of resources and management model in library information system. It can realize intelligent of library and improve the library's current management operation mode. Through RFID tags attach to all objects can make the objects in physical space and objects in cyberspace build the corresponding relations. This can provide a practical way for building intelligent information processing entities (Jiang Lifen, Lu Guizhagn, Xin Yunwei, 2007).

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