A LOAN ITEM MANAGEMENT SYSTEM

FIELD

The present invention relates to a loan item management system, and in particular a system that can be used to assist libraries manage items that are reserved or held for patrons, or which are lent to patrons on restricted short periods.

BACKGROUND

Libraries have introduced item or asset management systems that rely upon writing and reading data to and from radio frequency identification (RFID) adhesive tags placed on the items. The items include books, periodicals, DVDs, CDs and other items that are typically held by libraries. The item management systems include a Library Management System (LMS) and an RFID reader system that communicates with the LMS. The LMS is a computer system such as those provided by SirsiDynix (Siris Corporation), Libero (Insight Informatics Pty Ltd), and Amlib (infoXpert Pty Ltd).

The RFID reader system is able to read identification data from the tags of the items, and may include an RFID reader pad that is connected to the LMS. LMS's typically include a circulation client that is used by a trained librarian or technical staff member to control the LMS and update the information held for an item, when identified based on the read identification data. When a patron of a library borrows an item, the LMS client is used to update the data held for the item to indicate that it has been borrowed or loaned, and this process is referred to as "Check Out". Status data held for the item indicates that the item is checked out. Similarly, when an item is returned by a patron, the LMS client is used to again update the data held for the item, by performing a process referred to as "Check In". The status data for the item then represents that it is checked in.

When a patron wishes to reserve or place an item on hold that has been borrowed by another patron, and is currently checked out, the LMS can be used to record "on hold" data

against the item which associates the identifying data associated with the patron reserving the item, such as the name of the patron, with the data held for the item. The date of the reserve or on hold request is also recorded. When the LMS is used to Check In an item and it has associated on hold data, the LMS client will prompt the librarian and change the status of the item to represent that it is on hold and available for collection by the patron who reserved the item. Existing LMS clients allow the librarian to print an on hold docket or receipt which includes the name of the patron who reserved the item and an expiry date on which the on hold status will expire. The receipt or docket is usually placed on or with the item, and a librarian then will normally place the item in an area of the library where reserved items can be collected by patrons. To assist with identification, the items are usually shelved in an order that is based on the last name of the patron with the on hold receipt showing that name. The LMS may notify the patron that the item is ready for collection by mail or email.

One of the difficulties with reserved items is that patrons may never collect the item within the period for which it may be reserved, i.e. before the on hold expiry date. To address this, librarians have to physically locate the items using the dockets or receipts, either on the basis of the expiry dates or the names of the patrons, and then use the LMS client to perform the Check In process again. The Check In process enables the status of the item to be changed to one that represents it is to be placed on the normal shelves and available for patrons from the general collection. However, if there is another on hold or reserve request associated with the item, recorded for the benefit of another patron, then the LMS will again prompt the librarian that its status is to be changed to on hold and available for collection by the other patron. If so, then another docket or receipt needs to be printed, placed on or with the item and then returned to the reserved item area. This can be extremely time consuming for the librarian, particularly as the items may have to be handled a number of times, and there can be difficulties locating the items on the basis of the dockets, printing new dockets and having to perform the check in process a number of times for an item. There is also difficulty with having items stored with the receipts displaying patron's names. The names are visible to other patrons of the library and can be considered a breach or invasion of a patron's privacy.

Another difficulty libraries face is handling the lending of restricted items to patrons for very short periods, or which are referred to as short term loans. For example, University libraries hold items that may be highly desired by students, and in view of the high demand, are only lent to students on a short term basis, such as two hours. These items also tend to be reserved by large numbers of students, and consequently need to be turned over by librarians quickly. Handling these items efficiently and securely to meet the demands of patrons is a continual difficulty for libraries.

Accordingly, it is desired to address the above or at least provide a useful alternative.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

SUMMARY

Embodiments of the present invention provide a loan item management system, including:

a shelf unit having shelves for returned items, at least one shelf including a respective antenna for communicating with RFID tags of items placed on the shelf; and

a returns computer system including:

(i) a read controller for controlling reading of the tag data of the tags of items in said at least one shelf and associating location data representing the location of the items with the tag data; and

(ii) an item controller for accessing reserved item data and location data to present for a patron which shelf holds an item reserved for a patron.

A returns controller may invoke a check in process for a reserved item in said shelf unit when a reserved period expires for said reserved item.

Embodiments also provide a loan item management system, including:

a shelf unit having shelves for loan items, at least one shelf including a respective antenna for communicating with RFID tags of items placed on the shelf; and

a returns computer system including:

(i) a read controller for controlling reading of the tag data of the tags of items in said at least one shelf and associating location data representing the location of the items with the tag data; and

(ii) a returns controller for invoking a check in process for an item in said shelf unit.

DRAWINGS

Embodiments of the present invention are hereinafter described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a block diagram of an embodiment of a loan item management system;

Figure 2 is a block diagram of an embodiment of a returns computer system of the loan item management system;

Figure 3 is a flow diagram of a process executed by a read controller of the system;

Figure 4 is a flow diagram of a process performed by a returns controller of the system;

Figure 5 is a flow diagram of a process performed by an items monitor of the system; and

Figure 6 is a block diagram of an embodiment of a shelf unit of the loan item management system.

DESCRIPTION

A loan item management system 100 for a library or any other lending institution or organisation, as shown in Figure 1, includes a shelf unit 101, a returns computer system 120, an item management system 104, such as a library management system (LMS), a

patron kiosk computer 130, and a radio frequency identification (RFID) reader pad 140.

The shelf unit 101 includes a master unit 102 and one or more slave units 104, with each unit 102 and 104 including an array of cubicles or shelves 106 in which items 116, such as books, DVD's, CD's, periodicals etc. may be placed. The items 116 each include respective RFID tags 114 placed thereon. For example, the shelves may have height and width of 340mm and a depth of 300mm and the arrays in each unit 102, 104 may be four shelves high by two shelves wide. The master unit 102 includes a radio frequency identification (RFID) reader circuit 108 with a power point and a data point for connection to a communications network 220. The shelves 106 of both units 102 and 104 each include respective RFID antennas 110. The antennas 110 of the master unit 102 are connected to the reader circuit 108, and when a slave unit 104 is added, the antennas 110 of the slave unit 104 are also connected to the reader circuit 108. The reader circuit 108 generates radio frequency signals passed to the antennas 110 to excite and communicate with the RFID tags 114 of items 116 that are placed in the shelves 106. The reader circuit 108 is controlled by the returns computer system 120 to poll each shelf 106 periodically and consecutively. Accordingly, the reader circuit 108 only excites one antenna 110 of the units 102, 104 at any given time, so as to produce a forward radio frequency beam that is directional and only excites the tags 114 of items placed in that respective shelf 106. The shelves 106 may be constructed so as to be shielded to ensure that the beam produced by one antenna 110 does not excite and communicate with tags 114 of items 116 on other adjacent shelves 106. The RFID reader circuit 108 reads tag data from the excited tags 114 in a shelf 106 and sends it to the return computer system 120. The reader circuit 108 is also able to write tag data to the tags 114 in a shelf 106, using data sent from the returns computer system 120. The reader pad 140 also includes an antenna 142 to excite and communicate with tags 114 of items 116 placed on the pad 140. The reader pad 140 is also controlled by the returns computer system 120 to write tag data and read tag data from the RFID tags 114.

The tag data stored on the tags 114 represents, among other information, a unique tag identification number, an item asset number associated with the item, and a security state,

such as whether a security is set to "ON" or "OFF", representing the status of the item, e.g. whether it is considered returned or not. The tag data stored on the tags 114 complies with the draft standards of ISO 28560. The reader circuit 108, the RFID pad 140 and a RFID reader 604 can be provided by companies that produce RFID reader hardware, such as FEIG Electronic GmbH, and Tagsys SAS and RFID system software, such as FE Technologies (Express Promotions Pty Ltd), Bibiliotheca RFID Library Systems AG, and 3M. The RFID reader circuit 108, the RFID reader 604 and the return computer system 120 are connected by a data communications connection, such as a serial or Ethernet connection 220. The pad 140 is connected to a USB interface 210 of the returns computer system 120.

The returns computer system 120 communicates over a communications network 220 with the item management system (LMS) 104 using SIP2 (Standard Interchange Protocol Version 2). The LMS 104 maintains a database of item data, including at least some of the tag data, for all items held by a library or a lending institution, and other enterprise resource planning (ERP) data. Library management systems for libraries are provided by a number of parties including SirsiDynix (Siris Corporation), Libero (Insight Informatics Pty Ltd), and Amlib (infoXpert Pty Ltd). The item data maintained for an item represents respective information associated with the item, including the asset number, title, author, owner location, destination location, whether the item is a restricted short term loan asset, MARC standards information, call number, etc. The item data also includes status data representing whether the item has been checked in or checked out, details of any loan, and whether the item has been reserved by one or more patrons.

The returns computer system 120, as shown in Figures 1 and 2, is based on a standard computer 202, such as a 32 or 64 bit Intel architecture computer produced by Lenovo Corporation, IBM Corporation, or Apple Inc. The processes executed by the computer 202 are defined and controlled by computer program instruction code and data of software components or modules 250 stored on non-volatile (e.g. hard disk) storage 204 of the computer 202. The processes performed by the modules 250 can, alternatively, be performed by firmware stored in read only memory (ROM) or at least in part by dedicated

hardware circuits of the computer 202, such as application specific integrated circuits (ASICs) and/or field programmable gate arrays (FPGAs).

The computer 202 includes random access memory (RAM) 206, at least one microprocessor 208, and external interfaces 210, 212, 214 that are all connected by a system bus 216. The external interfaces include universal serial bus (USB) interfaces 210, a network interface connector (NIC) 212, and a display adapter 214. The USB interfaces 210 are connected to input/output devices, such as a keyboard and mouse 218 and the RFID pad 140. The display adapter 214 is connected to a display device, such as an LCD display screen 222. The NIC 212 enables the computer 202 to connect to the communications network 220. The network 220 may include one or a combination of existing networks, such as a LAN, WAN, the PSTN, the Internet, mobile cellular telephone networks, etc. The computer 202 includes an operating system (OS) 224, such as Microsoft Windows, Mac OSX or Linux. The modules 250 all run on the OS 224, and include program code written using languages such as C, Ruby, C# or a framework such as Microsoft .Net. The return computer system 120 communicates with the LMS 104, and the patron kiosk computer 130 using the communications network 220, and the same network can also be used to communicate with the shelf unit 101.

The returns computer system 120 includes modules 250 that provide a read controller 252, a returns controller 254, an LMS controller 256, a data store 258 and a items monitor 260. The data store 258 is used to store or cache item data obtained from the LMS 104 by the LMS controller 256, and store tag data obtained from the shelf unit 101 and the reader pad 140. The data store 258 may be provided by SQL database engine, such as SQLite.

The shelf unit 101 is used as an on hold location and/or a restricted short term loan location to place items 116 that have been recently returned. The on hold location is for items that may have been reserved by patrons. The reserved items are placed in a respective one of a group of shelves 106 of the unit 101 that form the on hold location for general reserved items. Another groups of shelves 106 may be used to place short term loan items when they are returned, and again an item is placed in any respective shelf 106 of this group.

For example, one slave unit 104 may be used for returning and collecting short term loan items, whereas another slave unit 104 and the master unit 102 may be used for general on hold or reserved items. In some libraries, to control the security of the restricted short term items, an entire shelf unit 101 may be placed in a secure area for the return and collection of short term loan items. This would ensure that patrons are unable to leave the secure area without checking out the short term items.

To determine what items 116 are placed in each shelf 106, the read controller 252 performs a read process 300, as shown in Figure 3, so as to control the reader circuit 108 to continuously poll each shelf 106 to read the tags 114 and items 116 located in that shelf. When invoked, the process 300 commences its step 302 to determine whether the shelf unit 101 is online, i.e. the returns computer 120 can communicate with the reader circuit 108, or whether a process stop or reconfiguration has been requested. If the shelf unit 101 is online and is to continue polling each shelf 106, a determination is made at step 304 to determine whether any item is detected in the current shelf by the reader circuit 108. The returns computer 120 allocates identification (ID) data representing a unique shelf (ID) to each shelf 106 of the unit 101. The shelf ID may be a unique number or name and is also used to mark each shelf 106 of a unit 101 so patrons can identify and locate a particular shelf. If at least one tag 114 responds to the reader circuit 108 in the current shelf with its tag identification (ID) number, the reader circuit 108 reads the tag data of all the tags 114 of items 116 in that shelf (step 306). The tag data read includes the asset number of the item and this is associated with the identification data for the current shelf, and is stored in the data store 258 with the item data for the items 116. The shelf ID is stored with the item data as location data or data that represents the location of the item 116. Using the shelf ID, a check is then made to determine (step 308) whether the shelf 106 is designated for short term loan or restricted items. If so, the item may have only just been returned, and the reader circuit 108 is controlled (step 310) to ensure the tag data of the items in the shelf 106 is set to "ON", to indicate the items have been returned. If an item is not detected in a shelf at step 304 or the tag data of items 116 have been read at step 306, the process 300 then proceeds to the next shelf (312) using the next shelf ID, and returns to step 302.

Some of the items 116 held by the lending institution may have RFID tags 114 that are difficult to read when simply placed in a shelf 106, such as items which may have a metallic cover. Other items may simply be missing an RFID tag or be oversized and cannot be placed in one of the shelves 106. For these types of items, referred to as exception items 610, an alternative shelf unit 600 includes a large oversized shelf 602 at the bottom of the unit 600, which may be used to place and hold exception items 610. The shelf unit 600 is the same as the master unit 102, but instead includes nine shelves 106 and the bottom shelf 602 which extends the width and depth of three shelves 106. The shelf 602 includes the RFID reader device 604 which can be removed from the shelf 602 and used by an operator to read the tags 114 of items 610 placed in the shelf 602. The read asset tag data of the tags is stored in the data store 258 with the shelf ID for the exception item shelf 602. For items 610 without tags 114 placed in the shelf 602, asset tag data to identify the items can be manually entered by the operator using the reader device 604 and recorded in the data store 258 with the shelf ID.

The returns controller 254 ensures the read or entered asset tag data is stored on the data store 258 and is queued for processing by the LMS 104 when necessary. The LMS controller 256 controls communication with the LMS 104. The returns controller 254 ensures recently read asset tag data of returned items 116 stored in the queue of the data store 258 is passed directly to the LMS 104 by the LMS controller 256 to perform returns processing by the LMS 104, i.e. to check-in returned items 116, as discussed below. The LMS controller 256 returns item data for each item 116 corresponding to the asset tag data and this is cached by the return computer system 120 in the data store 258. The item data may be cached for a predetermined period of time, for example, a few hours. When returned items 116 are placed on the RFID pad 140 of the return computer system 120, the returns controller 254 displays status data, including sort criteria, for the items on the pad 140 using tag data read from the items, the cached item data held in data store 258, data obtained from another data source or a combination of any of these.

The returns controller 254 executes an item management process 400, as shown in Figure 4, which is invoked for each thread used to read an RFID device. The process is used for

each RFID device, such as the shelf units 101, 600, the RFID pad 140, or the RFID reader 604 to obtain the tag data from tags 114 of items 116. The process 400 commences at step 402 by invoking the RFID device, such as the shelf unit 101, 600, reader device 604, or the pad 140, and then checks whether the process is to close at step 404. If not a check is made at step 406 as to whether shelf unit 101, 600, reader 604 or the reader pad 140 has detected and read one or more items 116. If an item 116 has been detected and read then for each item 116 the returns controller 254 accesses the tag data of the item including the asset number, and uses the asset number to interrogate the data store 258 (408) to obtain any item data for the item held in the data store 258. Data is held for a predetermined period of time in the store 258 for those items that have been returned or checked in already. If no item data is held in the store 258 for the item 116 (step 408), then the LMS controller 256 is invoked to obtain the item data from the LMS 104 (step 410) by performing a Check In process. For restricted items on a short term loan that may have been checked out and returned quickly, the returns controller 254 determines next (step 409) whether a shelf ID recently read corresponds to a short term loan shelf and whether security data for the item 116 that has recently been set to "ON", indicating it has just been returned. If so, the LMS controller 256 is also invoked to perform a Check In process (410) for the restricted item. If item data is held in the data store 258, the status data is checked (step 412) to determine if this is a reserved or on hold item located in one of the shelves 106. If it is an on hold item and the stored on hold expiry date with the status data indicates that the expiry date has passed, then the LMS controller 256 is invoked to perform the LMS check in for that item (step 410). If the expiry date has passed, this indicates that the item has not been collected from the shelf 106 and can be checked in and may be returned to the general collection or allocated to another patron who may have reserved the item. The item data extracted for each read item 116 is then used in a display process 414.

The display process 414 accesses status data associated with each item 116 and generates display data to display instructions on the display 222 for an operator of the return computer system 120. For example, the display data may generate a display indicating that the item has been returned and checked in successfully after being placed on the pad 140

and is on hold for a patron. The item may be displayed in a particular colour for identification that it is to be placed in a shelf 106 of the shelf unit 101 for the patron to collect. The actual shelf 106 that is selected, and in which the item 116 is placed, is determined by the system 120 as the reader circuit 108 polls the unit 101, and the location, being the shelf ID, is stored in the data store 258 against the item data.

The display process 414 accesses and displays status data associated with the item 116 which represents various sort instructions or criteria, including:

(i) To be shelved in this library;

(ii) Return to another destination (with destination details);

(iii) On Hold for a patron in this library and to be placed in shelf ID of shelf unit 101;

(iv) Short term loan item returned and placed in shelf ID of shelf unit 101;

(v) Sort by Call Number;

(vi) Sort by collection code;

(vii) Sort by Dewey Classification;

(viii) Sort by location code;

(ix) Sort by media type;

(x) Sort by SIP2 screen message.

As part of the display process 414, the returns computer system 120 uses the data held in the data store 258 to determine (step 416) if an item 116, 610, that is expected to be located on the shelf unit 101, 600 has not yet been detected after a predetermined time from when the item was checked in. For example, if the item is in on hold or a short term loan item that should be placed in one of the shelves 106 and, after a predetermined period of time, say one hour, has not yet been placed in one of the shelves 106, the returns controller 254 generates an alert (418) that is provided on the display 222 for an operator.

The LMS controller 256 executes a process 500 as shown in Figure 5. This determines at step 502 whether reconfiguration or stop data has been set for the controller 256. If not, a determination is made at step 504 to determine whether asset tag data for items has been

stored in the read queue of the data store 258. If so, a check is made at step 506 to determine if the LMS 104 is online. If the determination at steps 504 and 506 is negative, then the stop data is set and reconfiguration data set, respectively. If the LMS is online, then the asset tag data in the queue is sent to the LMS for returns processing (step 508); i.e. to Check In the items and update the item data for the items in the LMS 104. Based on the asset number the LMS 104 returns to the LMS controller 256 updated item data for each item 116 represented in the queue. A check is made at step 510 to determine if the communication and item data returned is successful and if so then the item data is stored in the cache (step 512) of the data store 258. The operation then returns to step 502. If the data transfer is not successful, a determination is made at step 514 as to whether the operation should be returned to step 502 for a retry, otherwise the item data returned is recorded as a failure at step 516 and then the operation returns to step 502. If reconfiguration or stop data is set at step 502, then all connections are closed at step 518 and the controller 256 ends. When an item is checked in and the updated item data returned, the updated item data includes any relevant status data associated with the item. For example, if the item has been reserved by a patron that has just been checked in, then status data is returned indicating that it has been reserved, and providing identifying information for the patron, such as the patron's name, and an on hold expiry date. The expiry date is set, when the item is checked in, to be a predetermined period from the checked in date, e.g. two weeks for normal items or a few hours for short term items. This status data is returned and available for access by the returns controller 254. The LMS 104 will automatically notify the patron that an item that they have reserved has just been checked in. For short term restricted items, the LMS 104 or the returns controller 254 will ensure that the patron is automatically notified to confirm that they have successfully returned and checked in the restricted item. The LMS 104 or the returns controller 254 will notify the patron using stored contact data, such as by email, SMS or post. For restricted short term items, the LMS 104 can also receive and store the location data, i.e. the shelf ID. Other location data may also be received and stored, particularly if the shelf unit for the reserved restricted items is in an entirely different physical location from the normal library.

The items monitor 260 generates user interfaces for the reserve item management system 100 based on the item data held for the returned items in the data store 258. The items monitor 260 serves a user interface for the patron kiosk computer 130, and allows a patron to visit a library and use the kiosk 130 to check the availability of items the patron has reserved or wishes to loan short term. On submission of patron identification (ID) data using the user interface, the interface is able to display the items that the patron has reserved or desires, and in particular display the location data, i.e. shelf ID's, for items that have been placed in the shelf unit 101. The patron is then able to go to the identified physical location, being the particular shelf identified by the shelf ID and collect the item. The patron can then arrange for the item to be checked out using the normal Check Out process, which can be executed using the returns computer 120 or the kiosk computer 130. The items monitor 260 also generates a user interface for librarian display 222 that communicates information about the items placed in the shelf unit 101, such as:

(i) Expired reserved items that need to be removed from the shelf unit 101 and their location;

(ii) Items 116 that have been incorrectly placed in the shelves of the shelf unit 101;

(iii) Items 116 that should be relocated within the shelves of the shelf unit 101, such as items held with the same title that are in close proximity or in the same shelf 106 or which need to be placed in a short term loan shelf;

(iv) Items 116 that have been returned and are missing from the shelf unit 101.

The loan item management system 100 provides a far more efficient mechanism for handling reserved or on hold items 116 and short term loan items. The items 116 are automatically identified when they are checked in by the returns computer 120 as being reserved by a patron and can be moved quickly to any shelf 106. The item's position in the shelf is continually monitored and periodically reported to the data store 258 of the returns computer 120. The LMS 104 notifies patrons that a reserved item is available for collection, and patrons can visit the library and use a kiosk 130 to determine the location of the reserved item. Patrons are also notified of the successful return of short term loan items. The return and placement in a correct short term loan shelf, and the subsequent collection can be handled efficiently without the involvement of any librarian. Once an on

hold or reserved item expiry date has expired, this is detected by the returns computer system 120 and a Check In process is automatically performed. If the item has been reserved by another patron, as indicated by the LMS 104, this status data is passed to the data store 258 and displayed. If, however, the item now needs to be returned to the general collection, the LMS 104 returns this status which is recorded in the data store and reported on the display 222. A librarian can then remove the item from the identified shelf 106 in which it has been placed and return it to the general collection. Items that have not yet been placed on a shelf 106 are identified, and a shelf unit 600 is also provided for handling exception items.

Many modifications will be apparent to those skilled in the art without parting from the scope of the present invention.

Claims:

1. A loan item management system, including:

a shelf unit having shelves for loan items, at least one shelf including a respective antenna for communicating with RFID tags of items placed on the shelf; and

a returns computer system including:

(i) a read controller for controlling reading of the tag data of the tags of items in said at least one shelf and associating location data representing the location of the items with the tag data;

(ii) a returns controller for invoking a check in process for an item in said shelf unit; and

(iii) an item controller for accessing item data and location data to present for a patron which shelf holds an item reserved for a patron.

2. A loan item management system as claimed in claim 1, including a returns controller for invoking a check in process for a reserved item in said shelf unit when a reserved period expires for said reserved item.

3. A loan item management system as claimed in claim 2, wherein the item controller indentifies, following the check in process, the reserved item is to be retained in the shelf as it is reserved for another patron.

4. A loan item management system as claimed in claim 2, wherein the item controller indentifies, following the check in process, the reserved item is to be removed from the shelf as no longer reserved for any patron.

5. A loan item management system as claimed in claim 1, wherein said at least one shelf is for short term loan items, and said system notifies a patron of return of said item.

6. A loan item management system as claimed in any one of the preceding claims, including a item data management system maintaining a database of item data for each

item, including status data representing an expected location for the item, and wherein the returns computer system communicates with the item data management system to identify items on the shelf unit that should be removed from the shelf unit.

7. A loan item management system as claimed in claim 6, wherein the returns computer system identifies items of the same title in close proximity which need to relocated.

8. A loan item management system as claimed in any preceding claim, wherein the returns computer system identifies items expected to be on the shelf and are not detected on the shelf.

9. A loan item management system as claimed in any preceding claim, wherein the shelf unit includes an exception shelf for exception items and a RFID reader for said exception items.

10. A loan item management system as claimed in any preceding claim, wherein the returns computer system generates a display to advise a user to place items in a predetermined location.

11. A loan item management system as claimed in claim 1 or 10, wherein the item data includes a predetermined physical location for the item, and the location data associated with tag data is compared by the returns computer with the predetermined location.