

INVENTION DISCLOSURE DESCRIPTION

Title: SMART SECURE RFID ITEM RETURN COLLECTOR

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1. FIELD OF THE INVENTION

Radio Frequency Identification (RFID) is an advanced wireless technology that has been successful in many fields of application. However, the application of passive RF technology to library books, file documents, audio and video CDs remain relatively new and can be further exploited. This invention proposes an ergonomically effective, secure, user friendly, flexible and efficient RFID Item Return Collector to capture, identify, accept the return and cancel the loan of items such as books and/or files. It is intended to complement (but not limited to) the RFID library management systems and file management systems.

2. BACKGROUND TO INVENTION

2.1 RFID Components

A RFID system carries data in suitable transponders, generally known as tags, and retrieves data, by machine-readable means, at a suitable time and place to satisfy particular application needs.

Data within a tag may identify an item in manufacture, goods in transit, a location, a vehicle, an animal or individual. Additional data support applications through item specific information or instructions immediately available on reading the tag. For example, the branch and shelf location of library book, the maintenance record of an asset like car or computer or machinery, health record of the particular person, or the processes that the product has passed through the various stages of production line.

A system requires means of reading or interrogating the tags and communicating the data to a host computer or information management system. A system will also include a facility for entering or programming data into the tags, if this is not undertaken at source by the manufacturer. Antennae can be distinguished as separate parts of an RFID system. Present in both readers and tags, it is essential for wireless communication between the two. Figure 1 shows the RFID system components. In addition to non-contact data transfer, wireless communication also allows non-line-of-sight communication.

2.2 The Problem

Since early 1980s, barcode technology has been commonly used for identifying articles in supermarkets, retail stores and libraries etc. However, barcoding technology requires close line-of-sight and manual physical alignment when reading the barcode and is limited to

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reading one barcode at a time. This is very time consuming and tedious. If the articles such as library books or file documents are returned through book/file-return chute, the loan cannot be cancelled until the staff collects the loan item and scans the barcode on the loan item with a barcode scanner. Scanning has to be done item by item, and the staff has to physically handle the items from one trolley to another.

With the introduction of RFID technology, the RFID tags are placed in items that are to be traced-and-tracked, such as library books, file documents. Once tagged, data relating to their sales, loan and return or their maintenance or life cycle record can be captured automatically and wirelessly, without human intervention.

Loan items can now be returned through conventional book/file-return chute where the loan can be cancelled instantly and on-line. However, this is open to abuse and fraud. There is no confirmation that the loan item has indeed been returned eventually. A dishonest person could stretch his/her arm to reach the collection area of the book/file-return chute, or the loan item could be tied to a string for surreptitious retrieval after supposedly being returned.

Thus some secured, final, irreversible means of confirming the return is needed.

3. THE INVENTION

3.1 Current Configuration

One of the main tasks of library books or file documents management systems, other than loaning, is to capture, identify and accept the return of loan items on-line electronically so that the loan could be cancelled and the system's loan database updated instantaneously. The speed of capturing, identifying and cancellation of loaned items returned are critical to the operational efficiency. Over the last few years, RFID Library Management System and File Management System where loan articles are returned through conventional RFID book-return chute have been implemented. However for these configurations, it is quite impossible to confirm whether the loan article was actually and irreversibly returned. To minimise the problem of false returns and to improve efficiency, the Smart and Secure RFID Item Return Collector is developed to address this deficiency.

3.2 The Proposed Solution (Invention)

We propose a Smart and Secure RFID Item Return Collector which uses two (2) radio frequency antennae. The first antenna serves to acknowledge the presence of the loan item in the RFID Item Return Collector and the second antenna to confirm the return of the loaned item. The antennae are placed adjacent to one another but spaced adequately apart to avoid frequency detuning to each other. To avoid the loan item from being retracted with a string or long stick tied to the loan item, the second antenna is placed lower than the first antenna and "sawtooth" shapes are cut at the end edge of the first slide, designed to trap the loan item from retracting. (Figures 2 and 3).

3.3 How the Invention Works

This invention differs from the conventional RFID book-return system with the introduction of a second antenna and the mechanical design of the book/file's slide within the Return Collector. The loan items are dropped into the Book/File-return's slide tilted at 25 to 35 degree (as shown in Figure 2) from the horizontal to allow the loan item to move naturally down the slide using the earth's gravity.

When a loan article is detected near the entrance of the Smart Secure RFID Item Return Collector, the first radio frequency (RF) antenna, Antenna 1, hidden underneath Slide 1 will detect the data programmed onto a RFID tag in the loan article. The data read by the RFID reader will be transferred to a personal computer (PC) to identify whether the article belongs to the system and if it does, the PC will activate an indicator light ("Loan Article Detected").

When the loan article is released and is allowed to move down the slides, it will come to Slide 2 where a second RF antenna hidden beneath Slide 2 will detect the data stored in the RFID tag in the loan article. The data captured by the reader will be sent to the PC. The PC will in turn activate another indicator "Loan Article Returned", to show that the loan article has been returned. The PC shall in turn update the loan database and cancel the loan status of that article.

The RF antennae could be connected to two separate RFID readers and to two different communication ports of the PC as shown in Figure 5, or to a single RFID reader via a RF multiplexer/switch and to the PC as shown in Figure 6.

Figure 7 summarises the process flow of the invention, where the loan item is *detected*, *returned*, and the records database *updated*.

3.4 Variations to the Basic Invention

Alternatively, the second antenna and its slide can be placed opposite the first antenna, where floor space is a constraint (Figure 3). Moreover, a one-way hinged flap can be added to the upper slide (Figure 4). Items returned drop into the collection bin/trolley, and cannot be reversed (taken) out. As an additional deterrent, a surveillance camera can be added to the system (as shown in Figures 2, 3 and 4).

4. BRIEF DESCRIPTION OF THE DRAWINGS

[Refer to Patent Drawings Sheets]

Figure 1 shows the components of a RFID system. These are the Reader/Programmer with Antenna, communicating with the Transponder (or Tag) with Antenna via the air interface.

Figure 2 shows the RF Antenna 1 positioned near the entrance of the slide to identify the presence of the loan article. In the case of a loan book, an indicator "Loan Book Detected" shall lit. When the loan book is released down the slide, it will pass through Slide 2 and be detected by Antenna 2. This is where a second indicator shall lit to inform the borrower that the loan book has been returned, i.e. "Loan Book Returned".

Figure 3 shows an alternative arrangement to Figure 2, where floor space is a constraint.

Figure 4 shows a hinged flap added to the end of the first slide. Items can only pass one way through the flap into the collection bin / trolley.

Figure 5 shows how the radio frequency antennae can be connected directly to its own RFID reader which in turn is connected to a different communication port on the PC.

Figure 6 shows an alternative to Figure 5, where the RF antennae can be connected to a RF multiplexer/switch then to a single RFID reader, which in turn is connected to a PC.

Figure 7 shows the basic process flow of accepting and confirming the return of the loan item.

5. DESCRIPTION OF THE PREFERRED EMBODIMENT

When to Use

The invention can immediately replace the current conventional return collection modules of RFID Library and File Management Systems.

The invention can be incorporated as part of RFID Library and File Management Systems in libraries, filing registries, and document centres. It can also be placed as remote/unmanned acceptance and return stations in shopping malls, office buildings, traffic interchanges, etc.

The invention can also be used to capture the submission and confirm receipt of any RFID-tagged item, such as postal parcels, CD-ROMs or video tapes for storage/distribution/return, tender documents, etc.

Fabrication

The RFID Return Collector can be easily fabricated from commonly available metal-, wood-, or plastic-based sheet materials. The antenna can be procured commercially off-the-shelf and taped, nailed, screwed or glued to the underneath of the slides.

Industrial Applicability

This invention can be used in these RFID systems:

- RFID Library Management Systems, File Management Systems, EAS (Electronic Article Surveillance) systems

The return/acceptance modules of these systems sense, accept and update the database of RFID-tagged items being introduced (or returned) to the hold of such systems.

CLAIMS

Title: SMART SECURE RFID ITEM RETURN COLLECTOR

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- Independent claim that this invention accepts, captures, identifies and confirms that the loan item is indeed returned with greater reliability and effectiveness.
- Claim that this invention minimises pilferage of the book/file-return collection system, thereby improve security and reduces losses of loan items.

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