RFID technology – the way forward at Leeds University Library

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Background

Since September 2001 Leeds University Library has been extending the opening hours in its three Leeds Campus libraries, which are now all open until midnight during term-time. Self-service check-in and check-out was already available at two of the three campus libraries and was extended to the third so that customers could borrow books when only security staff worked in library buildings, between 21.00 hours and midnight. However during this period customers were unable to access the existing counter collection, a closed access area for high demand, short loan items. The introduction of an open access self-service area, with a rapid through put of materials was required.

In September 2003, Leeds University Library opened its new open access high demand collection (HDC). Throughout the preceding summer the collection, consisting of more than 7000 books, over 8000 articles and nearly 3000 videos, CDs and DVDs was tagged with 3M RFID tags and Tattle-Tape™ security strips. All the photocopied articles were rebound inside plastic covers with

a card backing, so that RFID tags could be placed inside them and tattle-tape security strips inserted. These had not been necessary when all items were issued from behind the counter.

The 3M™ Digital Identification system (DID) was installed. This is a digital workstation with multiple functionality. It loads data from the library circulation system onto the RFID tags for identification purposes. It also allows very rapid check-in and check-out of RFID tagged items. Several books can be checked in simultaneously, as unlike barcodes, the RFID tags can be read from any position on the workstation. 3M tattle-tape security strips are re-sensitised at the same time.

Two 3M self-check units (with video check-in capability) were also installed in the high demand area. These are used for check-out during staffed hours and for self-check-in and check-out when the library is staffed only by security staff. The purpose built area is protected by 3M exit gates and turnstile access.

The development of the new collection provided the library with the opportunity to reconsider loan periods for items in the collection. Hitherto all print items, whether books or photocopied articles, were issued for four hours or overnight. All audio-visual items were issued as one-day loans, without consideration of the demand for them. A new three-day loan period for many of the books and CDs was introduced. Less popular audio-visual material was moved to open access with standard loan items. For the first time multiple copies of books in high demand were made available in the collection. The provision of three-day and four hour loan copies of one title had not been possible when every item had to be found and issued by staff behind the library counter.

After one year of operation we can say that the new High Demand Collection has been a great success. Library customers can browse the shelves, check out items on the two self-service units or photocopy items within the HDC area. During staffed hours items are returned via a staffed counter where they are checked in on the DID workstation. This can check in three items simultaneously, by reading the tags and resensitising the tattle tape at the same time. During unstaffed hours, items are returned through a book return slot in the outer wall of the collection area and checked in rapidly the following morning.

Customers have found the system quick and easy to use, queues at self-check units are never long, and staff enjoy using the DID workstation, which uses simple touch screen technology.

Use of the collection has increased dramatically. Counter Collection issues in session 2002/3 were 105,500. In session 2003/4, 125,250 High Demand Collection items were issued. But many more were read or photocopied within the High Demand Collection and returned to the shelves without being checked out. The inclusion of multiple copies of core text books has increased the number of annual additions to the book stock from a pretty stable 1470 per annum in 2002/3, to 4262 in session 2003/4, while the number of additions of photocopied articles has remained constant.

Contrary to expectation, making the collection open access has not resulted in a high loss rate. Many customers photocopy the items they need inside the High Demand Collection. Staff also feared that the collection would become untidy, with many items misplaced by students. This has not occurred. A member of staff is present in the collection most of the day, returning items quickly to the shelves. To aid shelving the spine colour of the photocopied articles is changed every 100 items so an item's approximate location can be clearly identified.

Testing the 3M Digital Library Assistant

The main driver for the use of RFID technology was to provide a quick and efficient service to customers in the High Demand Collection. However Leeds University Library had always been aware of the potential for using this technology for collection management. RFID tags, as well as providing security and rapid check-in and check-out, can be used with 3M's Digital Library Assistant (DLA) for stock control purposes.

In spring 2004, 3M agreed to let Leeds University Library staff test the use of their latest prototype Digital Library Assistant in the High Demand Collection to assess its usefulness with books, photocopied articles and a range of audio-visual materials.

The Digital Library Assistant is a handheld device onto which files carrying a range of data identifiable through the RFID tags can be loaded from the library circulation system. e.g. the shelf order of any collection, missing items lists, items on hold. Staff scan the shelves with the DLA which should be able to identify any items which are not in sequence by an indication of an error on the

DLA screen. Staff then investigate the source of the error.

Methodology

Two types of test were carried out:

Book stock

Shelf order data was loaded into the DLA from the library circulation system. Staff were trained in pairs to use the DLA to scan the shelves. It took approximately thirty minutes to train each pair and observe them to check that they were using the DLA correctly. Each shelf had to be scanned at least twice in order to ensure all items were scanned by the DLA. The following errors could be identified: wrong spine labels, incorrect data on the RFID tags, wrong class mark in the library circulation system, items that were not in the file downloaded to the DLA (usually very recent accessions), as well as mis-shelved items.

Non-book items

The second was to test the ability of the DLA to scan a range of non-book items. The DLA was already well tried and tested on books where the tags are placed sufficiently far apart to ensure that signals from each can easily be detected by the DLA. 3M did not guarantee that the DLA would work accurately with very thin items, as the RFID tags inside them are so close together that the DLA cannot identify each individually. However, in anticipation of using a DLA for stock control purposes library staff had placed tags on thin items at different heights along the spines during the summer tagging project, in the hope that the DLA would be able to distinguish between them. The types of non-book items were:

- **Photocopied articles** are shelved as A4 pamphlets, bound with a plastic front cover and card backing. The RFID tag is placed close to the spine inside the back cover. The tags are placed at a range of heights in order to avoid tags being next to each other on adjacent items.
- **CDs** are shelved in thin cases on narrow shelves. The RFID tag is stuck to the outside back of the case.
- **DVDs and videos** are shelved in the boxes in which they are bought, so that they are comparable in size to books. The RFID tags on these items are usually placed inside the box behind the video or DVD. Some boxes contain two video cassettes, each with a tag. These are the only cases where the video rather than the box is tagged.

The shelves holding these items were scanned by the DLA in order to ascertain how accurately it could identify them. The intention was not to look for processing or shelving errors.

Time frame

The study was carried out between 24 March and 30 May 2004. This period covered busy pre-vacation times, quieter vacation period and exam times to provide a range of usage conditions. Staff scanned books in the HDC when they could be spared from other duties throughout this period.

Results - books

As staff became accustomed to using the equipment it took approximately five minutes to scan a shelf of books, i.e. 1 metre, or approx 30 volumes. During the test period 2557 books were scanned in the HDC. The DLA picked up 92 errors of different types identified in table 1.

Table 1: Shelving and processing errors in book stock

Type of error	No	% total errors detected
Wrongly labelled	10	10.8%
Wrong class mark on OPAC	3	3.3%
Tag data incorrect	15	16.3%
Not in DLA file	16	17.4%
Subtotal	**44**	**47.8%**
Books mis-shelved	48	52.2%
Total errors	**92**	**100%**

The DLA was very helpful in identifying errors that would not be spotted by shelving staff. i.e. the first three in the above table. It has provided useful data for processing staff, who now know that there were only 44 errors out of 2557 books scanned, i.e. an error rate of just 1.72%. However staff felt that they could have identified the mis-shelved items more quickly by eye than using the DLA.

Results - non book items

Each shelf was scanned twice, some three times. Table 2 shows the percentage success rate that the DLA attained when scanning shelves for various type of non-book item.

Table 2: Percentage success rate in identifying non-book items

Item type	No. of items on shelf	No. items DLA found on shelf	% found by DLA
Articles shelf 1 (1st run)	194	178	92%
Articles (2nd run same shelf)	194	183	94%
Videos & DVDs shelf 1 (1st run)	38	18	47%
Videos & DVDs (2nd run same shelf)	38	35	92%
Videos & DVDs shelf 2 (1st run)	30	26	87%
Videos & DVDs (2nd run same shelf)	30	30	100%
CDs shelf 1 (1st run)	38	30	79%
CDs (2nd run same shelf)	38	30	79%
CDs shelf 2 (1st run)	63	30	48%
CDs (2nd run same shelf)	63	53	84%
CDs (3rd run same shelf)	63	55	87%

Photocopied articles

Contrary to expectation the DLA picked up signals of over 90% of the bound photocopies correctly. A considerably higher level of accuracy than expected. However this level of accuracy is not sufficient for identifying mis-shelving or other errors. Evidently, although staggered, the tags were too close together for the DLA to distinguish all of them clearly.

CDs

The percentage accuracy for these items was lower than for the bound photocopies. The cases are very small, so the range of possible locations for RFID tags is reduced. As with the photocopied articles the tags were too close together to give clear signals. In addition the shelves on which the CDs are placed are very narrow, so the DLA received signals from CD RFID tags on shelves above and below the one being scanned.

DVDs and videos

The DLA was not 100% successful at identifying all items in the sequences. The DLA could identify each video if it was individually boxed, but could only distinguish between pairs of videos (each separately tagged) if the video cassettes were arranged in the box so that tags were as far apart as possible. It is unreasonable to expect staff intervention to rearrange video cassettes so that the DLA would detect them.

Design and ease of use of the DLA

Shelving staff feedback

Staff found the DLA quite light and easy to use. Once the appropriate file is loaded operation is not complicated. However it has to be carried slowly along the shelves to detect all items. Two staff members shared the scanning, taking it in turns to carry the DLA and check the errored items.

It took about five minutes to scan a one-metre shelf with only two or three errors. The greater the number of errors registered the longer scanning takes, as each errored item must be removed from the shelf.

Books have to be neatly arranged on the shelves, to ensure that the DLA will pick up signals from the RFID tags. Some of this tidying time could be used to detect mis-shelved items, but not the processing and cataloguing errors.

Some staff felt that they could shelf tidy more quickly by eye than by using the DLA.

Using the DLA is very staff intensive. However staff did enjoy using the DLA and appreciated its ability as a collection management tool.

It certainly raised the profile of shelf tidying and checking with customers.

Technical issues

The DLA is compatible with a range of library circulation systems. However transferring data from the library's III circulation system to the flashcard in the DLA was complex and required library systems team assistance at the outset. Once it is programmed staff find it easy to operate.

Conclusions

The use of RFID technology in the new High Demand Collection has been a great success. The system is quick and easy to use. Issue and return turn round times have increased, reducing queues at the check out units and allowing staff to replace returned items onto the shelves very rapidly. Allowing students to access the High Demand Collection has certainly increased usage and not compromised security or tidiness.

The use of RFID tags has provided the potential for using the Digital Library Assistant for collection management, but unfortunately this has limited potential at present owing to the small proportion of books in the collection. Our tests show that the great benefit of the DLA is in detecting errors in processing and cataloguing that cannot be detected by shelving staff. It would certainly be very helpful in locating missing books if the appropriate data is loaded on to it.

Although not intended for use with small non-book items, we found that the DLA was much more successful at distinguishing between A4 size pamphlets than originally expected and, with careful placing of tags, could be used for stock control of these items. Multimedia stock is clearly more difficult to manage using the DLA. CD jewel cases are just too thin and narrow for the DLA to distinguish between them. The only suitable alternative at present would be to place these items in book size boxes.

The future

In an ideal world the library would like to extend RFID technology to all one week loan books which represent 35% of the Library's circulation, if funds allowed. The DLA would be an invaluable tool for collection management

Libraries would welcome technological developments that would lead to the DLA identifying RFID tag data on slim and small items, many of which are high circulation and high loss items. There is undoubtedly a demand for a tagging and security system which would enable efficient collection management of multi-media items. The development of the Digital Library Assistant could provide this technology.