RFID Implementation in Libraries

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Outline of Presentation

• Background of Radio Frequency Identification (RFID)
• Need of RFID
• Feasibility and Planning
• Check list & Best practices in Deployment
• Tendering
• Components
• How does Library RFID System Work
• Major Advantages
• Limitations
• Barcode vs. RFID; EM vs. RFID; Hybrid Technology
• Book ATMs
• Impact Study of RFID Implementation @IIT Delhi
• RFID Vendors with presence in India and sub-continent
• RFID in Indian Libraries
• Global Scenario
• Conclusion
Background

- Britishers first pioneered the RFID technology during the World War II for their Aircraft identification.
- In the late 1960s, US Government began using RFID to tag and monitor nuclear and other hazardous materials.
- The first US patent for an active RFID tag with re-writable memory was obtained by Mario E. Cardullo on January 23, 1973.
- RFID in India saw its beginning in the 1940s for Defence applications. First time, it was used for commercial purpose in 1980 for cattle tracking applications.
- The first library RFID suppliers started to market their systems in mid 1990s.
- Today, RFID is used for automatic toll collections, access control, security, tracking objects and humans in shops, libraries, hospitals, etc.
Need of RFID

• Branding
• Faster Check-out
• Faster Check-in
• Faster Renewal
• Library Security
• Faster Inventorying
• Tracking the misplaced documents
• Limitations of Barcode Technology and EM
• Saving in Time & Staff
• Streamlined transactions - can be used to identify, track, sort or detect library holdings

Refer to the Advantages and Comparison part for more details...
Implementation

Start

Begin with your goals

Why you want RFID?

Identify

Where RFID will deliver value to your Library and its Customers

Plan

Implementation

Ready your organization for change
Feasibility and Planning

• Smooth implementation requires thorough planning
• Before implementation, feasibility of the system is necessary
• Committee may be constituted with experts and administrators
• Committee may assess the requirements for the institution, budget availability, required hardware and software, cost effectiveness, availability of manpower, timeline, etc.
• Gaining management approval may be a big challenge as it may look into the Return on Investment (RoI)
• The committee should see some demos and visit the libraries where the system is successfully running
• Methodology for implementation can be divided into many phases
• Data validation is most important before actually starting the tagging work
Check List & Best Practices in Deployment

- Budget availability and flexibility
- Privacy policy, standards of RFID Tags & Equipments.
- Purpose specification: Library users must be given information of the purposes for which tags and readers are used
- Robustness (scalability, accuracy, etc.)
- Time bound to implement the new technology, maintenance and service from the vendor for the RFID components
- Training and experience, end-user confusion
- Accountability: The library must inform its users as to whom they can contact for questions and complaints
Balanced RFID Committee

• Domain Expert
• Administration
• Audit
• Account
• Library Team, etc.
Tendering …

- Tendering is the most important and difficult process for the implementation of the system especially in case of govt. institutions
- A good tender document should look into all the minute details of the technical, administrative and functional aspects
- If the tender document is fool proof then there may not be any problem in its implementation
- The feasibility report prepared by the committee may help in this regard
- The tender may have two parts; Technical Bid and Financial Bid (generally e-procurement for govt. tenders)
- Ask for customer references & arrange site visits and discuss your concerns with them
- Judge vendors’ technology know-how for products to be supplied
- Incomplete, vague and conditionally submitted bids should not be considered
- The bidder should have sufficient successful practical experience of supply, installation, testing, commissioning and post commissioning
Tendering

- The items to be supplied should be of proven good quality with makes having globally accepted presence and compatible with global standards.
- Supplied Equipments should allow forward compatibility with anticipated new standards.
- Proven capability of vendor to integrate the proposed solution with multiple LMS for future safety (with built-in SIP2/NCIP/NISO recommended).
- Issues related to onsite training, warranty, service and AMC should have been clearly mentioned.
- The validity of the successful bid should clearly be desired by the institute with a clear delivery schedule.
- Payment should be made after satisfactory installation and commissioning.
- The institute may also think to retain some security money for the post commissioning period for a couple of years.
Technical Bid Details

• Migration part if any
• Middleware
• Multi purpose RFID Staff Station
• Tag Details
• Smart Card Details
• Integrated Self Check-In/Out Station
• Book Drop Box
• EAS Pedestal RFID Gates
• People Counter
• Shelf Management System/Portable Hand Held Readers
• Reader Specifications
• Antenna Specifications
• Job Work
• Training
• Post Installation Services, etc.
Financial Bid

- Prices should be Turn-key basis with all the details, like:
- RIFD Tags – Total Unit, Unit Per Tag, Total Tags
- RFID Smart Card System
- Multi-purpose RFID Staff Station
- Integrated Self Check-In/Out Station
- Library Security Gate/EAS Pedestal
- Book Drop Box
- Shelf Management System
- RFID Server Layer for Integration or RFID Software
- Job Work
- Post Warranty AMC Charges
RFID@IITD-Kiosk Interface

Place your smart card on RFID Sensor

Smart Card Sensor

Courtesy - LibSys/IIT Delhi
RFID–How it Works-Login Screen–Staff Station
RFID Default Main Menu, tailored for IITD-LSmart based
RFID – User Account

Patron’s Account

Nabi Hasan
Id:
Category:
Fine Due:
Valid Upto:

Faculty, Scientific & Academic
0.00

Item Id | Title                     | Author   | Due Date   | Item Type  | Reserve | Ticket No | Over Due
--------|---------------------------|----------|------------|------------|---------|-----------|----------
17604   | Theory of elastic stability | Timoshenko | 01/07/2019 | Books(Unlim)| N       |           | 69.0(100 days) |
8163    | Theory of plates and shells | Timoshenko | 01/07/2019 | Books(Unlim)| N       |           | 828.0(100 days) |
RFID – Check Out Books

Check-Out Books

Patron Id: 16789

Submit  Cancel

Enter via Barcode
Just read the barcode of Patron card via Barcode Reader or Enter manually

Switch Identification mode

Bar-code Entry

Smart Card
<table>
<thead>
<tr>
<th>Item Id</th>
<th>Title</th>
<th>Type</th>
<th>Status</th>
<th>Due Date</th>
<th>Patron</th>
</tr>
</thead>
<tbody>
<tr>
<td>162116</td>
<td>Elementary analysis: the theory of calculus/ Kenneth A. Ross</td>
<td>Book</td>
<td>Check-Out Processed</td>
<td>30/06/2020</td>
<td>16789</td>
</tr>
</tbody>
</table>
RFID – Check Out Processed Mail

Central Library Book(s) Issue Slip

library@iiitd.ac.in

Check-out Slip
Date: 09/10/2019
Time: 10:34:56

Nabi Hasan,
Central Library
Faculty, Scientific & Academic

Following books have been issued on your account:

<table>
<thead>
<tr>
<th>S NO.</th>
<th>ACCN NO.</th>
<th>TITLE DETAILS</th>
<th>DUE DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>162116</td>
<td>Elementary analysis: the theory of calculus/</td>
<td>30/06/2020</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kenneth A. Ross/Ross</td>
<td></td>
</tr>
</tbody>
</table>

Checked-out By: MANSI

From,
Reader Service Division,
Central Library,
Indian Institute of Technology Delhi,
Hauz Khas, New Delhi-110016
Phone: 7017
RFID – Check In Processed

Check In - Books
Place the book on sensor/reader

<table>
<thead>
<tr>
<th>Item Id</th>
<th>Title</th>
<th>Type</th>
<th>Status</th>
<th>Fine accumulated</th>
<th>Due Date</th>
<th>Patron Id</th>
</tr>
</thead>
<tbody>
<tr>
<td>162116</td>
<td>Elementary analysis: the theory of calculus/Kenneth A. Ross</td>
<td>Book</td>
<td>Check-In Processed</td>
<td>0.00(0)</td>
<td>30/06/2020</td>
<td>16789</td>
</tr>
</tbody>
</table>
Central Library Book(s) Return Slip

library@iitd.ac.in

Check-In Slip
Date: 08/10/2019
Time: 10:35:20

Nabi Hasan
Central Library
Faculty: Scientific & Academic

Following book(s) have been returned:

<table>
<thead>
<tr>
<th>S.No</th>
<th>ACCN NO</th>
<th>TITLE DETAILS</th>
<th>DUE DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>162116</td>
<td>Elementary analysis: the theory of calculus/ Kenneth A. Ross/Ross</td>
<td>30/06/2020</td>
</tr>
</tbody>
</table>

Checked-In By: MANSI

**** Outstanding Items: Books 2

From,
Reader Service Division,
Central Library,
Indian Institute of Technology Delhi,
Hauz Khas, New Delhi-110016
Phone: 7017
RFID – Tagging a Book...

Tagging - Item
Place your book on reader

Fresh Tag Found !!!
RFID – Tagging a Book

Item Details - Tagging

Accession no: 162116
Status: Reference copy
Title: Elementary analysis: the theory of calculus/ Kenneth A. Ross
Author: Ross
Item Type: Book
Patron Id: null
Call Number: 517 ROS-E

Tag
Cancel

Tagging Successful
RFID – Patron Tagging
Staff Workstation

Used for the issue, return, renewal by the staff in the Library and also for label personalization/tagging, etc.
Exit Sensors /EAS Pedestal

- Gate Antennas issue a warning signal and activate the alarm system if a document pasted with a label is leaving the premises without an authorized issue/outward entry into software
- It may also be used to count the incoming/outgoing people with a facility to record their movement
- The system may be integrated with electronic counter, webcam trigger, CCTV recordings, etc.
Integrated Self-Issue/Return & Book Drop

Self Check-out/In

Drop Box

Drop Box facility
Different Drop partitions for different collections

Courtesy - Ithaca Public Library, New York
Patron/Smart cards

These cards can also be used as an institute ID card, for paying fees, fines, printing or other fee-based services; for gaining Internet access; for photocopying and more.
Shelf/Inventory Management System

Portable Shelf scanner allows library staff to take inventory and find wrongly shelved books without having to pull the books off the stacks. It is very useful for stock verification purpose.
Security and Surveillance

Security System Gates

CCTV Surveillance

Thermal Imaging People Counter

Security and Surveillance at IITD Central Library
Stock Verification using RFID (LSmart/Main Menu)
RFID Parameters
Components

RFID tag (or transponder): These are paper-thin smart labels which are electronically programmed, consisting of an integrated circuit and antenna coil that communicates with a reader by means of a radio frequency signal. Many types of RFID tags are available, viz. Active, Passive, HF/UHF/Hybrid… etc.
Inside the Tag
Tags are Made of these parts ->

1. Chips: Hold information about the physical object.
2. Antenna: Transmit radio signal
3. Package: Encases the Chips and Antenna, so that tag can be attached to the physical object.

Tags come in many flavors: passive, battery assisted, active, different frequencies, various anti-collision technologies, printed/wire wounded antenna, etc.

Storage capacity varies

Read-only or Read/writable

ISO 15693/18000-3 compliant

Paper thin 50x50mm with at least 1024 bits
## Tag Details

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Active RFID tags</th>
<th>Passive RFID tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power source</td>
<td>Internal</td>
<td>Energy transferred from the reader</td>
</tr>
<tr>
<td>Power availability</td>
<td>Continuous</td>
<td>When it is in the field of the reader</td>
</tr>
<tr>
<td>Communication range</td>
<td>Long range</td>
<td>Short range</td>
</tr>
<tr>
<td>Data storage</td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>Signal strength from tag to reader</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Signal strength from reader to tag</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Weight</td>
<td>120-130 grams</td>
<td>6-54 grams</td>
</tr>
<tr>
<td>Capabilities</td>
<td>Read/write</td>
<td>Read only</td>
</tr>
<tr>
<td>Operational life</td>
<td>Five to ten years</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Memory</td>
<td>2 MB</td>
<td>Up to 16 KB</td>
</tr>
<tr>
<td>Approx. Cost</td>
<td>Rs. 25</td>
<td>Rs. 15</td>
</tr>
</tbody>
</table>
# Operating Frequencies

<table>
<thead>
<tr>
<th>Band</th>
<th>LF  Low frequency</th>
<th>HF  High frequency</th>
<th>UHF Ultra high frequency</th>
<th>Microwave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>30–300kHz</td>
<td>3–30MHz</td>
<td>300 MHz–3GHz</td>
<td>2–30 GHz</td>
</tr>
<tr>
<td>Typical RFID Frequencies</td>
<td>125–134 kHz</td>
<td>13.56 MHz 433</td>
<td>433MHz or 865 – 956MHz</td>
<td>2.45 GHz</td>
</tr>
<tr>
<td>Approximate read range</td>
<td>less than 0.5 metre</td>
<td>Up to 1.5 metres</td>
<td>433 MHz = up to 100 metres</td>
<td>Up to 10m</td>
</tr>
<tr>
<td>Typical data transfer rate</td>
<td>less than 1 kilobit per second (kbit/s)</td>
<td>Approximately 25 kbit/s</td>
<td>433–956 = 30 kbit/s 2.45 =100 kbit/s</td>
<td>Up to 100 kbit/s</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Short-range, low data transfer rate, penetrates water but not metal</td>
<td>Higher ranges, reasonable data rate (similar to GSM phone), penetrates water but not metal</td>
<td>Long ranges, high data transfer rate, concurrent read of &lt;100 items, cannot penetrate water or metals</td>
<td>Long range, high data transfer rate, cannot penetrate water or metal</td>
</tr>
<tr>
<td>Typical use</td>
<td>Animal ID Car immobiliser</td>
<td>Smart Labels Contact-less travel cards Access &amp; Security</td>
<td>Specialist animal tracking Logistics</td>
<td>Moving vehicle toll</td>
</tr>
</tbody>
</table>
RFID Reader (or Interrogator)

RFID reader consists of a transmitter, receiver, antenna and a decoder. It communicates with RFID tags, identify them and receive data stored in the tag.
Application Software/Middleware/RFID Server Layer

- Used for Integration with RFID devices and the LMS
- Provides reader connectivity to other systems on the network
- Translates data and transmits to its other applications
- It is used for the reader to transmit or receive data from a tag. Software integrates the reader hardware with the existing library automation software for seamless functioning of circulation section.
Server/Docking Station

- It is one on which the software that interfaces with the integrated library automation software is loaded.
- The server is the heart of comprehensive RFID system. It is the communication gateway amongst the various components.
- It receives the information from one or more of the readers and exchanges information with the circulation database.
- Its software includes the API (Applications Programming Interface), necessary to interface it with the automated library system. The server typically includes a transaction database so that reports can be produced.
Patron/Smart Card Printer
People Counter

- RFID system may also have the facility to record the movement of incoming/outgoing members of the library with their details.
- If a library member is passing through the EAS pedestals with a Smart Card, its movement is recorded with details which helps in maintaining the statistics and other details for various uses.
Integrated Robotic Circulation System & Smart Library System

- Some of the libraries in developed countries like USA are also using the Robots for circulation, integrated with the RFID system
- Books/documents in this system are arranged in different enclosures and not as per the classified order to enable the robot to identify the required documents for the users for the issue and then to place it back after return at its original location
- Use of Smart shelves, Smart accessioning, Sorters, Dispensers, Conveyer belts

Examples: Mansueto Library, University of Chicago; Valparaiso University, Indiana; Colgate University, Hamilton, NY, USA, etc.

Book ATMs

The machine is a sort of "book dispenser" similar to an ATM in many aspects, which allows library card holders to borrow and return books without needing to visit a library. There are also the Book ATMs which are used for book selling.

http://www.newsgd.com/news/guangdong1/content/2009-09/15/content_5794176.htm

Book dispenser machine in Dongguan (www.lias.nccu.edu.tw)
RFID Standards for Libraries

- Important ISO standards pertinent to library RFID systems: ISO/IEC 15693, ISO/IEC 18000-3, ISO 28560, ISO 14443A
- These standards works on 13.56 MHz frequency
- The tags and the equipments used may carry the FCC & EN-ETSI Certifications
- They may follow the NCIP V2.0 or SIP2 protocol
- Voltage : 230 Volt
- Data Interface: RS-232

http://www.iso.org
http://www.iec.ch
Library RFID Diagram

How does Library RFID System work?

- The RFID reader sends out electromagnetic waves in the RF (Radio Frequency) spectrum.
- When the tag enters the RF field, the tag’s electronic circuits are powered by energy from the RF field.
- The tag then modulates the waves and sends them back to the reader.
- The reader converts the signals received from the tag into digital data and sends it to the host computer.
Major Advantages

- Hassle free issue/return/renewal
- Increases the security function in library
- Flexible library timings by use of Self Charging and Book Drop Kiosk
- Quick Inventorying, shelf reading, re-shelving, sorting, searching, weeding and exception finding
- Enhanced customer services and improved process efficiency
- Highly reliable, claims an almost 99.9 percent detection rate
- RFID tags last longer than barcodes
- EAS exit gates have an option to keep record of incoming and outgoing library users
- Fingerprint or Picture may also be integrated with the RFID
Limitations

- High cost
- Technology still developing, Interoperability and Standardization issues
- Integration problem of RFID solution with the software/hardware
- RFID system may be compromised with certain devices/conditions
- Moisture, metal, mist, distance and incorrect positioning of antennas may affect functioning
- Physical damage to the tags/removal by the library users
- Documents like magazines, pamphlets, CDs, DVDs may not have good location for bulky RFID tags and tag cost is also significant in their case
- Transition phase may lead to a chaos
- Privacy and Ethical issues
- Vendor support and technology compatibility issues
- Annual maintenance charges of post warranty period are very high
- Training/adoption by the staff and users
## BARCODE vs. RFID

<table>
<thead>
<tr>
<th>Barcode</th>
<th>RFID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barcode readers require a direct line of sight, using laser technology</td>
<td>Reading is done automatically using RF waves</td>
</tr>
<tr>
<td>Scan and read one barcode at a time</td>
<td>Scan and read multiple tags simultaneously</td>
</tr>
<tr>
<td>Reading by barcode takes much more time</td>
<td>Reader can interrogate or read tags much faster</td>
</tr>
<tr>
<td>Human intervention is required to scan a barcode</td>
<td>RFID tags can be detected hands-off</td>
</tr>
<tr>
<td>It should be visible on the product for scanning</td>
<td>Tags can be concealed in any non-metallic items</td>
</tr>
<tr>
<td>Readability of barcode can be impaired by dirt, moisture, abrasion or</td>
<td>RFID tags are not that much affected by those conditions</td>
</tr>
<tr>
<td>packaging, etc.</td>
<td></td>
</tr>
<tr>
<td>Barcode do not have read/write memory</td>
<td>RFID tags have read/write memory</td>
</tr>
<tr>
<td>Less read range compared to RFID</td>
<td>RFID tags have a longer read range</td>
</tr>
<tr>
<td>Technology is old, outdated and less expensive</td>
<td>Technology is advanced, but expensive</td>
</tr>
<tr>
<td>Ability to hold limited data</td>
<td>More data can be stored in a RFID tag and also facility for modifying it at a later stage</td>
</tr>
</tbody>
</table>
EM vs. RFID

• EM technology is the most used library security worldwide, protecting billions of books and other media. The electromagnetic strips are difficult to detect and remove, and can not easily be shielded by the human body or other materials.

• If compared with the RFID technology, the EM technology only offers the security and no other facility is available with it which is offered by the RFID technology.
Hybrid Technology (EM+RFID)

- There are also strip types with UHF tags which may serve both the purpose but have technical limitations.
- The Hybrid technology is the best solution for the libraries as it combines the Security feature of EM and all the features of RFID.
- However, the hybrid solution is a costly affair because every document has to be tagged with RFID label as well as with EM strip or Hybrid UHF Tag.
- Also the other equipments to be used for this technology are special like Exit Sensor Gates which may work with both type of systems and also required is the Magnetizing/Demagnetizing equipments.
- For Indian environment, where there could be lot of mishandling with the RFID tags; the hybrid technology may be the best option.
Impact of RFID System on IIT Delhi Library Users
Conducted a Study on IITD Users

- Student: 54%
- Library Staff: 18%
- Faculty: 6%
- Others: 22%
Ranking of users’ preference for RFID Use

No. of users (in %)

- Save time: Rank 1 (64), Rank 2 (20), Rank 3 (8), Rank 4 (4)
- Multiple book transaction: Rank 1 (36), Rank 2 (36), Rank 3 (10), Rank 4 (10)
- Self issue/return: Rank 1 (16), Rank 2 (42), Rank 3 (4), Rank 4 (4)
- Increased circulation timings: Rank 1 (76), Rank 2 (6), Rank 3 (6), Rank 4 (4)
Frequency of the use of RFID system

- Once in a Month: 16%
- More than once in a Month: 18%
- Once in a Semester: 8%
- Rarely: 54%
- No response: 4%
Rating of circulation system (using RFID)

- No response: 1 (2.00%)
- Do not know: 3 (6.00%)
- Good: 7 (14.00%)
- Very Good: 25 (50.00%)
- Excellent: 14 (28.00%)
Use of Drop Box for returning the Books

- Yes: 94%
- No: 2%
- No response: 4%
Effectiveness of RFID System for Security of Books

No. of users

- Yes: 90%
- No: 6%
- Do not know: 2%
- No response: 2%
Positive change in attitude of Users

- Yes: 78%
- No: 8%
- Do not know: 12%
- No response: 2%
Use of RFID in other areas

<table>
<thead>
<tr>
<th>Service</th>
<th>No. of users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payment of Fees/Fines, etc. through RFID Smart Card</td>
<td>29</td>
</tr>
<tr>
<td>Book ATMs</td>
<td>11</td>
</tr>
<tr>
<td>Drop box in Departments</td>
<td>16</td>
</tr>
<tr>
<td>Drop box in Hostels</td>
<td>20</td>
</tr>
<tr>
<td>No response</td>
<td>4</td>
</tr>
</tbody>
</table>
Future of RFID in Libraries

- 86% Good future
- 0% Short lived
- 8% Do not know
- 6% No response
RFID vendors with presence in India and Indian sub-continent

- 3M Library Systems, New Delhi
- Total IT Solutions, New Delhi
- Beegees, Mumbai
- Capgemini India, Chennai
- Ecole Solutions, Bangalore
- GreenFuturz Software Solutions, Chennai
- HCL Infosystems, Noida
- I-Tek, Pune
- Informatics, Bangalore
- Olex, Delhi
- LibSys Corporation, Gurgaon
- R.S. Barcodes, New Delhi
- RapidRadio Solutions, Ahmedabad
- VTLS Software, Noida, etc.
RFID in Indian Libraries

- IIT Delhi
- British Council Delhi
- American Center Library
- Jamia Hamdard
- NLU Delhi
- Sapru House, New Delhi
- NASSDOC, New Delhi
- IIM Indore
- IIM Lucknow
- IISc Bangalore
- IIT Madras
- IIT Kharagpur
- IIT Patna
- IIT Roorkee
- NCL Pune
- Nirma University, Ahmedabad
- NIT Rourkela
- NIT Surat
- University of Pune, etc.
Global Scenario

- Worldwide, RFID is used maximum in the United States, Singapore, United Kingdom, China, Japan, etc.
- Perhaps the largest RFID implementation in academic libraries is in the University of Hong Kong Libraries
- The largest implementation for public institutions is in Seattle Public Library in the United States
- RFID program of Netherlands Library Service, connecting all the libraries of the country with RFID based circulations is the most innovative
- Major jobbers are now including RFID tags in all library materials purchased from them like that of CIP data

Conclusion

• RFID technology is taking off in libraries at an increasingly rapid pace. It has the capability of making our lives in the library more convenient.

• The only barrier in the journey is the high cost. However, RFID applications lead to significant savings in staff costs, enhance services and provide efficient results.

• It is recommended that smaller and new libraries should adopt RFID at an early stage.

• Currently, not too many libraries world-wide are using RFID, but this figure is rapidly increasing as libraries understand the benefits and convenience of incorporating RFID into their system.

• Finally, we can say that despite all its limitations, the RFID technology is the future of libraries; but we should also remember that it is a supporting technology and not a competing one.
Disclaimer/Acknowledgements

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THANK YOU