

CASE STUDY

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Sultanate of Oman
Ministry of Manpower

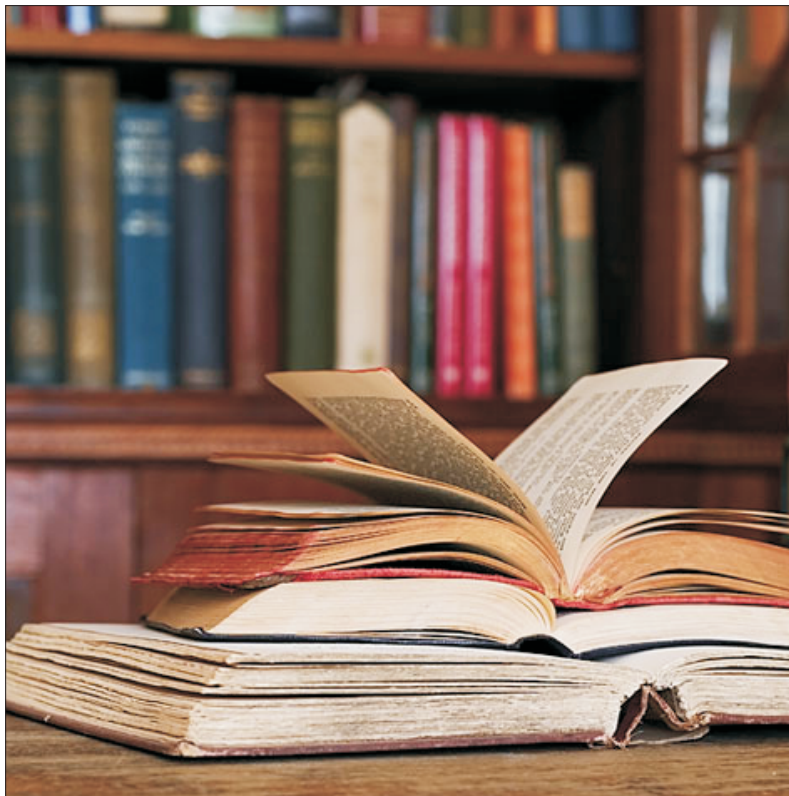
Government library in Oman opts for a RFID-enabled LIBRARY MANAGEMENT SYSTEM

Automated real-time maintenance of library inventory

Simultaneous check-in/check-out of stacked books

Minimum queuing with self check-in/check-out of books

Automatic confirmation messages, reminders and alerts
along with theft prevention and checking for defaulters



INSIDE:

Key Requirements
Solution
Implementation
Working
Benefits
Links



TECHNOLOGY

Solution:

EPC Gen2 compliant inventory
and personnel tracking solution

Tag Type:

Personna™ UHF Passive
Libra™ UHF Passive

Reader/Antenna:

Xtenna Proximity™
Porta™

Method:

Multiple Tracking via near-range
reader/antenna modules

Multiple Tracking via portal
reader/antenna modules

Integration Platform:

RFID Middleware:

Xtenna™ WebToolkit
Xtenna™ Studio

Application:

Essen RFID's
Library Management System

Database:

SQL Server 2005 Exp. ed.

Tag Manufacturer/Supplier:

Essen RFID, with US based chip inlay

Reader/Antenna Manufacturer:

Essen RFID, with US based module

Systems Integrator:

Essen RFID

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www.essenrfid.com





CASE STUDY

KEY REQUIREMENTS:

The government of the Sultanate of Oman has set up libraries across the country as part of its endeavor in human resource development. Its library in the Sur region is a pioneering project in this effort. The library incorporates modern facilities and provides educational and professional reading material for its visitors and members. As part of this process, it intended to include a high degree of automation in its operations while simultaneously tracking and preventing theft. The library therefore required an automated library management system for maintaining data of all its books, keeping track of all books issued and returned by its members, and sending reminders and alerts.

Main challenges:

- Ready data of all books available at the library.
- Easy search of any particular book within the library.
- Reduction in time for check-in and check-out of books.
- Preventing theft of books and preventing issue of non-lending reference books through alerts to security.
- Generating an alert to the library member on due date of book and to the library admin when the due date of a book has been exceeded.

SOLUTION:

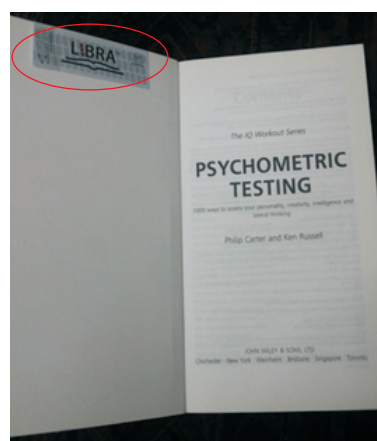
Essen RFID proposed a RFID-enabled Library Management System, that would meet all the above requirements and provide benefits at all levels for both members and library staff.

IMPLEMENTATION:

All books in the library are tagged with Essen RFID's LIBRA™ tags. New books are also similarly tagged when they arrive. Each library member is issued an ID card containing a PERSONNA™ RFID tag. All tags are registered into the database using a Xtenna Proximity™ reader.

A Porta™ RFID portal reader is installed at the entrance/exit doorway of the library. Two Xtenna Proximity™ readers are used for check-in and check-out of books.

The Library Management System is a .NET based application and uses SQL Server as the back-end database, with network connectivity to the central server.



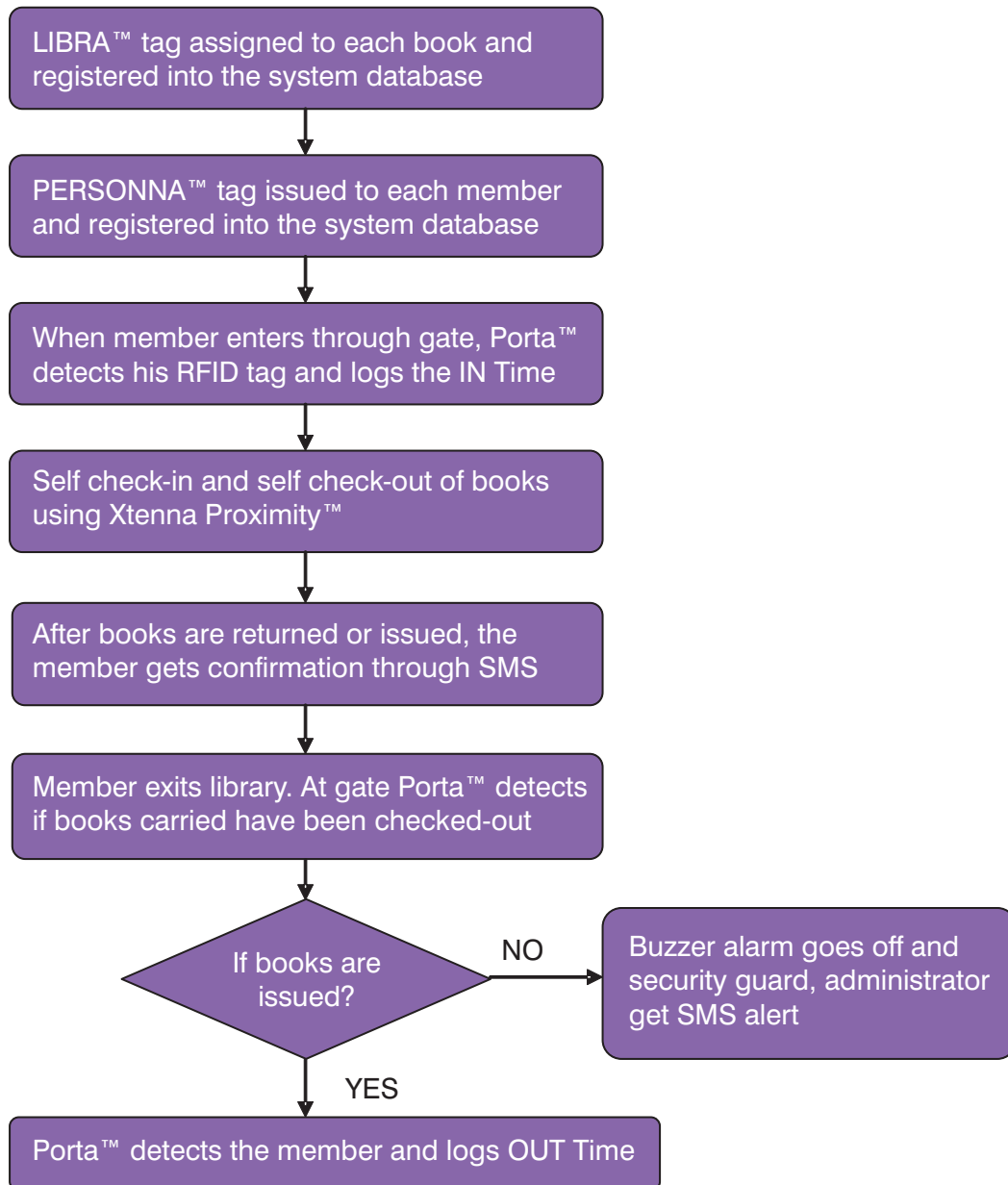
LIBRA™ RFID Tag



CASE STUDY

WORKING:

Flow Chart:



Process Flow:

1. The Library Management System contains a record of every book in the library. Each book is affixed with a LIBRA™ tag and registered into the database using the Xtenna Proximity™ reader. New book arrivals are also similarly tagged and registered.
2. Each library member is issued a membership ID card containing a PERSONNA™ tag. The tag is registered and assigned to that particular member in the database along with the required details.



CASE STUDY

3. Porta™ portal readers are installed at the IN and OUT gates of the library. When a member enters the library, his PERSONNA™ tag ID is read by the Porta™ reader and entered into the database.



4. If he is returning books back to the library, the library member goes to the check-in counter. He places the books in front of the Xtenna Proximity™ reader along with his PERSONNA™ ID tag. The reader identifies the tagged books and the library member. The system application updates the records in the database and the member receives a confirmation SMS that the books have been returned.
5. To borrow and take away books for reading, the library member picks up the required books and goes to the self-issuing check-out counter. He places these books in front of the Xtenna Proximity™ reader along with his PERSONNA™ ID tag. Xtenna Proximity™ reads the book tags and the membership ID tag, and automatically identifies the books and the library member.
6. The Library system application confirms the books in the database and makes an entry issuing these books to the particular library member, who then gets an SMS confirming the issue of these books to him along with the due date for returning them.
7. When the member exits the library, the tag on his ID card is read by the Porta™ RFID portal reader and this information is sent to the database that he is leaving the premises. The tag IDs of books he is carrying with him are also read and confirmed that they have all been through check-out and have been issued to him.
8. If the member takes a book out of the library without getting it issued at the check-out counter, then the Porta™ reader at the gate detects the non-issued book and immediately triggers a buzzer alert. The security guard as well as the administrator get a SMS with the book details. This enables the security guard to immediately intercept the offender. The administrator is also sent an email putting this on record for further punitive action.
9. On due-date, the system sends a reminder SMS as well as email to the library member that the books he has borrowed are now due for return.



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Application:

The main modules of the Library Management System are as follows:

Library Master: The main details of the library, such as library name and location are entered in this module.



RFID Enabled Sur Library Management System 2.1

Version:2.1
User:admin

RFID Enabled Sur Library Management System

Actions

- Masters
 - Location Master
 - Library Master
 - Book Master
 - Book Group Master
 - Book Sub Group Master
 - Member Master
 - Member Group Master
 - Book Transaction
 - Issue Book
 - Return Book
 - Shift Master
 - Manually Assign Shift

Library Master

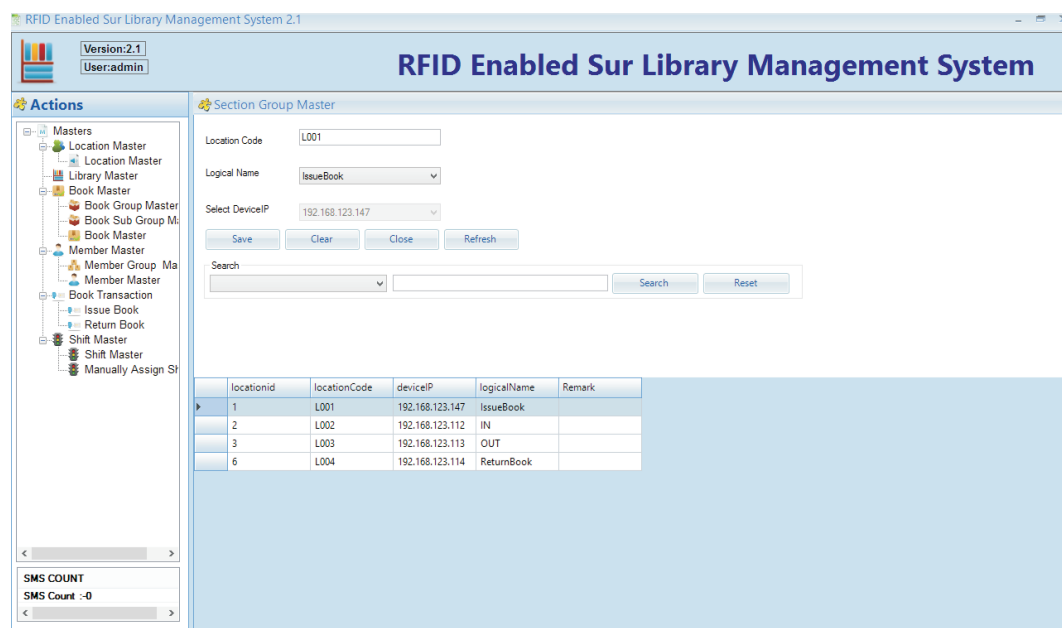
Library Code: L001
Library Name: Sur Library
Library Location: Sur Library

Save Clear Close Refresh

Id	Code	Name	Location
1	L001	Sur Library	Sur Library

SMS COUNT
SMS Count: -0

Location Master: In this module, the administrator assigns a specific task to each RFID hardware device that has been deployed and enters its IP address in the database, e.g. Porta™ portal reader devices are assigned to the IN and OUT gates, while the Xtenna Proximity™ reader devices are assigned to the Book Issue (check-out) and Book Returns (check-in) counters.



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 - Member Master
 - Member Group Master
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 - Return Book
 - Shift Master
 - Manually Assign Shift

Section Group Master

Location Code: L001
Logical Name: IssueBook
Select DeviceIP: 192.168.123.147

Save Clear Close Refresh

Search: [Search] [Reset]

locationid	locationCode	deviceIP	logicalName	Remark
1	L001	192.168.123.147	IssueBook	
2	L002	192.168.123.112	IN	
3	L003	192.168.123.113	OUT	
6	L004	192.168.123.114	ReturnBook	

SMS COUNT
SMS Count: -0



CASE STUDY

Book Group Master: Books available in the library are divided into groups based on subject category. The administrator creates these groups in the system, such as Literature, Science, History, etc., in this module.

RFID Enabled Sur Library Management System 2.1

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RFID Enabled Sur Library Management System

Actions

- Masters
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 - Member Master
 - Member Group Master
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 - Return Book
 - Shift Master
 - Manually Assign Shift

Book Group Master

Group Code: BG09
Group Name: LITERATURE - STORIES
Group Description: LITERATURE - STORIES

Save Clear Close Refresh

bGid	bGCode	bGParentName	bGParentDiscri...	Remark
1	BG01	LITERATURE - ...	LITERATURE - ...	
2	BG02	PSYCHOLOGY...	PSYCHOLOGY...	
3	BG03	ENGLISH LAN...	ENGLISH LAN...	
4	BG04	ENGLISH LAN...	ENGLISH LAN...	
5	BG05	ENGLISH LAN...	ENGLISH LAN...	
6	BG06	ENGLISH LAN...	ENGLISH LAN...	
7	BG07	APPLID SCIEN...	APPLID SCIEN...	
8	BG08	PURE SCIENCE...	PURE SCIENCE...	
9	BG09	LITERATURE - ...	LITERATURE - ...	
10	BG10	CONSTRUCTI...	CONSTRUCTI...	

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Book Group Master

Log

SMS COUNT
SMS Count :-0

Security Person List

Xtenna™

Book Sub-Group Master: Sub-categories are created within the Book Groups, for further classifications within each book category.

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RFID Enabled Sur Library Management System

Actions

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 - Member Master
 - Member Group Master
 - Book Transaction
 - Issue Book
 - Return Book
 - Shift Master
 - Manually Assign Shift

Book Sub Group Master

Group Name: LITERATURE - STORIES
Sub Group Code: SB00009
Sub Group Name: LITERATURE - STORIES
Sub Group Description: LITERATURE - STORIES

Save Clear Close Refresh

bSGid	bGid	bSGCode	bSubGName	bSubGDiscripti...	Remark
1	1	SB00001	LITERATURE - ...	LITERATURE - ...	
2	2	SB00002	PSYCHOLOGY...	PSYCHOLOGY...	
3	3	SB00003	ENGLISH LAN...	ENGLISH LAN...	
4	4	SB00004	ENGLISH LAN...	ENGLISH LAN...	
5	5	SB00005	ENGLISH LAN...	ENGLISH LAN...	
6	6	SB00006	ENGLISH LAN...	ENGLISH LAN...	
7	7	SB00007	APPLID SCIEN...	APPLID SCIEN...	
8	8	SB00008	PURE SCIENCE...	PURE SCIENCE...	
9	9	SB00009	LITERATURE - ...	LITERATURE - ...	
27	10	SB00010	CONSTRUCTI...	CONSTRUCTI...	

SMS COUNT
SMS Count :-0



CASE STUDY

Book Master: Details of each book such as book code, book title, author name, book group and sub-group are entered in this module, after which the tag ID is also fetched and assigned to the book.

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RFID Enabled Sur Library Management System

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- Masters
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 - Member Group Master
 - Member Master
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 - Issue Book
 - Return Book
 - Shift Master
 - Shift Master
 - Manually Assign Shift

Book Master

Book Code: B008 Book Copy No: 1
Book ISBN: 9781613190401 Book Copy Id: 1
Book Title: A TALE OF BOOKS Sub Group: LITERATURE - STORIES
Book Author Name: JARIR DIST BOOKSHOP Select DeviceID: 192.168.123.111-IssueBook Get Tag
Book Barcode: 8 Tag Id: 01124E323046703231323700
Library Name: Sur Library
Book Type: LITERATURE - STORIES Save Clear Close Refresh

Search: [] Search Reset

Id	Code	ISBN	Title	Author NAME	Barcode	CopyNo	Copy Id	TagId	Library Name
1	B001	9780335244287	HOW TO WRIT...	McGraw-Hill	1	1	1	01124E3130445...	Sur Library
2	B002	9780230224803	HOW TO WRIT...	Palgrave Mac...	2	1	1	01124E3130445...	Sur Library
3	B003	9781439181782	THE SECRET T...	Atria Books	3	1	1	01124E3130445...	Sur Library
4	B004	9780273761976	BRILLIANT ST...	Pearson Educa...	4	1	1	0108413030340...	Sur Library
5	B005	9780753720905	TELL ME WHY?	CHANCELLOR ...	5	1	1	0108413030340...	Sur Library
6	B006	9780141324692	FOOTBALL AC...	Penguin books	6	1	1	016db2000043...	Sur Library
7	B007	9780330510172	ANTHONY HO...	MACMILLAN ...	7	1	1	016db2000043...	Sur Library
8	B008	9781613190401	A TALE OF ...	JARIR DIST BO...	8	1	1	01124E3230467...	Sur Library
9	B009	9781613190319	OLIVER TWIST...	MACMILLAN ...	9	1	1	01124E3236655...	Sur Library
10	B010	9685626542	DRAUGHTSM...	Edward Arnold	10	1	1	01124E3230456...	Sur Library

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Book Master x Library Master x

Log

Xtenna™

Member Group Master: In this module, library users are divided into group categories such as Members, Administrative personnel, Staff, Security, etc.

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- Masters
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 - Member Group Master
 - Member Master
 - Book Transaction
 - Issue Book
 - Return Book
 - Shift Master
 - Shift Master
 - Manually Assign Shift

Member Group Master

Member Group Code: MG004
Member Group Name: Member
No of Book Allow: 4
No of Days: 4
Save Clear Close Refresh

Search: [] Search Reset

gId	pGCode	PatronType	no_of_book_all...	no_of_days
1	MG001	Library Admin	7	7
2	MG002	Library Staff	5	5
3	MG003	Security	1	1
4	MG004	Member	4	4



CASE STUDY

Member Master: This module contains details of each individual within the group category. The details of all library members as well as employees (admin, staff and security) are entered in this module. These include full address, contact telephone number and email ID. This is important since confirmation SMS and reminder emails to a library member are sent to the telephone number and email address provided here. Also, email and SMS alerts are sent to admin and security personnel based on the contact details provided here. The individual's photograph is also uploaded into the database. Membership registration and validity dates are entered. When a library member is to be registered, 'Member' is selected in the type field.

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 - Member Group Master
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 - Shift Master
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SMS COUNT
SMS Count: 0

Security Person List

Member Master

Member Code: M003 Registration Date: 03-12-2013
First Name: Emran Last Name: Ghaffari
Contact No.: Address: Qurm, Muscat
Email Id: emrang@gmail.com
Library Card: M00003
Library Name: Sur Library
Member Type: Member

No Photo Available

Upload

Save Clear Close Refresh

Id	Code	First Name	Last Name	Address	Contact No	Email Id	Library Name	Library Card Id	Tag Id
1	M001	Aadil	Allee	Al Ghubrah, M...		aadil.allee@g...	Sur Library	M00001	010e383532383...
2	S0001	Basir	Emami	Madinat, Musc...		emami.m@g...	Sur Library	S000001	010e383532383...
3	M002	Dabir	Dallal	Al Khuwayr, M...		dabir_d@gmai...	Sur Library	M00002	010e383532383...
4	M003	Emran	Ghaffari	Qurm, Muscat		emrang@gmai...	Sur Library	M00003	01124e3130445...
5	M004	Fardeen	Hakim	Qurm, Muscat		fardeen@gmai...	Sur Library	M00004	01124e3130445...
6	M005	Faraz	Razak	Al Khuwayr, M...		faraz_razak@g...	Sur Library	M00004	01124e3130445...
7	M006	Ghasan	Hassan	Al Ghubrah, M...		ghasaan@gma...	Sur Library	M00005	01124e3130445...
8	M007	Imtiaz	Jabbar	Madinat, Musc...		imtiaz_jabbar...	Sur Library	M00006	01124e3130445...
9	M008	Hashid	Jalali	Ruwi, Muscat		Jalali_Hasid@g...	Sur Library	M00007	e200915050160...
10	M009	Iqbal	Karim	Qurm, Muscat		iqbal@gmail.c...	Sur Library	M00008	0b0600114a313...

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Member Master

Log

Issue Book: This module allows the user to self-issue and check-out the books that he requires. The library member places his PERSONNA™ ID tag along with his selected books next to the Xtenna Proximity™ at the counter. The device reads the membership ID tag and the book tags, and the member's name and book details are displayed on the screen. He then confirms these books and clicks the 'Issue Book' button to complete the check-out. After a book has been issued its status automatically changes to 'not available' in the database, for the purpose of lending to other library members.



CASE STUDY

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RFID Enabled Sur Library Management System

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 - Book Group Master
 - Book Sub Group Master
 - Book Master
 - Member Master
 - Member Group Master
 - Member Master
 - Book Transaction
 - Issue Book
 - Return Book
 - Shift Master
 - Manually Assign Shift

SMS COUNT
SMS Count :-0

Security Person List

Issue Book

Issue Book: 192.168.123.147 [Start Issue Book] [Stop] [Refresh] [Issue Book] [Clear] [Close]

Member Details [Search] [Clear]

Confirmation	mid	Member Code	Name	Address	Phone	Email	Library name	Cardid	Category
<input type="checkbox"/>	1	M001	Aadil Allee	Al Ghubrah, M...		aadil.allee@g...	Sur Library	M00001	Member
<input type="checkbox"/>	2	S0001	Basir Emami	Madinat, Musc...		emami.m@g...	Sur Library	S000001	Security
<input type="checkbox"/>	3	M002	Dabir Dallal	Al Khuwayr, M...		dabir_d@gmai...	Sur Library	M00002	Member
<input checked="" type="checkbox"/>	4	M003	Emran Ghaffari	Qurm, Muscat		emrang@gmai...	Sur Library	M00003	Member
<input type="checkbox"/>	5	M004	Fardeen Hakim	Qurm, Muscat		fardeen@gmai...	Sur Library	M00004	Member
<input type="checkbox"/>	6	M005	Faraz Razak	Al Khuwayr, M...		faraz_razak@g...	Sur Library	M00004	Member
<input type="checkbox"/>	7	M006	Ghasaan Hassan	Al Ghubrah, M...		ghasaan@gma...	Sur Library	M00005	Member
<input type="checkbox"/>	8	M007	Imtiaz Jabbar	Madinat, Musc...		imtiaz_jabbar...	Sur Library	M00006	Member
<input type="checkbox"/>	9	M008	Hashid Jalali	Ruwi, Muscat		Jalali_Hasid@g...	Sur Library	M00007	Member
<input type="checkbox"/>	10	M009	Iqbal Karim	Qurm, Muscat		Iqbal@gmail.c...	Sur Library	M00008	Member
<input type="checkbox"/>	11	M010	Salma Malik	Qurm, Muscat		salma.malik@...	Sur Library	M00009	Member
<input type="checkbox"/>	12	M011	Inayat Mansouri	Al Ghubrah, M...		Inayat@gmail...	Sur Library	M00010	Member

Book Details ☐ Select All ☐ Select None ☐ Select Inverse

Confirmation	bookid	Book Code	Title	ISBN No.	Author Name	Book Type	Library name	Sub Category
<input checked="" type="checkbox"/>	8	B008	A TALE OF TW...	9781613190401	JARIR DIST BO...	LITERATURE - ...	Sur Library	LITERATURE - ...
<input type="checkbox"/>	10	B010	DRAUGHTSM...	96856526542	Edward Arnold	CONSTRUCTI...	Sur Library	CONSTRUCTI...

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Issue Book: x

Log

Xtenna™

Return Book: This module allows the user to return books to the library. At the check-in section, the library member places the books along with his PERSONNA™ tag ID next to the Xtenna Proximity™ reader. The device reads the book tags and his membership ID tag and displays the details on the screen. The member confirms the books and clicks the 'Return Book' button to complete the check-in process. After the books are returned, their status is automatically changed to 'available' in the database.

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Version:2.1
User:admin

RFID Enabled Sur Library Management System

Actions

- Masters
 - Location Master
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 - Book Group Master
 - Book Sub Group Master
 - Book Master
 - Member Master
 - Member Group Master
 - Member Master
 - Book Transaction
 - Issue Book
 - Return Book
 - Shift Master
 - Manually Assign Shift

SMS COUNT
SMS Count :-0

Return Book

Return Book: 192.168.123.147 [Start Return Book] [Stop] [Refresh] [Return Book] [Clear] [Close]

Book Details

Confirmation	bookid	Book Code	ISBN No.	Author Name	Book Type	Library name	Sub Category
<input checked="" type="checkbox"/>	8	B008	9781613190401	JARIR DIST BO...	LITERATURE - ...	Sur Library	LITERATURE - ...
<input checked="" type="checkbox"/>	10	B010	96856526542	Edward Arnold	CONSTRUCTI...	Sur Library	CONSTRUCTI...



CASE STUDY

Shift Master: This module is used to set up work shift timings for library and security staff. Shift start and end timings are entered here.

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 - Member Master
 - Member Group Master
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 - Issue Book
 - Return Book
 - Shift Master
 - Manually Assign Shift

Shift Master

Shift Code: Sh001
Shift Type: Morning
Shift Start Time: 07:00:00
Shift End Time: 12:59:00

Save Clear Close Refresh

ID	SHIFT_CODE	SHIFT_TYPE	START_TIME	END_TIME
1	Sh001	Morning	07:00:00	12:59:00
2	Sh002	Afternoon	13:00:00	18:00:00

SMS COUNT
SMS Count :-0

Assign Shift: Through this module, the administrator assigns work shifts to library and security staff. The employee name is selected and the shift is assigned to him in the database. This assigning data is used for the alert system. When a book tag that has not been checked-out is read at the OUT gate, the alert SMS is sent to the security guard currently on the assigned shift.

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Version:2.1
User:admin

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 - Manually Assign Shift

Manual Shift Assign

Employee Name: Basir Emami-S0001
Shift Type: Sh001-Morning

Assign Shift Clear Close

Search: [Search] [Reset]

Employee Name	SHIFT_TYPE
Basir Emami-S0001	Sh001-Morning



CASE STUDY

BENEFITS:

- Real-time status of inventory stock of library books.
- Tag IDs of many books can be read simultaneously at check-in and check-out even while books are stacked. The books do not have to be scanned one by one.
- Automation makes operations efficient and minimizes queuing.
- Self check-in and self check-out reduces staff requirement in the library.
- SMS confirmation sent to library members after check-out of books issued and check-in of books returned.
- Reminder SMS and email to library members on due-date.
- Defaulters and non-returns are easily ascertained when tag ID is read.
- Automated theft prevention measures and security alerts.

LINKS:

Hardware:



Tags:



Software:



Reference Example:

<http://www.essenrfid.com/Mailer/library-flash-demo.pdf>