



International school in Oman adopts a RFID-enabled LIBRARY MANAGEMENT SYSTEM

Self check-in and self check-out of books by students

Simultaneous check-in/check-out of stacked books

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

Automated maintenance of library inventory



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

For further details contact:

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www.essenrfid.com





CASE STUDY

KEY REQUIREMENTS:

Alruwad International School (AIS) is a reputed international school in Muscat, Oman catering to the educational needs of both, local as well as expatriate international students. Its school library has a wide-ranging stock of books for all student grades, besides professional reading material for teachers. As a newly established teaching institution of international standards, AIS intended to incorporate the latest and best facilities in its school library, including a high degree of automation that would allow students to self-issue and return books. This required an automated process to keep track of all books issued and returned by the students.

Main challenges:

- Self check-in and check-out of books.
- Keeping track of each book.
- Preventing theft of books and issuing of non-lending reference books through alerts to security.
- Generating an alert to the student and the library admin when the due date of a book has been exceeded.

SOLUTION:

Essen RFID proposed a Library Management System based on RFID, that would automate the check-in and check-out process for books, and incorporate various reminders and alerts for students, security staff and the library administrator.

IMPLEMENTATION:

All books in the library are tagged with Essen RFID's LIBRA™ tags. New books are also similarly tagged when they arrive. Each student 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 and 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.



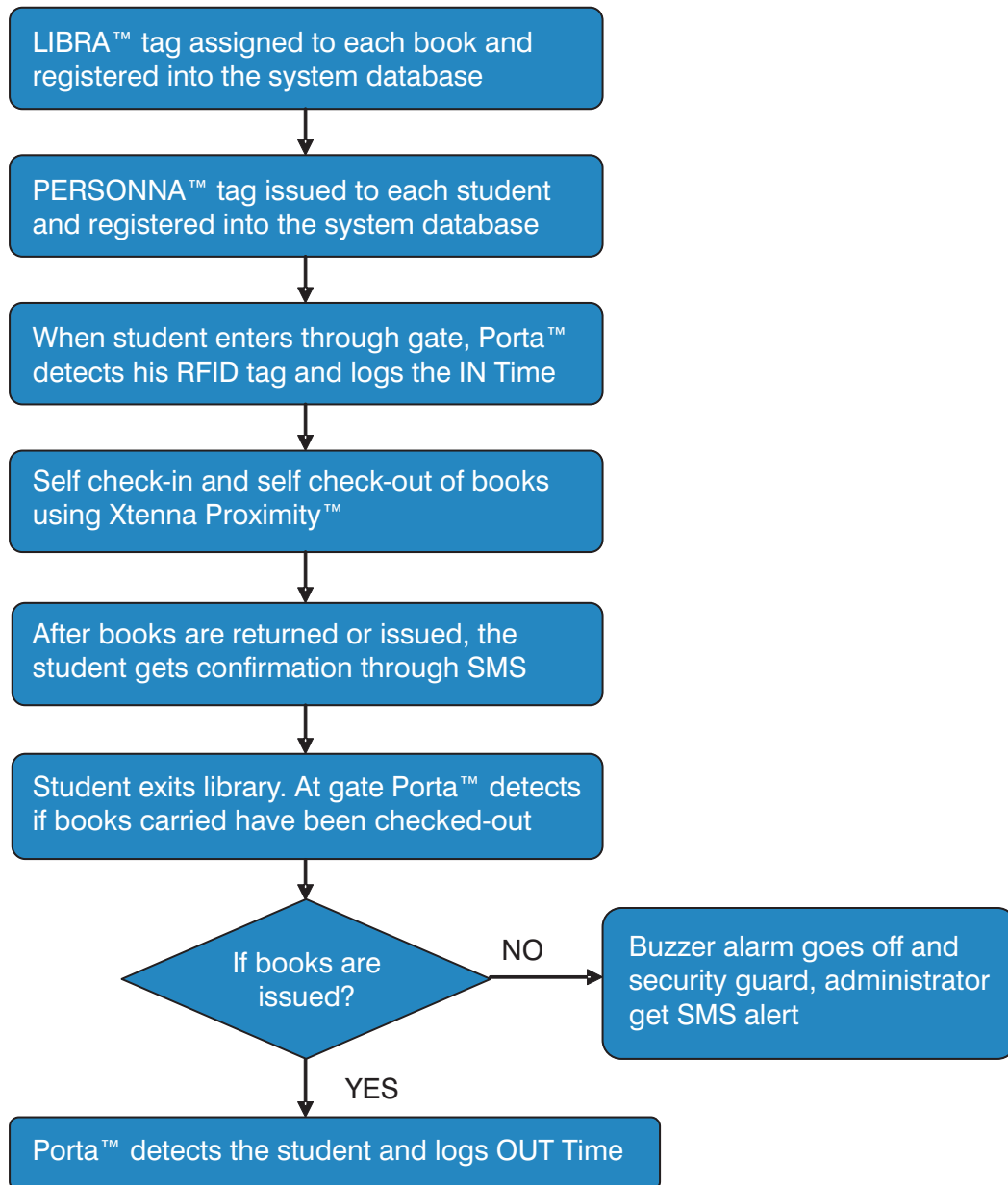
LIBRA™ RFID Tag



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 student is issued an ID card containing a PERSONNA™ tag. The tag is registered and assigned to that particular student 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 student enters the library, his PERSONNA™ tag ID is read by the Porta™ reader and entered into the database.



4. The student picks up the books that he requires 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 ID tag, and automatically identifies the books and the student.
5. The Library system application confirms the books in the database and makes an entry issuing these books to the particular student. The student then gets an SMS confirming the issue of these books to him along with the due date for returning them.
6. To return books back to the library, the student 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 student. The system application updates the records in the database and the student receives a confirmation SMS that the books have been returned.
7. When the student 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 the student 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.



CASE STUDY

8. If the student 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. The security guard can therefore immediately intercept the student. The administrator is also sent an email putting this on record so that the student can be warned or necessary action taken.
9. On due-date, the system sends a reminder SMS as well as email to the student that the books he has borrowed are now due to be returned back to the library.

Application:

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

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. For example, Porta™ portal reader devices are assigned IN and OUT gates, while the Xtenna Proximity™ reader devices are assigned for Book Issue i.e. check-out and Book Returns i.e. check-in.

RFID Enabled Library Management System 2.1

Version:2.1
User:admin

RFID Enabled Library Management System

Actions

- Masters
 - Location Master
 - Location Master
 - Library Master
 - Book Master
 - 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

Section Group Master

Location Code: L001

Logical Name: IssueBook

Select DeviceIP: 192.168.123.147

Buttons: Save, Clear, Close, Refresh

Search: [Search] [Reset]

locationid	locationCode	deviceIP	logicalName	Remark
1	L001	192.168.123.147	IssueBook	
2	L002	192.168.123.141	IN	
3	L003	192.168.123.142	OUT	
6	L004	192.168.123.148	ReturnBook	

SMS COUNT
SMS Count :0

Security Person List

Essen Rfid

Location Master x

Log

Xtenna™

Library Master: Here the main details of the library, such as library name and location are entered.



CASE STUDY

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Library Master

Library Code: L001
Library Name: ASI
Library Location: ASI

Save Clear Close Refresh

Id	ICode	IName	ILocation
1	L001	ASI	ASI

SMS COUNT
SMS Count :-0

Security Person List

Essen Rfid
Library Master

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

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RFID Enabled Library Management System

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 - Shift Master
 - Manually Assign Shift

Book Group Master

Group Code: BG02
Group Name: Science
Group Description: Science

Save Clear Close Refresh

bGid	bGCode	bGParentName	bGParentDiscri...	Remark
1	BG01	Story Book	Story Book	
2	BG02	Science	Science	
3	BG03	Mathematics	Mathematics	
4	BG04	History	History	

SMS COUNT
SMS Count :-0

Security Person List

Essen Rfid
Book Group Master



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Book Sub-Group Master: Book Groups are further divided year-wise into sub-groups based on the class/grade/standard being taught, such as Science VIII within the group Science for students studying in Class (Standard) VIII.

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

SMS COUNT
SMS Count :-0

Book Sub Group Master

Group Name: Science
Sub Group Code: Sub01
Sub Group Name: Science X
Sub Group Description: Science X

Save Clear Close Refresh

bSGid	bGid	bSGCode	bSubGName	bSubGDiscripti...	Remark
1	2	Sub01	Science X	Science X	
2	2	Sub02	Science IX	Science IX	
3	3	Sub03	Maths VIII	Maths VIII	
4	3	Sub04	Maths VII	Maths VII	
5	4	Sub05	History VI	History VI	
6	2	Sub06	Science VI	Science VI	
7	1	Sub07	Research	Research	
8	3	Sub08	Maths X	Maths X	
9	4	Sub09	History V	History V	
10	4	Sub10	History VII	History VII	

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

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RFID Enabled Library Management System

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

SMS COUNT
SMS Count :-0

Book Master

Book Code: B004
Book ISBN: 4
Book Title: Connect With Science
Book Author Name: Annie Jacob
Book Barcode: 4
Library Name: ASI
Book Type: Science

Book Copy No: 1
Book Copy Id: 1
Sub Group: Science VII
Select DeviceIP: 192.168.123.141-IN
Tag Id: 01124E31304450583323700

Save Clear Close Refresh

bookid	bookCode	bookISBN	bookTitle	bookAuthor_Name	bookBarCode	bookCopyNo	bookCopyId
6	B003	3	Exploring Universe	Robert A. Browne	3	1	1
9	B004	4	Connect With Science	Annie Jacob	4	1	1
11	B005	5	Science Grade Booster	Showick Thorpe	5	1	1
12	B006	6	New Science in Everyday Life	Vaishali Gupta	6	1	1
13	B007	7	Amazing Science	Racika Raman & Sarah...	7	1	1
15	B008	8	Mathematics Grade Booster	Showick Thorpe	8	1	1
16	B009	9	New Countdown	Shamlu Dudeja	9	1	1
17	B010	10	New Enjoying Mathematics...	Jose Paul	10	1	1
22	B011	11	Starting History & Civics	Asha Sangal	11	1	1
25	B012	12	Time Travel History & Civics	Amita Prasad & Mone...	12	1	1
26	B013	13	Oxford International Maths ...	Deborah Barton	13	1	1

Security Person List

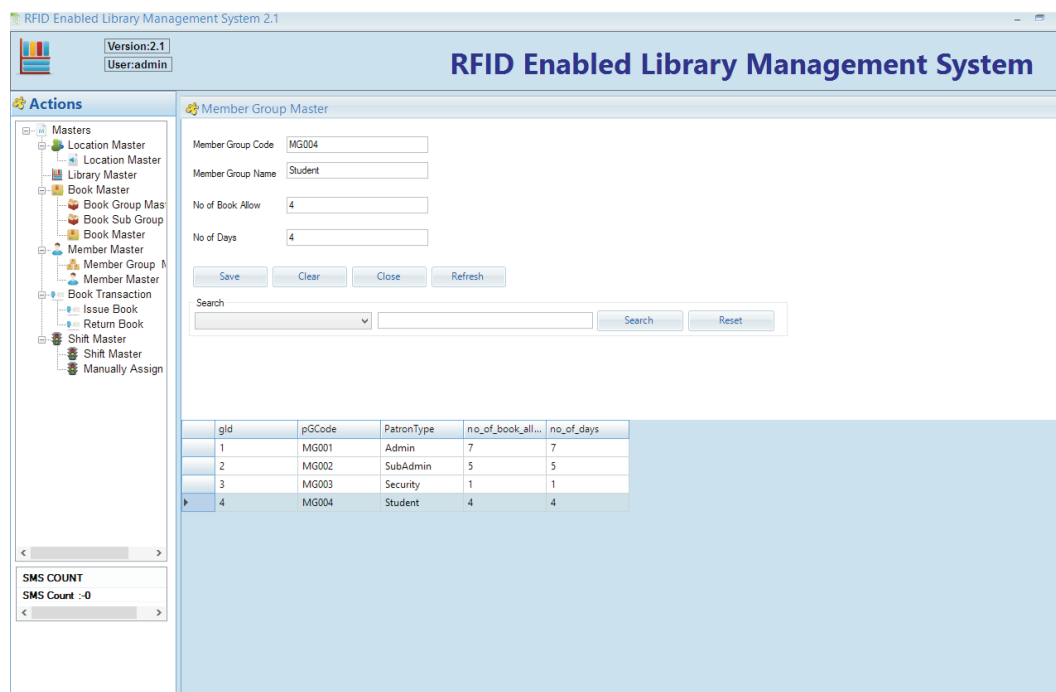
Essen Rfid

Book Master X



CASE STUDY

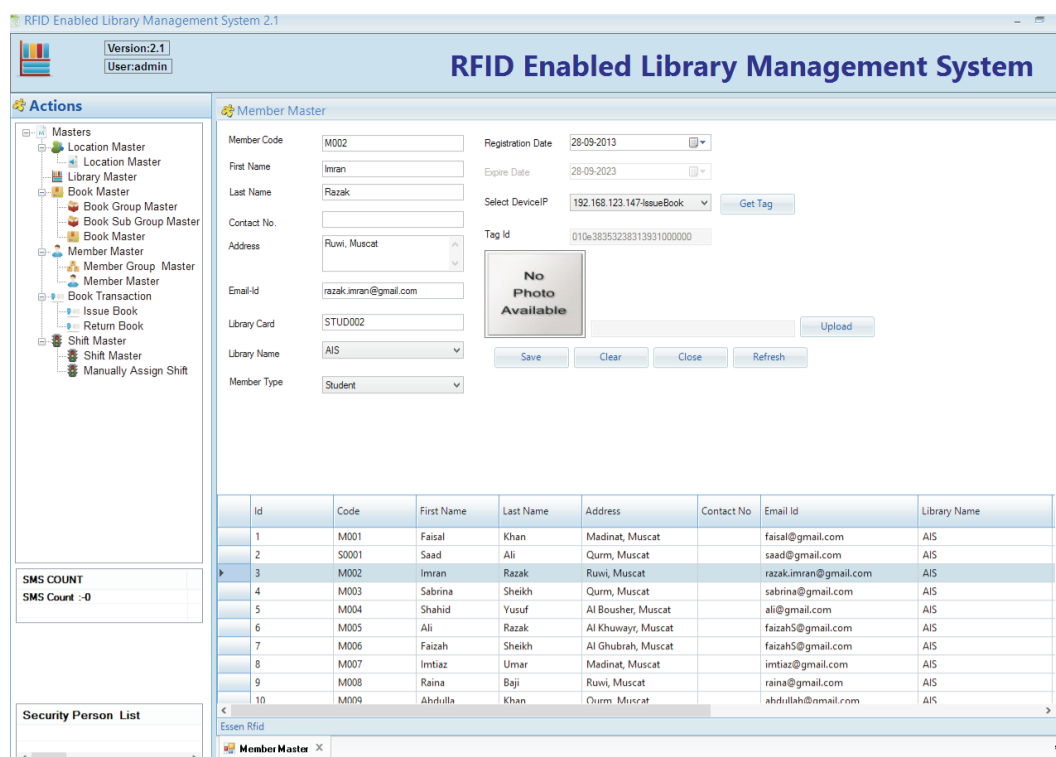
Member Group Master: Here, library users are divided into group categories such as Students, Teachers, Support Staff, Security, Administrator, etc.



The screenshot shows the 'Member Group Master' module. It includes a sidebar with a tree view of system modules. The main area contains a form for adding or editing a group, with fields for Member Group Code, Member Group Name, No of Book Allow, and No of Days. Below the form is a table listing existing groups.

gId	pGCode	PatronType	no_of_book_all...	no_of_days
1	MG001	Admin	7	7
2	MG002	SubAdmin	5	5
3	MG003	Security	1	1
4	MG004	Student	4	4

Member Master: This module contains details of each individual library user (member) within the group category. The details of all students and teachers are entered in this module. When a student is registered, his details are filled up and 'Student' selected as member type.



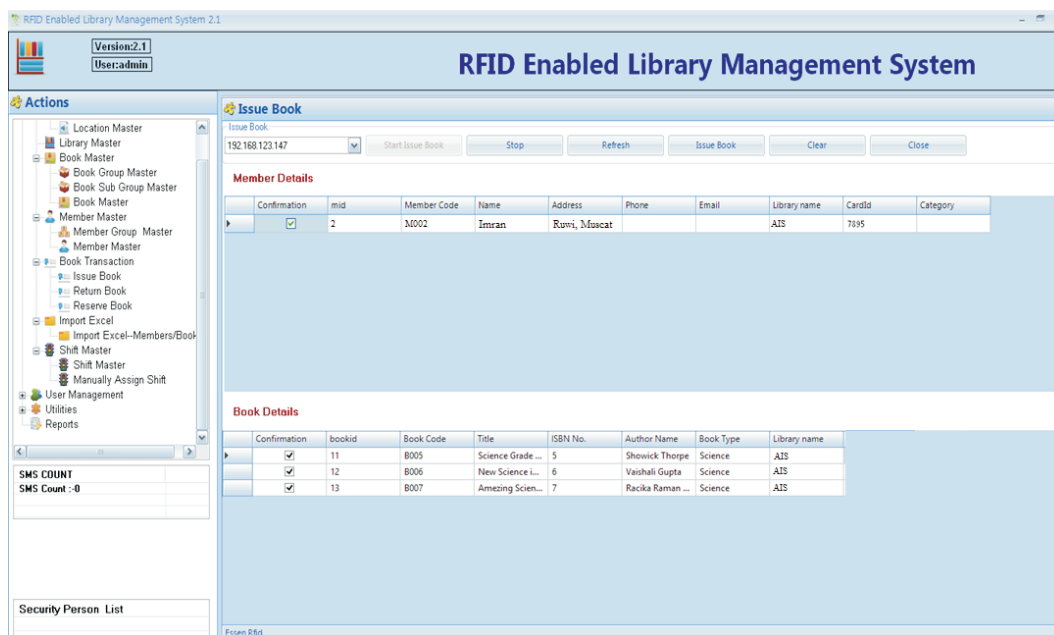
The screenshot shows the 'Member Master' module. It includes a sidebar with a tree view of system modules. The main area contains a form for adding or editing a member, with fields for Member Code, First Name, Last Name, Contact No., Address, Email Id, Library Card, Library Name, and Member Type. Below the form is a table listing existing members.

Id	Code	First Name	Last Name	Address	Contact No	Email Id	Library Name
1	M001	Faisal	Khan	Madinat, Muscat		faisal@gmail.com	AIS
2	S0001	Saad	Ali	Qurm, Muscat		saad@gmail.com	AIS
3	M002	Imran	Razak	Ruwi, Muscat		razak.imran@gmail.com	AIS
4	M003	Sabrina	Sheikh	Qurm, Muscat		sabrina@gmail.com	AIS
5	M004	Shahid	Yusuf	Al Bousher, Muscat		ali@gmail.com	AIS
6	M005	Ali	Razak	Al Khuwayr, Muscat		faizah5@gmail.com	AIS
7	M006	Faizah	Sheikh	Al Ghubrah, Muscat		faizah5@gmail.com	AIS
8	M007	Imtiaz	Umar	Madinat, Muscat		imtiaz@gmail.com	AIS
9	M008	Raina	Baji	Ruwi, Muscat		raina@gmail.com	AIS
10	M009	Ahdfulla	Khan	Qurm, Muscat		ahdfullah@gmail.com	AIS



CASE STUDY

Issue Book: This module allows the user to self-issue and check-out the books that he requires. The student places his PERSONNA™ ID tag along with his selected books next to the Xtenna Proximity™ at the counter. The device reads the ID tag and the book tags, and the student's name and book details are displayed on the screen. The student then confirms these books and clicks the 'Issue Book' button to complete the check-out.



The screenshot shows the 'Issue Book' module of the 'RFID Enabled Library Management System 2.1'. The interface includes a sidebar with a tree view of system modules, a main content area with a table of member details, and a table of book details.

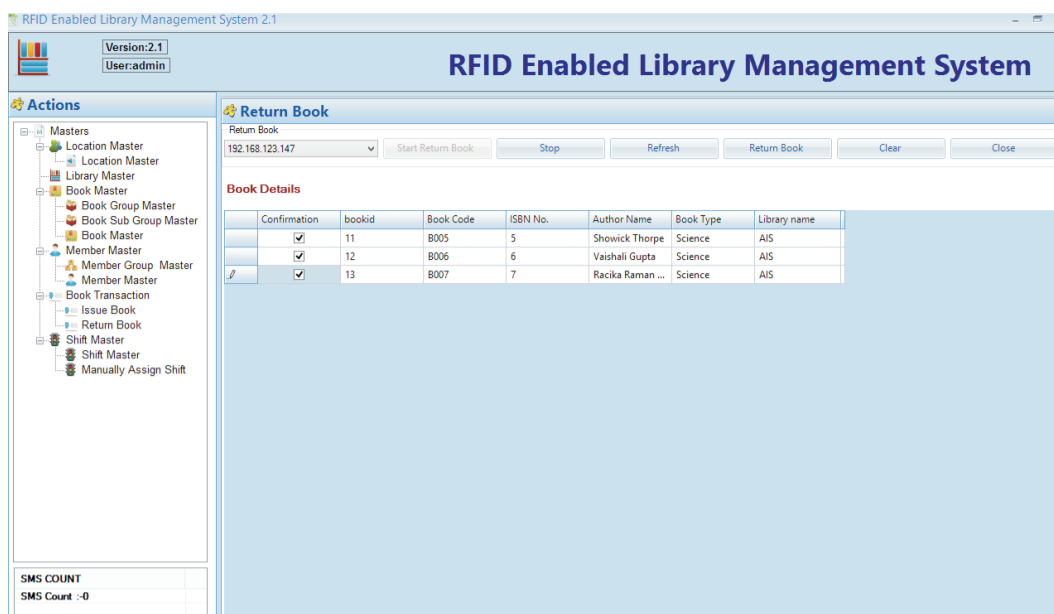
Member Details Table:

Confirmation	mid	Member Code	Name	Address	Phone	Email	Library name	Cardid	Category
<input checked="" type="checkbox"/>	2	M002	Imran	Ruvvi, Muscat			AIS	7895	

Book Details Table:

Confirmation	bookid	Book Code	Title	ISBN No.	Author Name	Book Type	Library name
<input checked="" type="checkbox"/>	11	B005	Science Grade ...	5	Showick Thorpe	Science	AIS
<input checked="" type="checkbox"/>	12	B006	New Science L...	6	Vaishali Gupta	Science	AIS
<input checked="" type="checkbox"/>	13	B007	Amzing Scien...	7	Racika Raman ...	Science	AIS

Return Book: This module lets the user return books to the library. At the check-in section, the student places the books along with his PERSONNA™ tag ID next to the Xtenna Proximity™ reader. The device reads the book tags and his ID tag and displays the details on the screen. The student confirms the books and clicks the 'Return Book' button to complete the check-in.



The screenshot shows the 'Return Book' module of the 'RFID Enabled Library Management System 2.1'. The interface includes a sidebar with a tree view of system modules, a main content area with a table of book details, and a table of member details.

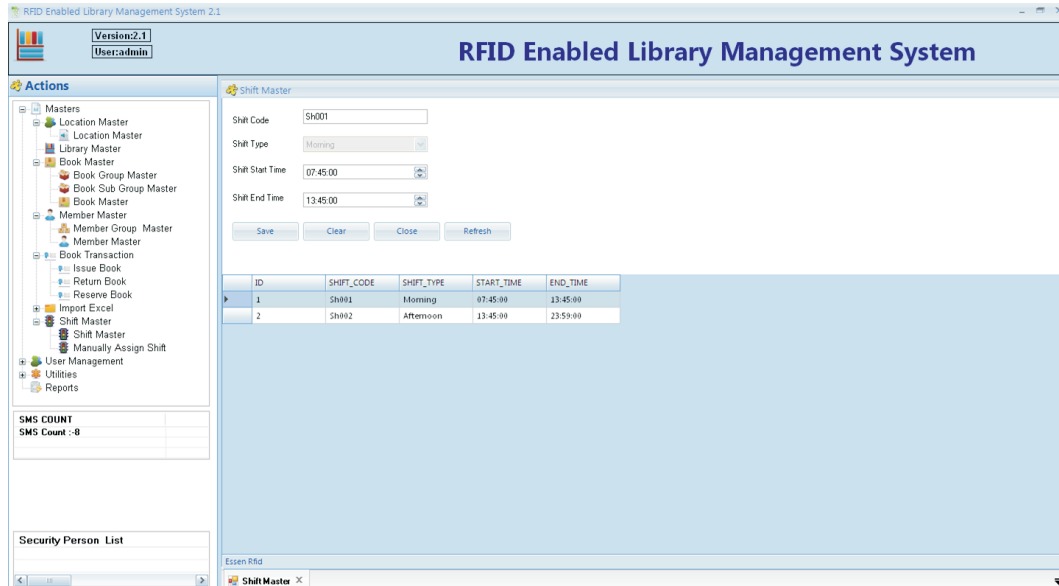
Book Details Table:

Confirmation	bookid	Book Code	ISBN No.	Author Name	Book Type	Library name
<input checked="" type="checkbox"/>	11	B005	5	Showick Thorpe	Science	AIS
<input checked="" type="checkbox"/>	12	B006	6	Vaishali Gupta	Science	AIS
<input checked="" type="checkbox"/>	13	B007	7	Racika Raman ...	Science	AIS



CASE STUDY

Shift Master: This 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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 - Return Book
 - Reserve Book
 - Import Excel
 - Shift Master
 - Manually Assign Shift
 - User Management
 - Utilities
 - Reports

SMS COUNT
SMS Count : -8

Security Person List

Shift Master

Shift Code: SH001
Shift Type: Morning
Shift Start Time: 07:45:00
Shift End Time: 13:45:00

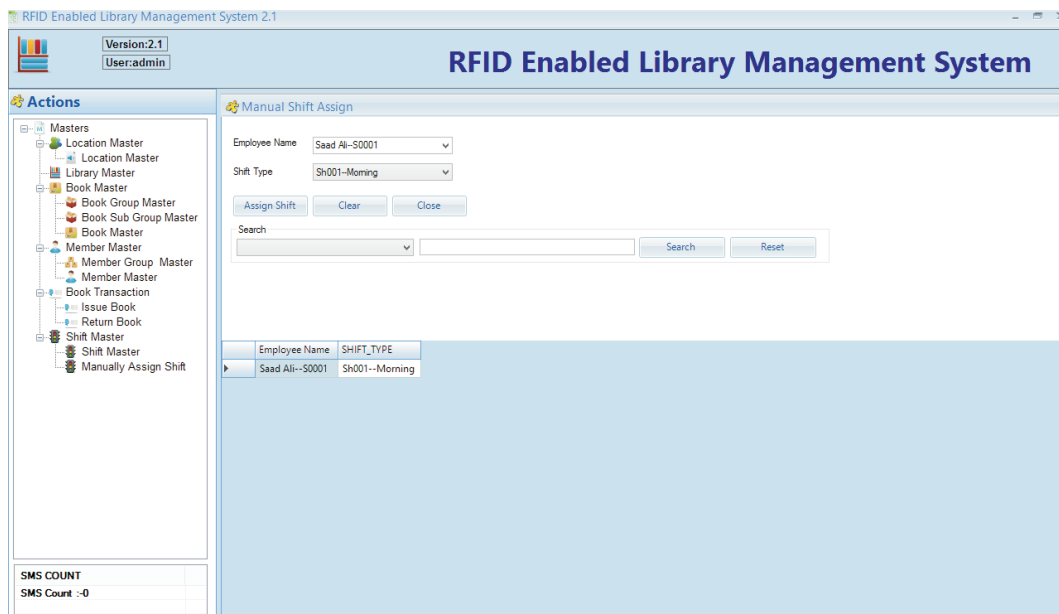
Save Clear Close Refresh

ID	SHIFT_CODE	SHIFT_TYPE	START_TIME	END_TIME
1	Sh001	Morning	07:45:00	13:45:00
2	Sh002	Afternoon	13:45:00	23:59:00

Essen RFID

Shift Master

Assign Shift: This module allows the administrator to manually assign work shifts to library and security staff. The employee name is selected and the shift is assigned to him in the database. This assigning is used by 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 working the assigned shift.



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SMS COUNT
SMS Count : -0

Manual Shift Assign

Employee Name: Saad Ali--S0001
Shift Type: Sh001--Morning

Assign Shift Clear Close

Search

Employee Name	SHIFT_TYPE
Saad Ali--S0001	Sh001--Morning



CASE STUDY

BENEFITS:

- Self check-in and self check-out reduces staff requirement in the library.
- 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.
- Easy maintenance of inventory stock.
- Automation makes operations efficient and minimizes queuing.
- SMS confirmation sent to students after books returned are checked-in and books issued are checked-out.
- Reminder SMS and email to students 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>