# Asset tracking and management system for library using active radio frequency identification (RFID).

# Muthuselvi R\*

Department of Computer Science and Engineering, Kamaraj College of Engineering and Technology Virudhunagar, India

#### Abstract

In Today's world RFID (radio frequency identification) technology is one of the most popular technologies for tracking and tracing, whereby a person or an object is identified using Radio Frequency (RF) transmission using a special kind of a sensor network. Recently, radio frequency identifications (RFIDs) are used to identify the assets which are permanent objects used internally in business. Computers, tools, library books, equipment are some examples of the assets. In the proposed work, physical location of the library books can be found quickly using radio frequency identification (RFID). It reduces the searching time and hence the unnecessary wastage of time is avoided.

Keywords: Radio frequency identification (RFID), Library management, Healthcare asset tracking.

## Accepted on August 17, 2016

# Introduction

Asset tracking refers to tracking the process of physical assets, either by scanning barcode labels attached to the assets or by using tags using Global Positioning System GPS) or radio frequency identification (RFID) which transmission their location. An asset is always tracked as a unique item. Each book or each Personal Computer (PC) is provided with unique barcode or unique RFID tag. The accurate information of the assets is required. RFID has the advantage of having the ability to recognize more than one tag simultaneously. Manual intervention is also not required to read RFID tags. Therefore, RFID technology can enable the ubiquitous use of wireless devices that have virtually unlimited lifetimes without incurring management costs [1]. In many hospitals, costlier mobile equipment is used. Tracking the equipment is very challenging and labour-intensive. It is required to track the clinical, bio-medical and the strategic assets [2]. Mobile medical equipment such as IV pumps and wheelchairs can also be tracked using RFID. Radio frequency identification (RFID) tags transmits the location of data to a computer and that can be displayed in the required places. Searching time is also very much reduced. The hospitals can improve the service quality. The comprehensive and integrated view of the assets can be maintained [2].

Radio frequency identification (RFID) technology helps the retailers to check the accuracy of the inventory. Healthcare providers and medical device manufacturers find lot of difficulties in storing, procuring and tracking the usage of Intermodulation Distortions (IMDs). Manual intervention is very much required which leads to inaccuracy in data collection and significant labour costs [3]. In this work, library

books are considered as asset and library automation system using RFID is developed. RFID tags helps the librarian to track the books. It can be known that if the books are issued or they are available in the library. This project helps the librarians to locate the books quickly and avoids unnecessary delay in searching the books. The information contained on microchips in the RFID tags attached to library materials is read using radio frequency technology. While using tags, the alignment or orientation of the book is not an issue. The proposed work can be extended to healthcare asset tracking.

# **Literature Survey**

Patrik et al. described the usage of RFID in building a smart hospital. It is suggested in this paper that business processes can be optimized and patient safety can be improved. The RFID locator, an assets tracking application is developed to improve the scalability and reliability. It is also suggested that it is important to make sure that RFID does not interfere with pacemakers and heart monitors used in the hospitals. Side effects of radio frequency on human beings have to be clarified [4]. Hoon et al. proposed a system that tracks the movement of vehicles which carry containers using RFID. It provides not only the accurate measurement of distance but also guarantees Line-Of-Sight (LOS) communication. Both practical and theoretical methods are discussed in this work [5]. Annaraman et al. proposed smart radio frequency identification (RFID) system, which identifies and tracks the books automatically. Many benefits like improved utilization of man power, infrastructures are found by using RFID system [6].

Vimalraj et al. suggested that RFID provides good solution to the libraries [7].

Srujana et al. made an attempt to implement RFID based library management system in the university. The proposed system is based on high frequency DLP radio frequency identification (RFID) 1 read/writer having the range of frequency is 13.56 MHz's and it can read up to 15 Tags simultaneously [8]. The work proposed by Lakshmi et al. is RFID based library management system. The system performs the transactions very quickly. It is very easy for the librarians to handle the issue and return of books from library [9]. Dipti et al. give brief idea about the emerging RFID technology, its importance in the library management system and its working. The various advantages and disadvantages of RFID technology in libraries are discussed. Besides, the work describes the implementation of RFID technology at central library, Indian institute of Madras (IITM). This will provide new insight for other libraries to implement RFID system [10]. Manjiri et al. proposed a library management system using RFID. The system maintains a database in which the number books to be issued and returned are stores. The student information is also stored in a database. The student is identified by the RFID card. The database is regularly updated. Using Global System for Mobile Communication (GSM) technology, due date of the book and fine amount is sent to the student [11].



Figure 1. Radio frequency identification (RFID) system.

## **Problem Description**

#### Existing system

In the existing system, bar code technology is used. A bar code is provided for each book. Barcode reader is to be read using the reader by the librarian. Human intervention is required to issue the book, to handle the return of the book and database update. The barcodes need to be programmed at the time of manufacture and these codes can be computed only once. This process is very time consuming and lot of time is wasted.

## **Objective**

The RFID based Library Management System simplifies the issuing, reissuing and returning of the books. The information about the book can be obtained quickly. Since automation through RFID is incorporated, human intervention is very much minimized.

## Radio frequency identification (RFID) technology

Radio frequency identification (RFID) enables identification from a distance, and unlike earlier bar-code technology, it does so without requiring a line of sight. Larger set of unique IDs are supported. It is possible to corporate many data like manufacturer, product type, etc. Different tags placed in the same location can be identified by RFID system.



#### Figure 2. Architecture.

The technical infrastructure involves a radio transponder and receiver, more commonly known as a tag and reader. Information related to a given object is stored on a joined tag and transmitted to a reader over a Radio Frequency (RF) connection. The reader in direct connects via wired or wireless networks to servers hosting RFID applications that make use of transmitted RFID input, and, in the case of supply chain applications, middleware manages the flow of RFID data between readers and enterprise applications. Figure 1 shows technical components of an RFID system.

## **System Design**

#### Proposed approach

In proposed approach introduces the asset tracking and management system for library using active RFID. Radio frequency identification (RFID) technology is one of the most popular technologies for tracking and tracing, whereby a person or an object is identified using Radio Frequency (RF) transmission using a special kind of a sensor network. Unlike a barcode system, RFID can recognize many tags simultaneously and quickly. RFID provides one of the best solutions for the identification of assets. In existing system of library management, manual process is required and students those who enter into the library search books in every rack and then get the book. This system is more inefficient and time is wasted by the students because sometimes students don't know whether books are available or not. An automated solution is proposed in this work. In the library every book is attached with RFID tag and RFID readers are connected to the host through the RS232 interface.

#### Architecture

Figure 2 shows overall architecture for asset tracking and management system for library using active RFID.



Figure 3. Design of interface.



Figure 4. Main window.

#### Interfacing design

The three important aspects need to be emphasized are Visual Basic (VB) programming language, Microsoft Access, and RFID set equipment. The whole system previously successfully implemented with the combination of these three aspects. Visual Basic (VB) was developed ease the management system to monitor the self-check in/out and book Drop. The software that has been used in this project is Visual Studio 2008; MySQL. Visual studio 2008 is used to track the book's location and availability whereas Microsoft Access is used as storage information system. Connectivity of Visual studio and Microsoft Access are done to store the database and

display the tracked location. Visual studio acts as a server of my system. Visual studio is used to track the book's location by using passive RFID reader. The whole data is send to the Microsoft Access which is a database system as shown in Figure 3.

New Item	Annual Statements State	
Ele		
E tasa	Title	
📑 Details	Adhor	
- Borowing	Publisher	Total Pages
	Edition	Copyright Date
		4/27/2016
	Category	Date Added
		<ul> <li>4/27/2016</li> </ul>
	Location	
	RFID tag	

Figure 5. Updation of the database.

Eve	_		
taxes	Title ADA Memoratinian		
Details	Author		
_	Ayala,Kenneth j		
- Borowing	Publisher	Total Pages	
	Kennth J	888	
	Edition	Copyright Date	
	4	4/15/2016	
	Category	Date Added	
	Computers & Internet	4/15/2016	
	Location		
	3,11		
	RFID Tag		
	368358354		

Figure 6. Modification of the book details.

## **Results and Discussion**

#### Experimental setup

The scope of work of the project is to develop a RFID based library management system to assist the librarians for more active management of books in the library. Graphical User Interface (GUI) for the system is developed using Visual Studio. To store the details of the book to the database, Microsoft Access is used. All the book information is loaded in the RFID tag. The student database contains the information like name of the student, email id, phone number, address, and date registered. The information has to written into the tag. The library database contains the information of the book like name, author name, publisher, number of copies in the library, available copies in the library. The database maintained with Microsoft Access using Visual Studio, which is much secured and user friendly.

When a book is issued to a student, library database the student data base is updated. The issued date and returned date of the

book is updated in the student database along with student and book information. Similarly, when books are returned, library database and student database are updated. Searching of books accepting Unique Identification Number (UID) will search the information of book such as Unique Identification Number (UID), book title, book author and book publisher. The department of Computer Science and Engineering has nearly 500 books in the department library. The system is developed for the department library.

The proposed system is implemented using various modules. The modules are

- Admin
- Collections
- Borrower
- Borrow History
- Reports

#### Results

Figure 4 shows main window of this project. This window has four main modules.

**Admin:** The administrator has the authority to create the users. The library database and the student database are maintained by the administrator. These are shown in Figures 5 and 6.

**Collections:** This module lists all the information about the library. This module have search box. In this search box, Searching for books using Unique Identification Number (UID) will search the information of book Unique Identification Number (UID), book title, book author and book publisher. Search/Issue book's screen accessed from actions screen, in this screen search and issue is done. First user enters the criteria for book searching and a book is successfully finding than the user can select the book he wishes to get issued in grid and get it issued as shown in Figure 7.

-	· Section									
	fore	34	Adv	Tubere .	Campro	Der Nation	Carro	+ 344	browl	
	8 M	Must by straing	R.	45	Grade Elfend	41.216				
	8 m	22 Reventely	Apale/Remailing	Revill 2	Corpulate Science	4525	1	1		
	5 tot	ET Recorders	motion and all	N/WHEEK	Conjules Eliterat	4525				
	8 he	EX Reporter	April: Renth 2	Rev0-2	Conjules El Honel	4525	7	7		
	8 he	Functional adaptivations	All Aurola	10	Graphic Eliterat	4525	5	5		
	5 ha	Assetting for Themps.	lena .	linia.	Graphic Silteral	4526	7	7		
	8 ha	And Sele	Renalt Rela	Tate .	Computer & Harted	4526	7	7		
	8 14	Next Advances	Teg	Tes	Corpulas Silitanal	4525	,	7		
	5 tot	Approximate as	Lanar ang	-	Grades Siltered	4525		4		
	8 mil	Aprile Insp	-	*	Graphic Silteral	4525				
	8 mil	decodeted	inte	nente	Conjulate Silitanut	4525				
	5 tot	<b>Multility</b> es	Rel Sea	Ref.	Graphic Eliterat	4525		,		
	5 tot	Multiple receivable.	approach is	Tergana	Graphic Eliterat	4525		,		
	8 14	10P not 10	Repri	figet	<b>Equator</b>	4525	,			
	8 14	Segreg ToP	T(past	Geor	<b>Equator</b>	45.25				
	5 to 1	Criteria properi	Dest/fail	Ped .	Gradeslinese	45.25				
	5 tak	-	Deb/Terrey	Terrey	Gradestiment	4525		,		
	5 ta	(-heatha	Pate States	Salar	Gradeslittenet	4525				
	5 tot	Case in Andrew	Seats Dates	Servetia	Grades United	475,275				
	5 tot	Octomer Services	Set Ann	546	Conjules (Lintered)	475275				

Figure 7. Collections.

Figures 8 and 9 show how the book can be searched and the result of the search respectively.

		4									
		_		Me	Autor	Gauge	Dan Mind	Case .	1.044	Broad .	
		fer.	- Topmany		-0	Computer & Harriel	411208				
· ·		dalar	and the second se	April (accell)	Rends J	Company & Harriel	415-0216		5		
Second 1		fagery	months.	mail related #	not served at	Graphic Littlenet	475.075				
-	8 tos		Lopicano.	April Territory	Rendly J	Company & Harriel	415.0216	,			
	8 http://doi.org/10.100	A gene	na siptracia.	Adv. Namins	Au.	Groupers & Instat	415-0216				
		Anna	ing for Therape.	letter .	longer (	Computer & Harrist	470.078				
	1 to a	April 1	346	Farrest Parts	Note:	Company & manual	415-0216				
		10.00	1000	Tes .	Tang .	Cospiler & Hand	470.075				
	1 1 m	April 1	the last the last	Lance cog	-	Company & Harriel	415.0216				
	8 ha	140	te image	-	-	Groupers & Instat	415-0216				
			i with the set	teles	1000	Computer & Harrish	470.078				
	8 ha	helice	induce.	Act date	Aut.	Company & Harrist	415-0216				
		And a second	the manufacture of	page and page 1	Tenyes.	Computers & Harriel	475.075				
	1 1 m	10.0	4.0	fore the	Report	Dynamy	415.0216	,			
	8 ha	ingen	1.00	N prost	Girun .	Equang	415-0216				
		Crew	to program	Deschool 1	Ped	Computers & Harriel	475.078				
	8 ha			Desilience -	1010	Company & Harriet	415-016				
		0.0	ter Tar	Patr. Bahan	Baller.	Computer & Harrish	470.078				
	1 1 4	-	distant and	Servers (Mass	<b>Serverio</b>	Company & Harrist	415.0216				
		Cont.	and in the	Internet in	See .	Consider & Name	1707				

Figure 8. Book search.

Celectors III II	date .									icei 🖓 👼
	i 🔰 i	10 August 10 Aug								1
	op - land	e - 10								
	fund	-	New	Fable	Centre	Dan Aded	Game	in State	Broad	
	8.14	10° ni 10	Repril	Repri	Expressing	475.075	1	4	1	

Figure 9. Result for book search.

lover int	Acres, 1									10101
			d 1	ž						ő
luer0	fellere	Let New	(m)	hee	Alles	9	Poeta	AwGe	Server.	10m
CITE/UP	Shah	0	spect-Mpaires	78/67	Ned	Relation	Terinte	638	41(2)5	
CT17148	fears fan Kinar	A	insert? (Springer	\$75422	Two	Angel 1	Tanitada	656	4525	
CENTRE	liter .	8	vier/Epral con	1962	Tuburge	State	<b>Teritori</b>	010	4525	
CENTRAL	ites	1	answitzend com	10/0427	Relat	Refure	Teritolu	6702	415226	
02117-028	Spre	1	spradgration	87642	Terrepter	Refut	<b>Taritalı</b>	0778	4526	
00117-008	lings.		Accellgral on	700542	Teri	Bed .	Terminals.	048	4525	
011140	Resile	5	retain/grait on	20042	Webver	indexpr	Teritoti	6982	4526	
01571488	van Serbys		wantholigal:	9372M	Owtower	Refere	Teritoti	Q214	4525	
01171-08	Samia	4	Antisepa/Rpsl	274.25	Farront	Padura	Terematic	080	415226	
00111-000	Dep	1	dostignal on	10002	Tecnegate	Refut	Teritoti	620.6	1525	
021571-0211	feate	1	manifysion	87642	Walkinger	Seine	Terminals.	62016	1525	
00111-002	Figures		spin-dynal on	30.02	<b>Augusti</b>	Refut	terihalu	628110	4526	
087579400	Nerjana		responsibility of a	B7642	waturing	Destant	terihalu.	602	4525	
CENTRAL	Despte	5	ine Weignal on	78542	waterior	Series 1	Teritati	4152	4526	
01571-005	Telefort		wind of goal care	8854	whereas	Sector	Tankatu	680	4526	
01572484	Leaves		incriment/Epsil	10,7004	Terror	Terror	Teritota	667	415226	



**Borrower:** This module lists all the information of the student those who have registered in the application. It displays the automatically generated identification, first name, middle name, last name, address, gender, age, year, department, mobile. It gives an edit link, from which administrator can edit the submitted information as shown in the Figure 10. Each student can choose the book from the drop down list. The due date for the book is also displayed. The screen shot is shown in Figure 11.

Select a Borrower		tem				
		Ttle		Copies	In stock	Borrowe
Sethupathi O	*	Software En	gineering	5	4	1
Kesava Ram Kumar A Vijay R Arasi E Suganya S						
Mariula S		Deserve Med				
vaira Santhiya P	E	DOITOW MOR				
Shamila J						
Divya T						
Ranjitha S						
Rajashree R						
Nranjana P						
Devapriya S	ч	Late Fee	Due Date			
Velselvi M		0.00	4/26/2016 •	0	lose	Borrow

Figure 11. Choosing the book and checking the due date.

Search 🔍	-		Return Item			
Fornat	Tite	Borover	Borow Date	Due	Reuned	Daily Late Fee
Book.	Agle and iterative dex.	Veloelvi M	4/25/2016	4/25/2016	4/25/2016	0
Book.	ASP net 4.0	Devaptyle S	4/25/2016	4/30/2016		0
Book.	Acounting for Manage.	Rejarivee R	4/25/2016	4/25/2015		0
Book	Advance in structural .	Dige T	4/25/2016	4/25/2016		0
Book	C++ Pitner Pus	Stamle J	4/25/2016	3/1/2016	4/25/2016	0
Book:	Begining PHP	Durga P	4/25/2016	4/25/2016		0
Book.	Software Engineering	Anni E	4/25/2016	4/25/2016	4/25/2016	0
Book.	Clent server Computing	Marjula S	4/15/2016	4/16/2016		0
Book	Software Engineering	Sethupathi O	4/15/2016	4/16/2016		0

Figure 12. Borrow history.

4				1	
Stude	ntinformatio	n			
Dudent	ione Phone	Emal	Addes	Date Registered	
inhach	0 7581657	njashu)@pral. Lan	MyRud	475/254	
Carpita Participante	n Sunor A. 1656421	lasand?@prail: pri	hei	4152216	
V(sy R	75%64211	<ul> <li>iay@ynak.com</li> </ul>	shuthunager	415225	
A SET	10710421	assignation	Moduok	415/274	
Ligned 1	80560	ngaryan@grait un	Nunargelan	4152214	
Duga P	795x5421	degedigenei in m	hei	415/274	
Marijula I	740xH02	narjales@gnalic un	Viudiunopa	415274	
-site Sant	10° 1770H	usisarhijağın allım	Overlanvari	4162214	
Portio J	17147204	stamioyapai@g	Remod	416/274	

Figure 13. Report on student information.

**Borrow history:** This module lists all the information of the borrowed books. This module displays the borrower details, issue date, return date and fine details. Then borrower can return the book using this module as shown in Figure 12.

**Reports:** The module contains various facilities like student report, book report, and transaction report. It allows you to export the information from the reports to spread sheets or text files to use them in other applications. It generates all reports automatically and very easily as shown in Figures 13 and 14.

 						_	
Book List Report Parties	Apr 25.27	8				d	
16	Autor	Publiher	Copylight Do	le Copies	Borrowed	in Stock	
Clettleverbrivis gide	Ofsi. Isbetriole	ona	415276	1	٥		
Clerifiere Pogonning with	ohilikoen oheyConto	Robert	4152216	1	٥	1	
Cloud Computing	John Harris	a Josyda	415274	8	0		
				15	15	0	
Comics & Grapi Introduction to data maintone with	tentilos Josh Tali	teritiy	415225	,	٥	,	
				7	7	-	
Computers & In							
Consuler when architecture	Mpro. M Mpris	NOVO. N'MOYS	415/276	*	a	·	
Crystography and	20ings	76ings	415/274	18	0		

Figure 14. Report on books.

#### Conclusion

Radio frequency identification (RFID) implementation in libraries has been discussed. The whole system was designed to overcome the disadvantages of barcode systems and thus demonstrated. The entire project was planned to reduce the need of skilled librarians. Though the system is more expensive than the barcode systems, security is ensured and is more efficient. RFID in library speeds up all the techniques like issuing, reissuing returning books, books searching processes. Performance of a system depends upon the data on the tag, effectiveness of RFID reader position, tag position and they all depend upon the cost. Developments in RFID technology continue to earn larger memory capacities, wider reading ranges, and faster processing. Renewing of manual book keeping, books are now more comfortably traceable, improved utilization of resources like manpower, framework, etc. Less time consumed as no line of sight is mandatory, minimized manual intervention, minimized manual errors, and fast access to books are the main advantages after implementation of RFID based Library Management System (LMS). An automated RFID based Library Management System (LMS) will increase the speed of action as issuing and returning back is now automated.

## **Future Work**

In future the tag system can be implemented in any type of asset tracking, especially in multi-national offices to keep track in their office files, often DVDs. It can also be used in hospitals for healthcare asset management to track and maintain equipment.

#### References

1. Sekyoung Y, Yongwoong J. Radio frequency identification (RFID)-based automatic scoring system for physical fitness testing. IEEE Sys J 2015; 9.

- 2. Radio frequency identification (RFID) and Real-time locating system in healthcare. Oat sys 2013.
- 3. New cognitive approaches to long-standing challenges. IBM Smarter Cities 2016.
- 4. Hoon C, Yunju B. Design and implementation of practical asset tracking system in container terminals. Int J Precis Eng Manufactur 2012; 13: 1955-1964.
- Srinivasa Ravi K, Varun GH, Vamsi T, Pratyusha P. Radio frequency identification (RFID) based security system. Int J Innov Technol Explor Eng 2013; 2: 132-134.
- Annaraman PT. Smart library management system using Radio frequency identification (RFID). Int J Adv Res Electric Electr Instr Eng 2015; 4: 1916-1925.
- Vimalraj S, Sameera S. Radio frequency identification (RFID) based library management system. International J Innov Res Adv Eng 2015; 2: 326-329.
- 8. Srujana C, Rama Murthy B. Development of Radio frequency identification (RFID) based library management system using MATLAB. Int J Eng Adv 2013; 2: 480-482.

- Sree Lakshmi A, Sree Gowri A. Library management system using Radio frequency identification Technology (RFID). Int J Comp Sci Info Technol 2014; 5: 6932-6935.
- Dipti RS, Dhara S. Radio frequency identification Technology (RFID) at central library, IIT Madras. Int J Sci Eng Appl Sci 2015; 1: 156-172.
- 11. Manjiri A, Vinaya C. FPGA based library management system. Int J Adv Res Comp Sci Soft Eng 2015; 5: 294-298.

### \*Correspondence to

Muthuselvi R

Department of Computer Science and Engineering

Kamaraj College of Engineering and Technology

India