AN INTERNET OF THINGS APPROACH TO LIBRARY MANAGEMENT AND MONITORING

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Abstract

In the world of urbanization, time and efficiency are matter of priority. RFID (Radio Frequency Deification) is emerging technology which improve standard of living, particularly the two abovementioned ones. Library is the key place of knowledge. Reading books makes the perfect in his life. The requirements of books and creations or publishing are increased every day. The volumes of library books increased as per need but the management is big issue nowadays. Here we tried to solve one such kind of problem using RFID and GSM. To improve the library facility automation we proposed a module which has RFID reader in addition, general library software with GSM support. Here in this proposed library management system, Borrow, Renewal, returns, mischief and Stock verification etc., are done easier and faster using latest Internet of Things technology. This system alerts the students about renewal date and library dues.

Keywords: *RFID, GSM and RFID Reader.*

1. Introduction

Libraries are essential in our life to improve our knowledge. In the Present library system manpower is major issue to monitor renewal, mishandling, updating, stack handling, etc. Barcodes are widely used in library automation systems now but they affect severely due to line of sight issues. For proper reading of data the reader and barcode should see (6). Here we tried to solve the issues which arise in the library by using Internet of things based RFID technology. In some libraries RFID is used for automation (5) but it is not implemented with alert system. The present system monitors issue of books in the circulation counter. Remind the user for renewal and returning of books is important factor to manage library system.

Reference section is to be automated like sections for better utilization. In Present automation library systems reference section stock is maintained by RFID but monitoring and preference is not mapped properly (5). Here we are proposing a novel method to monitor order preference of reference materials to enhance the quality. RFID tags are placed on each and every book in the library. The RFID tag contains details of the book (ie) book name,

author name, publications, edition, year and cost for entry purpose. RFID reader will be placed in the circulation counter, entrance of library and reference section reading table. GSM module or Internet connection are used for sending alert message. While issuing books, the RFID reader will get the information from the tag and it is sent to the data processing system. While returning of a book, the Reader gets information from the tag and is given to the processing system to update. Everyday system sends SMS to the students to remind their due date and penalty due amounts if they failed to do renewal.

We also use attendance management system with RFID reader. It helps to alert the student at entrance of the class room in daily basis. If the particular student fails to return the book this attendance module will not register his entry and alert him by voice message. Rest of this paper is organized as RFID, GSM, Implementation, Future work and conclusion.

2. RFID

Radio frequency identification (RFID) has been around for decades. Only recently, however, has the convergence of lower cost and increased capabilities made businesses take a hard look at what RFID can do for them (3),(4). Though the bottom line story of that deployment has yet to surface, it does seem to support the inevitable movement of inventory tracking and supply chain management toward RFID.

2.1. TECHNICAL OVERVIEW

The basic premise behind RFID systems is that you mark items with tags. These tags contain transponders that emit messages readable by specialized RFID readers. Most RFID tags store some sort of identification number; for example a customer number or product SKU (stock-keeping unit) code(1). A reader retrieves information about the ID number from a database, and acts upon it accordingly. RFID tags can also contain writable memory, which can store information for transfer to various RFID

readers in different locations. This information can track the movement of the tagged item, making that information available to each reader. RFID tags fall into two general categories, active and passive, depending on their source of electrical power. Active RFID tags contain their own power source, usually an on-board battery(2). Passive tags obtain power from the signal of an external reader. RFID readers also come in active and passive varieties, depending on the type of tag they read. In figure 1 shows passive RFID tags.
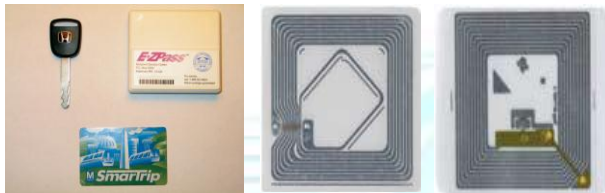

Figure 1

3. GSM

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership. Throughout the evolution of cellular telecommunications, various systems have been developed without the benefit of standardized specifications. Here are using SIM300 GSM module shown in figure 2. The SIM300 module is a Triband GSM/GPRS solution in a compact plug in module. Featuring an industry-standard interface and delivers GSM/GPRS 900/1800/1900 MHz performance for voice, data and fax in a small form factor with low power consumption.

Figure 2

4. Internet of Things

The Internet of Things refers to uniquely identifiable objects (things) and their virtual representations in an Internet-like structure. The term Internet of Things was first used by Kevin Ashton in 1999. The concept of the Internet of Things first became popular through the Auto-ID Centre and related market analysts publications. Radio-frequency identification (RFID) is often seen as a prerequisite for the Internet of Things.

If all objects of daily life were equipped with radio tags, they could be identified and inventoried by computers. However, unique identification of things may be achieved through other means such as barcodes or 2D-codes as well. With all objects in the world equipped with minuscule identifying devices; daily life on Earth would undergo a transformation. Companies would not run out of stock or waste products, as involved parties would know which products are required and consumed. Mislaid and stolen items would be easily tracked and located, as would the people who use them. One's ability to interact with objects could be altered remotely based on current status and existing user agreements. The objects themselves do not converse, but they may now be referred to by other agents, such as powerful centralized servers acting for their human owners. The next generation of Internet applications using Internet Protocol Version 6 (IPv6) would be able to communicate with devices attached to virtually all human-made objects because of the extremely large address space of the IPv6 protocol (7). This system would therefore be able to identify any kind of object.

5. Design and Implementation

In our work we are planning to give a complete solution in library automation particularly circulation counter and alert systems. Here we are using RFID tags for identity, RFID readers, PC for database and GSM module or internet connection.

RFID Tags and Readers: Here we are using RFID tags in Books and for students identity i.e. ID cards. The passive 125 KHz RFID tags are preferred for this purpose. RFID readers are placed in different locations to collect data and mange the information as mentioned in block diagram in figure 3.

Place1: Circulation counters in library
Place2: Entrance of the library
Place3: In Reference Section
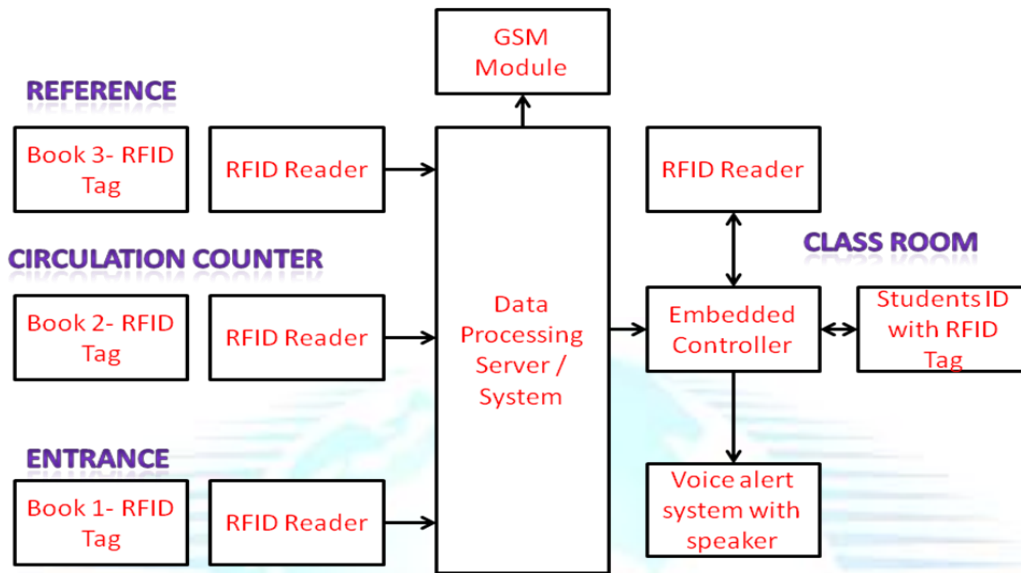Place4: Entrance of the class room

Figure 3

5.1. Place 1: Circulation counters in library

The circulation counter RFID is connected to the serial port of the front end PC and then library server. Using this accession of the book is managed and it is stored in database. The same reader may be utilized for stock verification purpose. At the time of stock verification by moving the reader closer different rags we can count the entities with any physical movement of books by which time is saved. Figure 4 shows block representation of the circulation section figure 5 shows output screen of the PC (Personal Computer). The output screen shows data entry of returning book and search operation of book.
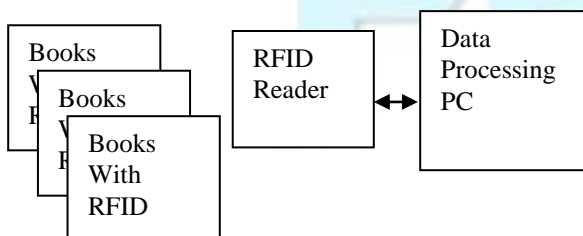

Figure 4

BOOK RETURN/TARGET ID GENERATION	
STUDENT ID	STEC001 - NAGARAJ.S
BOOK NAME	DSP (PRINCIPLES, ALGORITHM AND APPLICATIONS)
AUTHOR	John G. *PROAKIS* and Dimitris G. MANOLAKIS
ID ON BOOK	2 10 20 010 18 04 15
TARGET ID	5 10 20 00 004 01 02

SEARCH		
DEPARTMENT	ECE	
BOOK TITLE	DSP (PRINCIPLES, ALGORITHM AND APPLICATIONS)	
AUTHOR		
	SEARCH	
	RESULTS	
TITLE	AUTHOR	REMARKS
DSP	John G. *PROAKIS* and Dimitris G. MANOLAKIS	10 AVAILABLE
	DR. SALIVAHANAN	N. A
	NAGOOR GANI	2 AVAILABLE

Figure 5

5.2. Place 2: Entrance of the library

The reader placed in the entrance of library is connected to server which is used to manage mischief. It alarms while the book is taken out without proper entry. So the loss of book is managed. The figure 6 shows block representation of this section.
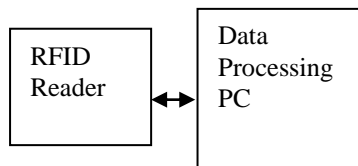

Figure 6

5.3. Place 3: In Reference Section

The third reader is placed in the reference section to collect the information about order of preference. It helps to rate the reference books and it will help us to give more attention to those books or journals. The same database can be used in preparing requirements with efficient manner. It is given by figure 7.
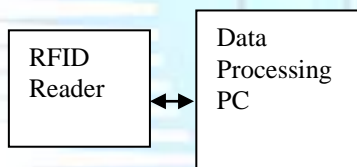

Figure 7

5.4. Place 4: Entrance of the class room

The fourth reader is placed in front of class rooms; purpose is to alert the students while entering in to the class about returning the books. Actually the main job of the reader is to manage student's attendance. If the particular student is not returned his books in time then the system will not register his attendance and warn him to return the book. The block representation of this section is mentioned in figure 8.
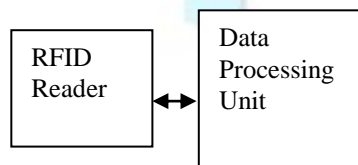

Figure 8

6. CONCLUSIONS

In this project we designed alert system module about Library book renewal, return and library dues. There are number of library management systems are available but here we proposed an optimized solution using RFID and GSM mobile technology. It solves almost all the library related problems. In developed countries like USA, England, German and Japan RFID and GSM technologies are widely used for library management. But in India we don't implemented any automated system for RFID based library management system. Keeping this in mind we have proposed this system with low cost. Our future work is to design a complete college automation system using RFID, GSM and web enabled services.

References

[1] Klaus Finkenzeller, "RFID Handbook - Fundamentals and Applications in Contact less Smart Cards and Identification ", Wiley, 2003, Chapt.1, 2, 13

[2] Manish Buhptani, Shahram Moradpour, "RFID Field Guide -Developing Radio Frequency Identification Systems", Prentice Hall, 2005, pp 7-9, 16-225, 160, 231

[3] Robert A. Kleist, T.Theodore A.Chapman, DavidA. Sakai, Brad S. Jarvis,"RFID Labeling - Smart Labeling Concepts & Applications for the Consumer Packaged Goods Supply Chain ", Printronix, 2004, pp93-95

[4] Yoon S. Chang, Harris C. Makatsoris, Howard D. Richards, "Evolution of Supply Chain Management - Symbiosis of Adaptive Value Network and ICT", 2004, pp 41, 383-384

[5] Alan Butters, Principal Consultant, Sybis, "RFID IN AUSTRALIAN ACADEMIC LIBRARIES: EXPLORING THE BARRIERS TO IMPLEMENTATION", AARL September 2008 vol 39 no 3 pp 198-206.

[6] Harry E. Burke, *Automating Management Information Systems: Barcode Engineering and Implementation* – Thomson Learning, ISBN 0-442-20712-3.

[7] R. Hinden, S. Deering, "RFC 4291 IP Version 6 Addressing Architecture", The Internet Society February 2006. http://www.rfc-editor.org/rfc/rfc4291.txt