BOOK DROP RFID IN UMP LIBRARY: "PRACTICALITIES IN BORROWING AND RETURNING BOOK BY SELF"

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ABSTRACT

Radio Frequency Identification (RFID) is evolving as a major technology enabler for identifying and tracking goods and assets around the world. It can help hospitals locate expensive equipment more quickly to improve patient care, pharmaceutical companies to reduce counterfeiting and logistics providers to improve the management of moveable assets. It also promises to enable new efficiencies in the supply chain by tracking goods from the point of manufacture through to the retail point of sale (POS). In addition, it also been apply in library management by improve the current systems in the library. Methodology that be used in this project is a Waterfall Model. This system will be developing using Microsoft Visual Basic 2008. This system makes the borrowing and returning book more practical for the user.

ABSTRAK

Radio Frequency Identification (RFID) adalah berkembang sebagai teknologi utama untuk mengenal pasti dan mencari barangan dan aset di seluruh dunia. Hal ini dapat membantu hospital mencari peralatan yang mahal lebih cepat untuk meningkatkan penjagaan pesakit, farmasi untuk mengurangkan pembekal pemalsuan dan logistik untuk memperbaiki pengurusan aset bergerak. Hal ini juga menjanjikan untuk membolehkan kecekapan baru dalam sistem rantaian bekalan dengan mencari barang dari sudut perkilangan hinggalah titik jualan runcit (POS). Selain itu, juga berlaku dalam pengurusan perpustakaan dengan memperbaiki sistem pada masa kini di perpustakaan. Metodologi yang digunakan dalam projek ini adalah "Waterfall Model". Sistem ini akan dibangunkan dengan menggunakan Microsoft Visual Basic 2008. Sistem ini membuat dan mengembalikan proses pinjaman buku lebih praktikal bagi pengguna.

TABLE OF CONTENTS

CHAPTER	TITLE		PAGE
	DECLARATION OF THESIS		**ii**
	SUPERVISOR'S DECLARATION		**iii**
	DEDICATION		**iv**
	ACKNOWLEDGEMENT		**v**
	ABSTRACT IN ENGLISH		**vi**
	ABSTRACT IN BAHASA MELAYU		**vii**
	TABLE OF CONTENTS		**viii**
	LIST OF TABLES		**xiii**
	LIST OF FIGURES		**xiv**
	LIST OF APPENDICES		**xvi**
1	**INTRODUCTION**		
	1.1	Introduction	1
	1.2	Problem statement	3
	1.3	Objective	5
	1.4	Scope of study	
		1.4.1 The library systems	5
		1.4.2 User	6

2 **LITERATURE REVIEW**

2.1 Introduction 7

2.2 RFID Technology 8

2.2.1 Barcode systems 8

2.2.2 The Arrival of RFID 9

2.2.3 Comparison between barcode systems and RFID 9

2.3 RFID Component 10

2.3.1 Antenna 11

2.3.1.1. Antenna characteristic 12

2.3.2 Reader 13

2.3.2.1 Reader components 13

2.3.3 Tags 15

2.3.3.1 Passive Tags 16

2.3.3.2 Semi-active (Semi-passive) Tags 17

2.3.3.3 Active Tags 18

2.3.3.4 Writing Capabilities 18

2.3.4 Frequency 20

2.4 RFID Standard 21

2.4.1 ISO Standard and RFID 21

2.4.2 EPC Global Standard 22

2.4.2.1 EPC Class Type Features Tag Type 22

2.5 Related Systems 23

2.5.1 RFID in Library 23

2.5.1.1 Advantages of RFID in Library (Library Automation Using RFID) 24

2.5.1.2 LibBest management Library RFID Management System 25

2.5.1.3 Singapore National Library 26

2.5.1.4 The Shenzhen Library 27

2.5.2 RFID in Health Care 27
2.5.2.1 Pharmaceutical Applications 28
2.5.2.1.1 Drug Counterfeiting 28
2.5.2.1.2 Clinical Trials 29
2.5.2.1.3 Inventory Management 30
2.5.2.1.4 Patient Tracking 30
2.5.3 Item Tracking 31
2.5.3.1 Vehicle Tracking 31

2.6 Book drop System in Library 32
2.6.1 LibBest book drop 32

3 METHODOLOGY
3.1 Introduction 34
3.2 Waterfall Image 36
3.3 Requirement Gathering and Analysis 37
3.4 Systems Design 40
3.4.1 Context Diagram 43
3.4.2 Data Flow Diagram Level 0 for Borrower 44
3.4.3 Data Flow Diagram Level 1 for Borrower (Borrow and Return) 45
3.4.4 Data Flow Diagram Level 0 for Librarian 46
3.4.5 Flow Chart Diagram for Borrower when Borrowing 47
3.4.6 Flow Chart Diagram for Borrower when Returning 48
3.4.7 Flow Chart Diagram for Librarian 49
3.4.8 Borrower Interface 50
3.4.9 Librarian Interface 50

	3.4.10 Database Design	50
	3.4.11 Process of Database Design	51
	3.5 Implementation	53
	3.5.1 Software Requirement	53
	3.5.2 Hardware Requirement	54
	3.6 Testing	54
	3.7 Maintenance	55
4	**IMPLEMENTATION**	
	4.1 Introduction	57
	4.2 Result of UMP Library Borrowing and Returning Book by Self By Using RFID	57
	4.2.1 Database Contruction and Tables	58
	4.2.1.1 Details of the Table	59
	4.2.2 Database Connecter for RFID	61
	4.2.3 System Interfaces	62
	4.3 Interfaces Design	64
	4.4 Conclusion	67
5	**RESULT AND DISCUSSION**	
	5.1 Introduction	68
	5.2 Result Analysis	69
	5.2.1 Login Module	70
	5.2.2 Book Information Module	71
	5.2.3 Borrow Book Module	72
	5.2.4 Return Book Module	73
	5.3 Constraints	73
	5.3.1 Development Constraints	74
	5.3.1.1 Lack of Programming Skill	74

	5.3.1.2 Time	74
	5.3.2 Hardware Constraints	74
	5.3.2.1 Lack of Hardware Knowledge	74
	5.3.3 Physical Constraints	74
	5.3.3.1 Prototype Size (1:2)	74
	5.4 Future Research	75
6	**CONCLUSION**	
	6.1 Introduction	76
	6.2 Result Analysis	77
	6.3 Lesson Learning	78
	REFERENCES	79
	APPENDICES	82

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.0	The comparisons between barcode system and RFID	10
2.1	Antenna characteristic	13
2.2	The reader main components	14
2.3	Types of writing capabilities	20
2.4	Frequency range, wavelength and read range	21
2.5	18000 Series	23
3.0	Librarian database design	54
3.1	Borrower database design	54
3.2	Operation database design	54
3.3	Book database design	55
3.4	Software requirement	56
3.5	Hardware requirement	56

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.0	RFID antenna	12
2.1	RFID reader	14
2.2	Passive tag	17
2.3	Semi-passive tag	18
2.4	Active tag	19
2.5	History of RFID in library	25
2.6	Drug counterfeiting	30
2.7	The smart book drop	35
3.0	Waterfall Image	38
3.1	Current book drop system in UMP Library	40
3.2	The pie chart of books that not pass using current book Drop	41
3.3	New design for UMP book drop	42
3.4	Use case diagram for book drop systems	44
3.5	Context diagram for book drop	45
3.6	DFD level – 0 in borrowing	46
3.7	DFD level – 1 in borrow and return	47
3.8	DFD level - 0 for librarian	48
3.9	Flow chart diagram for borrower (borrowing)	49
3.10	Flow chart diagram for borrower (returning)	50
3.11	Flow chary diagram for librarian	51
3.12	E-R diagram	53
4.0	Table for book information	60
4.1	Table for borrow book information	61

4.2	Table for user information	61
4.3	Database table in Microsoft visual basic	63
4.4	Database connecter for RFID	63
4.5	Consistency and standard interface	64
4.6	Error prevention interface	65
4.7	Information interface	66
4.8	This is the first interface for admin and patron	67
4.9	Interface home for admin	67
4.10	This interface for the patron	68
4.11	Interface design for admin to fill up book information	68
5.0	Login module	72
5.1	An error message appear when did not enter the ID	72
5.2	Book information module	73
5.3	Information message will be appear	74
5.4	Borrowing interfaces when the patron borrow book	74
5.5	Return book module	75

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Result of book drop	83
B	Questionnaire for PSM research	85
C	Gannt chart PSM 1	86
D	Gannt chart PSM 2	87
E	*User manual*	*88*
F	Question for questionnaire	96

CHAPTER 1

INTRODUCTION

1.0 Introduction

The concept of RFID technology was developed in 1948 but it has had to wait fifty years before it has been able to deliver on its original promise. RFID which is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or responders. RFID is an object that can be applied to or incorporated into a product such as book and the purpose of identification and tracking using radio waves. RFID was then conceived, as the name suggests, as a means of enabling tags to identify themselves to a radio receiver. The tags now come in all shapes and sizes and are attached to a staggering range of items with a wide range of applications from cars (electronic tolls) to earrings (brand protection).

A library is the place where information of data places such as source, thesis, services and the most important is books. Most of the library in a large space because its place all the information. There are a lots of process can be done in the library. The most service been used by customer is borrowing and returning the books. Most of the user, will borrow some of the book as reference at home or room. Because the technology is improved, the library found new technology which is Radio frequency identification and most known as RFID. By using RFID, it will reduce the maintenance and decreased the cost. The implementation of RFID gives benefit to the library and user.

RFID in library been divided into three main part. The first part is the RFID tags, then the second part is the RFID reader and the last part is the antenna. This three part is relay with each other. If one of the parts doesn't work, the system will not fully function. The first part, which is the RFID tags. RFID tags been divided into two; active tags and passive tags. There are differences between both tags. Active tags have a transmitter and their own power source typically a battery. The power source is used to run the microchip's circuitry and to broadcast a signal to a reader the way a cell phone transmits signals to a base station. For passive tags, the function still the same but the specification is different which is Passive tags have no battery. Instead, they draw power from the reader, which sends out electromagnetic waves that induce a current in the tag's antenna.

The second part is the RFID reader. An RFID reader is a device that is used to interrogate an RFID tags. The reader has an antenna that emits radio waves; the tag responds by sending back its data. A number of factors can affect the distance at which a tag can be read. The frequency used for identification, the antenna gain, the orientation and polarization of the reader antenna and the transponder antenna, as well as the placement of the tag on the object to be identified will all have an impact on the RFID system's read range. And for the antenna, it been used to read the radio signals to activate the tag and read and write data to it.

The advantages of the RFID is reduced the cost management. This is because the RFID tag which is passive, have a long time period (10 years). So, there is no need to change the tags eventually. The entire book will be tag with RFID passive tags, and its cost a large amount. But the passive tags it cheap and it also can save the library cost. Both of this reason are the best advantages by apply RFID in the library. RFID tags also can be read automatically when a tagged product comes past or near a reader. This will require scanning product and allowing more proactive and real-time tracking. Otherwise, it also has greater data capacity which item details such as the title of the book, weight and others.

The book drop systems, is the one way of returning the book. This system is one of the advantages for the user and the library. This is because, the book drop can let the users self check out the books without through the counter. In other case, if the book drop is placement outside the library, the users can return the book at any time. And this will make the systems is exactly user-friendly. Beside, librarians are able to allocate more time to customer service, as they are free from the labor-intensive loan cancellation activity associated with barcode system.

In Universiti Malaysia Pahang (UMP) had been began using RFID systems in February 2009. In June 2009 the system was introduced to return the book drop for 24 hours. Book drop is placed at the outside of the library and operate in conjunction with RFID systems. Once applied to the use of book drop found it was unable to process all types of books, especially books lightly. This leads users to a fine due to the delayed return of books in book drop. Based on this statement, its shows that like other university UMP also implement the RFID in the library management.

The new systems will be replaced the current system in order to increased the UMP library management. In addition, the new systems will enhance the book drop RFID system in UMP library. Other than that, the new system also will implement the new interface that replaced the current interface which is more user-friendly.

The new design of the book drop will have the specific requirement such as the parameters of the RFID hardware location. The length of the book drop will be added and the slope also will be increased in order to increase the performance of the book drop. Other than that, the placement of RFID hardware also will be different from the current system. The RFID reader will be place in 1 meter distance from the entrance also from the antenna.

1.1 Problem Statement

1) The current system doesn't detect the certain books that pass through the book drop.

2) The entrance of the book drop doesn't fit the books size.

3) The interface design is not well-defined.

The first problem is, the current system doesn't detect the certain books that pass through the book drop. This problem is the biggest problem occurred in book drop systems. So, it shows that the book drop systems it not fully function at the library. There is the type of the books that can't be detect when it pass through the book drop. The types of the books are light book such as novel or any reference book with lease page. This problem occurred with this basic which is the slope of the book drop, the speed of the book, and the placement of the RFID reader. This three main part are the most important in book drop systems. If one of these parts is not well function, this problem occurred and that make the books can't be read.

The second problem in the book drop systems is, the entrance of the book drop doesn't fit the books size. This problem it's referring to the height of the books. This is other prove that the book drop can't fully function to the user. This problem also makes the user need to go to the counter and manually return it. It's also shows that the book drop is not user-friendly.

The third problem is most of the user doesn't know how to use the book drop even its too simple because the users just need to return the book by insert the book to the book drop. But before that, they need to do some process. Because the interface design is not well-defined, it makes the user not understand on the steps for use the book drop. This will make the user go to the counter and return in by manually which is they have to be in the library and this need to be done during office hour only.

1.2 Objective

a) To develop a system to be more efficient to all types of books that pass through the book drop.

b) To design a book drop with a new measurement based on the height and width of the book in order to make sure all the book can pass through the book drop.

c) To design a book drop interface in order to make it user-friendly.

1.3 Scope of Study

The scope of this project is focus to the:

1.3.1 The library systems

1) The system will used to returning the books.

2) The book drop design will used PVC.

3) The book drop will used 13.56MHz passive tag.

1.3.2 User

1) The user of the system is the staff or the lecturer and students in UMP.

2) The librarian will manage the library system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A review of literature review was performed to identify studies relevant to the topic. The main source for the literature search was the RFID in Logistics: A practical introduction, Boca Raton: CRC Press. Other sources included the RFID: Radio Frequency Identification and RFID Implementation, McGraw-Hill. A combination of the following keywords was used to identify relevant material; RFID application, component of RFID, frequency in RFID, library with RFID, RFID standard, book drop at library. A limited study was found about book drop system in library and most of the studies examined about the RFID in library only. In the UK, Glasgow University Library was the first university library to install RFID (in 2002) and has been joined subsequently by a small number of university libraries including Middlesex and Nottingham Trent University (Matt & Rob, 2006,p: 17). It shows the RFID technology become increasing after the UK, Glasgow University Library

develop it. The emergent themes may be divided into six broad areas: RFID technology, RFID component, RFID standards, related systems and book drop systems.

2.2 RFID Technology

2.2.1 Barcode systems

The best-known and most widespread use of bar codes has been on consumer products used in most grocery industries. In the late 1960s, supermarkets sought to automate point-of-sale information and testing of bar code technologies became paramount. For instance, in 1972 a Kroger store in Cincinnati operated using a bull's-eye code. The need for standardization led to the forming of a committee within the grocery industry to select a standard code to be used within the industry (Erick & Christopher, 2008, p: 5). Unfortunately, printing problem (cost of ink and smearing) and accurate scanning issues prevented the bull's-eye model from achieving commercial success. Ultimately, IBM's UPC model was chosen by the industry. Adopted on April 3, 1973, the UPC revolution inventory tracking and management in the retail world (Steven, 2005, p: 25). This show the technology of barcodes been enhanced from bull's-eye to UPC model.

However, as scanning technology became more common place and cost effective, new uses for it began to emerge. Numerous opportunities presented themselves as possible new application. As new applications emerged, however, they brought with them a new set of challenges. For example some applications demanded a greater working distance between barcode on the product and the reader in the work environment (Steven, 2005, p: 40). To solve this problem, the new technology called Radio Frequency Identification (RFID) been developing.

2.2.2 The Arrival of RFID

RFID has its roots in early military identification systems, and is based on an array technological innovation that began in the early 1940s. The work that most often cited as the first insight into the potential of RFID is Harry Stockman's "Communication by Means of Reflected Power," a paper published in the October 1948 issue of Proceedings of the IRE. In the paper, he discusses the use of a reflected radio signal as a way to identify a remote object based on the reflection signature from the object (Steven, 2005, p: 42). These research shows that the RFID has been found during bar code systems implementation but the technology doesn't been implement yet.

The 1960s were the prelude to the RFID explosion of the 1970s. R.F. Harrington studied the electromagnetic theory related to RFID in his papers including "Theory of Loaded Scatterers" in 1964. Inventors were busy with RFID-related inventions such as Robert Richardson's "Remotely activated radio frequency powered devices," and J. H. Vogelman's "Passive data transmission techniques utilizing radar echoes." (Jeremy, 2005, p: 9).The 21st century opens with the smallest microwave tags built using, at a minimum, two components: a single custom CMOS integrated circuit and an antenna. Tags could now be built as sticky labels, easily attached to windshields and objects to be managed. The use of RFID for electronic toll collection had expanded in the United States to 3,500 lanes of traffic by 2001 (Jeremy, 2005, p: 11). RFID era becomes more expended day by day until now.

2.2.3 Comparison between barcode systems and RFID (Dennis, 2007)

These tables compare between these two technologies of the dynamic data, read range, storage capacity, multiple reads and accuracy.

Table 2.0: The comparisons between barcode systems and RFID

No.	Factor	Barcode Systems	RFID
1.	Dynamic data	• Data cannot be changed once they are printed	• Read-write tags data can be changed and added to after they have been commissioned
2.	Read range	• Usually must be within a few feet of the scanner	• Can be read over much greater distances
3.	Storage capability	• Can store only about 11 characters of useful data	• Can store more data
4.	Multiple read	• Only one can be read at a time	• Multiple RFID tags can be read at one time
5.	Accuracy	• Not accurate	• More accurate

2.3 RFID Component

A basic RFID systems consits of three components:

1. An Antenna or coil

2. A transceiver (reader)

3. A transponder (tag)

2.3.1 Antenna

The function of the antenna is to both transmit and receive electromagnetic signals between the tags and the reader. The effective electromagnetic field that the antenna transmits is in RFID terms known as the interrogation zone. That is, the antenna creates a three-dimensional space that is used to communicate with the RFID tags. In order to obtain successful communication, the tags must be within range of the antenna or in the interrogation zone (Erick & Christopher, 2008, p: 21).

An antenna can be designed based on several factors, such as the following: reading distance of the tag from the reader, known orientation of the tag to the reader, arbitary orientation of the tag to the reader, particular product types, speed of the tagged object, specific operating conditions and reader antenna polarization (Sandip, 2006,p: 12). From this paragraph, it can be prove that the range is not only the factor just like been stated in paragraph one but it also related with other factors.

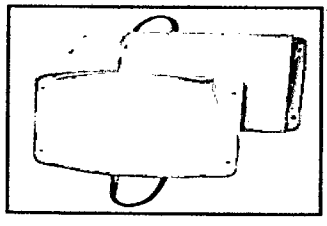

Figure 2.0: RFID Antenna

2.3.1.1 Antenna characteristic (Dennis, 2007)

Table 2.1: Antenna characteristic

Characteristics	Description
Impedance	• The resistance of an electrical component to alternating current. • Measured in ohms. • Important to make sure the device to function (impedance of antenna must match with impedance device).
Polarization	• Move of the wave. • Polarization must be aligned to get the best power transfer between two antennas.
Gain and effective radiated power	• Gain- the measure of antenna performance. • Measured in dB (decibels).
Bandwidth	• Different antenna sizes and configuration behave differently at various bandwidths.
Appearance	• Antenna must fit in with the décor of the surroundings or be unobtrusive