

BOOK RENTAL SYSTEM USING RFID

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Especially dedicate to my lovely father, mother, my whole family members, my friends and my supervisor.

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ABSTRACT

The Book Rental System Using RFID is a system that can reduce the amount of time required to perform the book rental process in the library. This system consists of a RFID tag that is stamped on the back of the books, a RFID card, a RFID reader to interrogate the RFID tag and card, and software to control the hardware and decode the responses from the RFID tag and card. The process of renting books in library using this system is the book borrower will pass through the RFID reader after finishing deciding which book he/she decides to borrow, then the RFID reader will read the RFID tag that is attached to the backside of the books and the RFID card that is attached to the borrower's shirt. The RFID reader will send data to the library software and the software will change the status of the book and the book borrower's data will be stored in the library database. This system makes the book borrower do not need to go to the library counter to borrow the book.

ABSTRAK

Book Rental System Using RFID adalah satu sistem dimana dapat mengurangkan jumlah masa untuk menjalani proses peminjaman buku didalam perpustakaan. Sistem ini terdiri daripada pelekat RFID yang telah diekatkan pada belakang buku di perpustakaan, kad RFID, pembaca RFID untuk berhubung dengan kad dan pelekat RFID, dan sebuah perisian untuk mengawal pembaca RFID serta menyahkod signal dari kad dan pelekat RFID. Proses untuk meminjam buku didalam perpustakaan dengan menggunakan system ini adalah peminjam buku tersebut akan melalui pagar antenna bersama –sama dengan buku yang ingin dipinjam. Semasa melalui pagar antenna tersebut, pembaca RFID akan membaca data pada kad RFID dan pelekat RFID yang terletak pada muka surat terakhir pada buku tersebut. Pembaca RFID akan menghantar data tersebut ke perisian perpustakaan dan perisian perpustakaan akan menukar status individu tersebut kepada peminjam dan status buku tersebut kepada buku yang telah dipinjam. Sistem ini akan membuatkan peminjam buku di perpustakaan tidak perlu untuk pergi ke kaunter perpustakaan untuk meminjam buku.

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LIST OF SHORTFORM

SMA	-	Sub Miniature version A
JTAG	-	Joint Test Action Group
EEPROM	-	Electrically Erasable Programmable Read Only Memory
CMOS	-	Complementary Metal Oxide Semiconductor
DBMS	-	Database Management System

CHAPTER 1

INTRODUCTION

1.1 Background of Project

In general terms, RFID (Radio Frequency Identification) is a means of identifying a person or object using a radio frequency transmission. The technology can be used to identify, track, sort or detect a wide variety of objects. Communication takes place between a reader (interrogator) and a transponder (Silicon Chip connected to an antenna) often called a tag. Tags can either be active (powered by battery) or passive (powered by the reader field), and come in various forms including Smart cards, Tags, Labels, watches and even embedded in mobile phones. The communication frequencies used depends to a large extent on the application, and range from 125KHz to 2.45 GHz. Regulations are imposed by most countries (grouped into 3 Regions) to control emissions and prevent interference with other Industrial, Scientific and Medical equipment (ISM).

Over the years methods for capturing and storing information have evolved from paper and card systems, through keyboard data entry, bar code data capture and are now augmented by technological improvements such as touch screens on the shop floor. All of these initiatives have been aimed at improving accuracy, completeness and timeliness of information. However these all rely on access to a host computer system to make use of data collected.

So, how does RFID differ from other methods of identification and data capture? A typical RFID system is made up of three components: tags, readers and the host computer system.

Tags - An RFID tag is a tiny radio device that is also referred to as a transponder, smart tag, smart label or radio barcode. The tag comprises a simple silicon microchip (typically less than half a millimeter in size) attached to a small flat aerial and mounted on a substrate. The whole device can then be encapsulated in different materials (such as plastic) dependent upon its intended usage. The finished tag can be attached to an object, typically an item, box or pallet and read remotely to ascertain its identity, position or state. With a user memory of 2K bits organized in 64 blocks, the 13.56 MHz card enables advanced solutions in a variety of markets, including access control, security, ticketing, public transportation, production control, warehouse management etc.. This card can be easily customized and personalized using standard thermo transfer printers. In applications where the card needs to be used with a clip, we recommend a pouch since punching a hole would destroy the product. In addition to the functionality defined in the ISO/IEC 15693 standard, the Vicinity Card Transponder also supports an extended set of command options, providing more system flexibility.

Readers – The reader, sometimes called an interrogator or scanner, sends and receives RF data to and from the tag via antennae.

A reader may have multiple antennae that are responsible for sending and receiving radio waves. The readers can be fixed or mobile, can read information stored on the tags and write information to them. This can be achieved without direct line of sight and in environments where traditional data collection could not operate. A major advantage is that information can be written to the tag multiple times so storing a history that travels with the article. RFID readers were once designed to only read one type of tag, passive or active. Due to the expense and ubiquity of readers in today's society readers are becoming more flexible and can read many different types of tags. Like tags, readers also come in several different sizes. The smallest reader is the size of a postage stamp; the largest is the size of a desktop computer. RFID readers are normally on at all times seeking out a radio signal from a tag. Once

a signal is detected the reader will send out message to the tag. If the tag is promiscuous the reader will instantly be able to access the information on the tag and read it. If the tag is secure, the reader will be required to send a password, or a code to unlock the information written on the tag. Once the proper code is sent the tag's information will become accessible. When readers and tags communicate the only information being sent between the two are number schemes. Number schemes located on RFID tags range from 64 bits to 96 bits of memory. When the reader receives this number it is sent to a computer network that will decode the numbering scheme. For example, in the Mobile SpeedPass system once a tag's serial number is sent to the reader it will be connected to Mobile's payment network. The serial number will access the payment account set up previously with Mobile and the user will be approved and payment transaction completed.

	Low Frequency	High Frequency	Ultra High Frequency	Microwave
Frequency Range	125 – 134 KHz	13.56 MHz	866 – 915 MHz	2.45 – 5.8 GHz
Read Range	10 cm	1 m	2 – 7 m	1 m
Application	Smart Cards, Ticketing, animal tagging, Access Control	Small item management, supply chain, Anti-theft, library, transportation	Transportation vehicle ID, Access/Security, large item management, supply chain	Transportation vehicle ID (tolls), Access/Security, large item management, supply chain

Figure 1.1: Table of RFID reader types.

Host Computer – The data acquired by the readers is then passed to a host computer, which may run specialist RFID software or middleware to filter the data and route it to the correct application, to be processed into useful information.

The usages of RFID are very wide nowadays, because it is very useful to enhance the security in a library and also can increased efficiency and productivity. This project is about to develop a book rental system using RFID, that's mean the process of borrowing books in a library. The conventional style of process borrowing books in a library is:

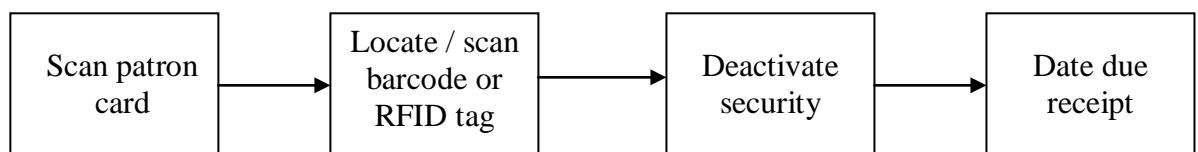


Figure 1.2: Conventional style of process borrowing books block diagram.

It is a four step process and it is tedious and slow. This conventional style will take time and lead to inefficiencies and lead to the long queue of book borrower and also unsatisfactory feeling of the book borrower. The Book Rental System Using RFID can overcome this problem by reducing the step of the conventional borrowing process into one step which is scanning the borrower RFID card and RFID tag at the book. The concept of Book Rental System Using RFID is the borrower don't need to go to the libraries counter to borrow book but passing through the antenna gate with the book that he/she want to borrow. While passing through the antenna gate, the borrower's card and the book's tag will be activated than transmitted the data to the antenna. The antenna will detect the data and send it to the reader and the reader will interrogate the data before send the data to the library software to decoding the responses from tag and change the status of the book and the book's borrower. The RFID tag and RFID card that were used in this project is a passive type with frequency 13.56 MHz and the RFID reader is a HF type with 13.56 MHz frequency.

1.2 Objectives of Project

The aims of doing this project are stated below;

1. To develop a detection system by using a software (MS Visual Basic 6) and hardware (RFID).
2. To interface the software and hardware detection system.
3. To implement the detection in library.

1.3 Scopes of Project

This research will develop hardware and software that could be used to optimized the process of borrowing book in library. The components that will be used for this project are:

1. 13.56 MHz RFID module.
2. 13.56 MHz passive RFID tag and card.
3. Microsoft Visual Basic 6.
4. USB port.

The scopes of tasks are stated below:

1. Develop the 13.56 MHz RFID reader.
2. Develop the library software using Microsoft Visual Basic 6.
3. Interface between the hardware and library software using USB port.
4. Test the connection between the hardware and software after all design was completed.
5. Design the gate entrance.

1.4 Outline of Thesis

This thesis consists of five chapters. The first chapter discuss about background, objective and scope of this project. Chapter two discuss more on theory and include literature reviews that have been done. It also will discuss on components of the hardware and software used in this project. Chapter three discuss on the methodology hardware and software development of this project. Chapter four will discuss about project's testing and results. Finally in chapter five it will discuss about conclusion and future work proposal for the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Literature Review Overview

This chapter discuss about reviews of existing project created to get an idea about the project design, conception and any information that related to improve the project. With different concept and design, there are other creations and innovations of projects done by other people. Researches related to this project also covered in this chapter.

2.2 Library RFID Management System

The Library RFID Management System was a creation of BookTec Information Co that to make a library fully equipped with RFID technology. In this system, they has made The Patron Self check out station which every book borrower can register their name and the book into the library system by their self without seeing the librarian at the counter.



Figure 2.1: Patron Self Check-out station.

The Patron Self Check-out station is basically a computer with a touch screen and a built-in RFID reader, plus special software for personal identification, book and other media handling and circulation. After identifying the patron with a library ID card, a barcode card, or his personal ID number (PIN), the patron is asked to choose the next action (check-out of one or several books). After choosing check-out, the patron puts the books in front of the screen on the RFID reader and the display will show the book title and its ID number (other optional information can be shown if desired) which have been checked out.

The patron then confirms that he/she has finished the check-out process and a receipt is printed, showing which books have been borrowed and the return date. The RFID tag in the book is set on quiet as a result no alarm will go off at the EAS gates. It is also possible to use the station for Check-In (return) of books. In this case the patron identifies herself, chooses return and then puts one book or a stack of books onto the reader. The borrower will receive a receipt. If the books were to be taken through the gate now, an alarm would sound.

One important point for library productivity is that the whole process is significantly less time consuming than with barcode and magnetic strip system; therefore long lines are avoided and fewer stations are needed for the same process.