



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF DATABASE SYSTEM FOR AUTOMATED  
STORAGE RETRIEVAL SYSTEM USING RFID TECHNOLOGY**

This report submitted in accordance with requirement of the Universiti Teknikal  
Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering  
(Robotic and Automation) with Honours

by

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I hereby, declared this report entitled “Development of Database System for Automated Storage Retrieval System using RFID Technology” is the results of my own research except as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic and Automation) with Honours. The member of the supervisory committee is as follow:

(Signature of Supervisor)

.....

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## **ABSTRACT**

Nowadays, competition between manufacturers is very challenging. To continue survive in the field of manufacturing, a lot of investment in new technology has been added to improve production. Besides, efficiency and reducing time of store materials in the deposited also very important because it involves high cost. Automated Storage Retrieval System (ASRS) has been stealing the focus to the manufacture how to apply them as alternative to conventional storage of goods. Most ASRS based infrared and barcode as a tool in their technology. Use of Radio Frequency Identification (RFID) can replace the bar code capabilities. To obtain a good impact, database systems to record the necessary data and find goods that are deposited in the store are required. Therefore, the ideas of “Development of Database for Automated Storage Retrieval System using Radio Frequency Identification Technology” were developed to find and create a system that can help manufacturer stored their product more faster and effectively compare by using barcode system. The use of barcode becomes very complicated when the industry wants to build a particular product ID. The memory exist in RFID tag can easily store any require data or number so that it’s become increase in the current trend. In this thesis, overall processes from initial stage until finish will explain to facilitate the readers understand this project.

## **ABSTRAK**

Pada masa kini, persaingan di antara pengilang- pengilang adalah sangat hebat. Untuk terus bertahan dalam bidang pembuatan, banyak pelaburan terhadap teknologi terkini telah di buat bagi meningkat kan pengeluaran produk. selain itu kecekapan dan pengurang masa terhadap penyimpanan bahan- bahan ke dalam setor juga amat penting kerana ia melibatkan kos yg tinggi. Automated Storage Retrieval System telah mencuri tumpuan para pengilang untuk mengaplikasikannya sebagai alternatif kepada cara penyimpanan barang konvensional. Kebanyakan ASRS berasaskan infra merah dan kod bar sebagai peranti di dalam teknologi mereka. Penggunaan Radio Frequency Identification (RFID) dapat menggantikan keupayaan kod bar. Bagi mendapatkan impak yang baik, satu sistem penyimpan data perlu di wujudkan untuk merekod dan mencari barang-barang yang berada di dalam setor. Oleh itu, kajian terhadap "Development of Database for Automated Storage Retrieval System using Radio Frequency Identification Technology" dibangunkan bagi mencari dan mencipta sistem yang boleh membantu para pengusaha untuk menyimpan produk mereka dengan cepat dan efektif berbanding penggunaan barcode. Penggunaan barcode menjadi sangat rumit apabila pihak industry ingin membina satu ID untuk sesuatu produk. Simpanan data yang terbina siap di dalam tag RFID telah memudahkan untuk menyimpan data atau nombor yang diinginkan maka ia menjadi pilihan bagi pasaran sekarang. Didalam tesis ini juga, bermula dari kajian di peringkat awal hingga akhir diterangkan bagi memudahkan pembaca memahami projek ini.

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# TABLE OF CONTENT

Declaration	i
Approval	ii
Abstract	iii
Abstrak	iv
Acknowledgment	v
Table of Content	vi
List of Tables	x
List of Figures	xi
List Abbreviations	xiv
<b>1. INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem Statement	3
1.3 Objective	3
1.4 Scope	4
1.5 Significance	4
1.6 Justification	5
1.6.1 Previous Research	5
1.6.2 The Gap	6
1.7 Project Schedule	7
<b>2. LITERATURE RIVIEW</b>	<b>10</b>
2.1 Introduction	10
2.2 Database	11
2.2.1 Introduction and History	11
2.2.2 Studies of Database System	11
2.2.3 Visual Basic.Net	15
2.2.4 Microsoft Access	17



2.2.5	Conclusion of Database Review	19
2.3	Automated Storage Retrieval System	20
2.3.1	Introduction and History	20
2.3.2	Studies of Automated Storage Retrieval System	21
2.3.3	Conclusion of ASRS review	29
2.4	Radio Frequency Identification	30
2.4.1	Introduction and History	30
2.4.2	Studies of Radio Frequency Identification	35
2.4.3	Type of Tags	36
2.4.4	Tags Classes	39
2.4.5	ISO Standard	40
2.4.6	Advantages of RFID	41
2.4.7	Disadvantages of RFID	42
2.4.8	Conclusion of RFID review	43
<b>3.</b>	<b>METHODOLOGY</b>	<b>44</b>
3.1	Introduction	44
3.2	General Research Strategy	44
3.2.1	Project Research	46
3.2.2	Problem Statement	46
3.2.3	Proposal Submit	46
3.2.4	Writing Report	46
3.2.5	Information Sources	47
3.2.6	Development	47
3.2.7	Finalize, Modification and Troubleshoot	47
3.2.8	Testing	47
3.2.9	Report Submit	47
3.2.10	Project Presentation	48
3.3	Specific Research Strategy	48
3.3.1	Radio Frequency Identification	51

3.3.2	Database	54
3.3.3	Automated Storage Retrieval System	59
<b>4.</b>	<b>DESIGN AND DEVELOPMENT</b>	<b>60</b>
4.1	Introduction	60
4.2	Development of Interface	60
4.3	Development of Database	66
4.4	Development of Hardware	69
4.5	Project Setup	71
4.6	Sequence Process Flow for Overall System	75
<b>5.</b>	<b>ANALYSIS, RESULT AND DISCUSSION</b>	<b>77</b>
5.1	Introduction	77
5.2	Distance analysis	77
5.2.1	Result for Distance Analysis	79
5.2.2	Finding of Distance Analysis	81
5.3	Tag Orientation Analysis	82
5.3.1	Result for Orientation Analysis	84
5.3.2	Finding of Orientation Analysis	85
5.4	Position Analysis	86
5.4.1	Result for Position Analysis	88
5.4.2	Finding of Position Analysis	88
<b>6.</b>	<b>CONCLUSION AND RECOMMENDATION</b>	<b>89</b>
6.1	Overview	89
6.2	Conclusion	89
6.3	Recommendation	90
	<b>REFERENCES</b>	<b>91</b>
	<b>APPENDICES</b>	

- A Mechanical Design of RFID Reader
- B Error Code
- C Baud Rate Setting
- D The Relation of Frequency and Channel Number
- E Confidex Manual
- F Coding

## LIST OF TABLES

1.6.1	Previous Research	6
1.6.2	Gantt Chart PSM 1	8
1.6.3	Gantt Chart PSM 2	9
2.3.1	Solvable special cases of the basic sequencing problem for unit-load ASRS	22
2.3.2	Methods for dynamic sequencing of unit load ASRS	22
2.4.1	Chronology of RFID	31
2.4.2	The Technical Differences between Active and Passive RFID Technologies	38
2.4.3	The Functional Capabilities Differences between Active and Passive RFID Technologies	38
2.4.4	The Tag Classes	40
2.4.5	Defining Air Interface for RFID Devices in ISO/IEC 18000 Series	41
3.3.1	RFID tags specification	51
3.3.2	RFID reader specification	52
5.2.1	Data record for distance analysis	80
5.3.1	The read rate comparison between horizontal and vertical	83
5.3.2	Orientation Analysis result	84
5.4.1	The read rate interpretation	88

## TABLE OF FIGURES

2.2.1	Real-time Database Architecture for QoS Guarantee	12
2.2.2	A contain of spatial database	13
2.2.3	MySQL architecture	14
2.2.4	A database includes stored data and data access software	15
2.2.5	A data cube holds data defined by multi-dimensional axes	16
2.2.6	The Ms Access database objects	18
2.3.1	Key differences between ASRS and AVSRS system configurations	23
2.3.2	Illustration of AVS/R system including vehicle and lift mechanism	24
2.3.3	Schematic plan layout of the ASRS	25
2.3.4	Perspective view of the ASRS	26
2.3.5	Schematic of the storage operation	27
2.3.6	Illustration of the retrieval operation	28
2.3.7	Illustration of the order picking operation	28
3.2.1	The diagram of process flow in general	45
3.3.1	Process flow of the system	49
3.3.2	The process flow diagram	50
3.3.1	RS-232 and Power Connections	53
3.3.2	RS-232 Connector	53
3.3.3	Starting Visual Basic	55
3.3.4	New Project pop-up window	56
3.3.5	New Form window open	56
3.3.6	Starting Microsoft Access window	57
3.3.7	Create a file name	57
3.3.8	New Table open.	58
3.3.9	Design View button	58

3.3.10	Data filled	58
3.3.11	An ASRS flow process	59
4.2.1	Origin interface provide from vendor	61
4.2.2	Edited interface with save button	61
4.2.3	Command language for Save button	62
4.2.4	Data captured and stored in text file.	63
4.2.5	Main window for user interface.	63
4.2.6	Command language for Update Out button	64
4.2.7	Command language for Update In button	65
4.2.8	The Category window	66
4.2.9	The Manage Lot window	66
4.3.1	Category table inside database	67
4.3.2	Part master table	67
4.3.3	Lot table	68
4.3.4	Part Transaction table	69
4.4.1	Technical drawing using Solidwork	70
4.4.2	Actual door frame	70
4.5.1	View of complete setup	71
4.5.2	Detail view of Hardware	72
4.5.3	Setting for connection mode and IP address	73
4.5.4	Setting for antenna selection	73
4.5.5	Setting for IP address of computer (host)	74
4.5.6	Observation when the Start button was clicked	75
4.6.1	Process flow for user guiding	76
5.2.1	Condition of system during distance analysis	78
5.2.2	Screenshot for Test 1	79
5.2.3	Graph Reading versus Distance	80
5.3.1	Horizontal condition	82
5.3.2	Vertical condition	82
5.3.3	Detail screenshot for Orientation Analysis	83

5.3.4	Graph Reading Rate versus Test Number	84
5.4.1	Outside view of template box	86
5.4.2	Several views in Position Analysis	87
5.4.3	The screenshot taken after a minute	87

## LIST OF ABBREVIATIONS

AGV	-	Automated Guided Vehicle
ASRS	-	Automated Storage Retrieval System
AVSRS	-	Automated Vehicle Storage Retrieval System
DBMS	-	Database Management System
FCFS	-	First Comes First Served
IC	-	Integrated Circuit
I/O	-	Input/ Output
IP	-	Internet Protocol
LAN	-	Local Area Network
P&D	-	Pickup-and-Deposit
QoS	-	Quality of Service
PSM	-	Projek Sarjana Muda
RGV	-	Rail Guided Vehicle
RFID	-	Radio Frequency Identification
SCM	-	Supply Chain Management
SDK	-	Software Development Kit
S/R	-	Storage/ Retrieval
UHF	-	Ultra High Frequency
VB	-	Visual Basic



# **CHAPTER 1**

## **INTRODUCTION**

This chapter begins with background of storage system in manufacturing. This thesis concerned with the database system and will discuss application of Radio Frequency Identification (RFID) in Automated Storage and Retrieval System (ASRS). Later, the thesis will identify the advantage of RFID in manufacturing sector.

### **1.1 Background**

Groover (2007) stated that the function of storage system is to store material for a period of time and to permit access to those materials when required. Materials stored by manufacturing firms include a variety of types. It categories into three sections with relate directly to the product, relate to the process and relate to overall support of factory operation. The types of storage and methods were dividing into conventional and automated types. In conventional storage, it has four different storage equipments which refer to typical applications. The types are bulky storage, shelves and bins, rack systems and drawer storage. An automated storage system represents a significant investment, and it often requires a new and different way of doing business. It was separated into two general types that are automated storage and retrieval systems and carousel storage systems.

This thesis involves in Automated Storage and Retrieval System (ASRS) to implement RFID technology which result to increase the performance of storage system. While

older technology that use barcode in ASRS was increased the productivity however by upgrading to RFID which make ASRS become greater efficiency and more facilitate. Groover (2007) acknowledged ASRS is a storage system that performs storage and retrieval operation with speed and accuracy under a defined degree of automation. ASRS consists of rack structure for storing loads and a storage/retrieval mechanism whose motions are linear (x-y-z motions). It also consists of one or more aisle that is each serviced by a storage/retrieval (S/R) machine (the S/R machines are sometimes referred to as cranes). The aisles have storage racks for holding the stored materials. The S/R machines are used to deliver materials to the storage racks and to retrieve materials from the racks. Each ASRS aisle has one or more input/output stations where materials are delivered into the storage system or moved out the system. The input/output stations are called pickup-and-deposit (P&D) stations in ASRS terminology.

In other view, RFID technology can be alternative the used of barcode. RFID can reduce a cost and increase flexibility when it integrated with ASRS. Mark Brown (2007) defines RFID technology belongs to a broader group of technologies known as Auto-Identification (Auto-ID). RFID encompasses technologies that use electromagnetic (radio) waves, part of electromagnetic spectrum, to identify individual items, places, animals or people. RFID can be appropriately implemented for many uses. The most common is to use an identifying number that uniquely identify an object, place, animal or person. The number is stored on an integrated circuit (IC) that is attached to an antenna. Together, the IC and the antenna are called as RFID transponder or tag. The tag is attached to the object, place, animal or person to be identified. A device called interrogator or reader communicates with the tag and is use to read the identifying number from the tag. The reader feeds the number it reads into an information system, which store the number in its database or search it database for the number and returns information stored within about the object, place, animal or person.

In order to connect within the ASRS and RFID, this system requires a database that consists of interface and spreadsheet. Molina H.G. (2008) quoted a database is nothing

more than a collection of information that exists over a long period of time, often many years. In common parlance, the term database refers to a collection of data that is managed by a database management system. Molina also quoted a famous paper written by Ted Codd (1970), database systems changed significantly. Codd proposed that database systems should present the user with a view of data organized as tables called relations. Behind the scenes, there might be a complex data structure that allowed rapid response to a variety of queries. Database systems become a major role to this project. The fully utilization of the system will determine success in this project.

## **1.2 Problem Statement**

Productivity becomes the important thing in every manufacturing to survive and compete within each other. Highest request from customer needs the company to prepare and have efficient inventory management system. Today, many multinational manufactures have expensive inventory control such as Automated Storage Retrieval System and Carousel Storage System but they didn't use the RFID technology to implement at the entrance of storage. They mostly still used barcode as we know the barcode have some weaknesses. Efficient database also plays an important role in a company. Use paper to record is not very appropriate at present. So, database is needed as the correct solution.

## **1.3 Objective**

- a. To study and analyze the knowledge of RFID and its application into the storage system
- b. To develop a database for storage system.
- c. To interfacing the RFID which connect to database system so every product movement (in / out) will record automatically.

## **1.4 Scope**

Due to the scope of this thesis, there are a number of research limitations. These limitations lead to areas in which further research can be conducted and may be suitable for other thesis. The scope will result in a lack of quantitative data to prove specific findings such as how many companies are using RFID in SCM or exact cost savings realized by corporations. The thesis will not be investigating issues such as society's privacy concerns. Privacy advocates ensure that privacy related RFID issues remain at the forefront of the industry. The concerns of these groups need reviewing to decipher the extent to which privacy regulations may limit the use of RFID.

## **1.5 Significance**

A database system can provide a manufactures and its supply chain partners with a significant competitive advantage, which can fully justify the investment of money and time. A fully functional database system is capable of enhancing the company capability to fully utilize capacity, accurately schedule production, meet delivery due date and enhance the efficiency. Barcodes have become a universal tool used by organizations in supply chain management (SCM) since the early 1970s and it is now a multi-billion dollar business. However, mounting pressure from a variety of areas is driving organizations to further increase efficiency, which has lead to the rise of RFID. Financial markets demanding that companies use capital more efficiently and with the advent of new technologies such as the Internet, consumers now have the ability to compare prices around the globe, sparking a price war among retailers. Business need to be mindful of this trend as it will inevitably lead to tighter profit margins. The study of the RFID in inspection system is a very broad topic because the study consists of three main fields of engineering, which is mechanical, electrical, and information technology (programming). Firm knowledge on these three disciplines is compulsory in order to develop the automated storage and retrieval system base RFID technologies. RFID

offers a completely new range of applications that vendor claim will lead to improved SCM. While there have been many successful rollouts of RFID technology, few have been related to ASRS. Those applications that have been for SCM purposes have typically been used exclusively for internal organizational purposes such as asset management. There is still reluctance in the business community to invest large amounts of capital in such new technology that is yet to prove itself in the long-term. Compounding this reluctance is the fact that many of these businesses have invested heavily in legacy barcode systems. There is a preference to use a cautious approach, waiting to see what global business leaders do. This is particularly evident in smaller companies, who are delaying announcements regarding the new technology.

## **1.6 Justification**

### **1.6.1 Previous Research**

An initial review of the literature identified few papers in the area, as the technology is relatively new. Some of the works reviewed have been cited in Table 1.1. Numerous articles cover ASRS or barcode technologies but fall short of exploring the complementary relationship that they share. An example of this would be Po-Hsun Kuo, or Heung Soon Felix Lee and Samantha K. Schaefer, both thoroughly covering ASRS equipment and its implementation, but failing to discuss about the database that used in ASRS. Similarly, the SoftChain whitepaper talks about the need to improve SCM and the areas where inefficiencies are common, but aside from it suggesting its SCM software, it does not delve into the technologies that will allow the discussed improvements to ASRS.

**Table 1.6.1:** Previous Research.

<b>Topic</b>	<b>Author</b>
ASRS	Po-Hsun Kuo (2004); Heung Soon Felix Lee and Samantha K. Schaefer (1996); Kees Jan Roodbergen and Iris F.A. Vis (2006)
SCM Concepts	Aedy (2004); AP White Paper (2002); Mcnerney (2003); SoftChain (2002); Kumar (2001); Tompkins (2003); Wu & Ulieru (2000).
RFID Technology	Ames ed. (1990); Boone (2003); Finkenzeller (1999); Gerdeman (1995); Hudson (2004); Masters (2003); Michael (2003); Savi Technology (2002); Zebra Technologies (2004).
Database	Brown (1997); Cohen (1994); Collins & Whipple (1990); Geers (1994); Harmelink (1993); Hind (1994); LaMoreaux (1998); Vernon (2003); Wenter (1994).

### **1.6.2 The Gap**

There is a lack of research, especially of an academic nature, which covers the implement of existing database system and emerging RFID technology, in relation to ASRS technology. The vast majority of articles are whitepapers written by industry players who have a vested interest in promoting their products and services to industries. These whitepapers do not support recognized research methods and lack academic review. Many of the other reviewed works delve into niche topics or are too general. This thesis will make its contribution in bringing all the important issues together. This research is important as it intends to clearly address the gap in current literature and identify the database system for ASRS. It will also identify how the deployment of RFID will converge or coexist with ASRS and will also refer to the need for a global standard such as the EPC Standard.

## **1.7 Project Schedule**

The detail of the project schedule is in Gantt chart below (table 1.6.2). The Gantt chart shows about the planning and flow of Projek Sarjana Muda 1 (PSM 1). This Gantt chart shows the required topics, action and time needed in order to fulfill the project scopes and objectives.

**Table 1.6.2:** Gantt chart for PSM 1

No	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Title														
1	Brainstorming	■													
2	Proposal		■	■											
3	Literature Review				■	■	■								
4	Research Methodology							■	■						
5	Report PSM 1									■	■	■			
6	Presentation Preparation												■	■	
7	Presentation														■
8	Project Starting														■
9	Log book					■	■	■	■	■	■	■	■	■	■