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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FACULTY OF MANUFACTURING ENGINEERING
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TAJUK: Development of Database System for Automated Storage Retrieval System Using RFID Technology

SESU PENGAJIAN: 2009/10 Semester 2

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Author’s Name :  SOFIAN BIN ABD SAMAD
Date :  9th APRIL 2010
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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(Official Stamp of Supervisor)
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

ACKNOWLEDGEMENT

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<tr>
<td>AGV</td>
<td>Automated Guided Vehicle</td>
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<td>ASRS</td>
<td>Automated Storage Retrieval System</td>
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<tr>
<td>AVSRS</td>
<td>Automated Vehicle Storage Retrieval System</td>
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<td>DBMS</td>
<td>Database Management System</td>
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<td>FCFS</td>
<td>First Comes First Served</td>
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<td>IC</td>
<td>Integrated Circuit</td>
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<td>I/O</td>
<td>Input/Output</td>
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<td>IP</td>
<td>Internet Protocol</td>
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<td>LAN</td>
<td>Local Area Network</td>
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<tr>
<td>P&amp;D</td>
<td>Pickup-and-Deposit</td>
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<td>QoS</td>
<td>Quality of Service</td>
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<td>PSM</td>
<td>Projek Sarjana Muda</td>
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<td>RGV</td>
<td>Rail Guided Vehicle</td>
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<td>RFID</td>
<td>Radio Frequency Identification</td>
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<td>SCM</td>
<td>Supply Chain Management</td>
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<tr>
<td>SDK</td>
<td>Software Development Kit</td>
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<td>S/R</td>
<td>Storage/Retrieval</td>
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<tr>
<td>UHF</td>
<td>Ultra High Frequency</td>
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<td>VB</td>
<td>Visual Basic</td>
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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>
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<td>Brown (1997); Cohen (1994); Collins &amp; Whipple (1990); Geers (1994); Harmelink (1993); Hind (1994); LaMoreaux (1998); Vernon (2003); Wenter (1994).</td>
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### 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

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