UNIVERSITI TEKNIKAL MALAYSIA MELAKA

RFID BASED DOOR ACCESS SYSTEM

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

NURHIDAYAH BT AZMI

FACULTY OF MANUFACTURING ENGINEERING

2010
TAJUK: RFID BASED DOOR ACCESSS

Sesi pengajian: 09/10 semester 2

Saya NURHIDAYAH BT AZMI mengaku membenarkan laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kewgunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka di benarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukara antara institusi pengajian tinggi.
4. **Sila tandakan (  

   [☐] SULIT (mengandungi maklumat yang berkaita keselamatan serta kepentingan Malaysia yang termaktub dalam AKTA RAHSIA RASMI 1972) 

   [☐] TERHAD (mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan dimana penyelidikan telah dijalankan) 

   [☐] TIDAK TERHAD

   Disahkan Oleh:

Alamat tetap: 1-1. Blok F, Jalan 3, taman seri serdang, 13200 kepala batas, Penang

cop rasmi:

Tarikh: ___________________________  Tarikh: ___________________________
DECLARATION

I hereby, declared this report entitled “RFID BASED DOOR ACCESS SYSTEM” is the results of my own research except as cited in references.

Signature:

Author’s Name: NURHIDAYAH BT AZMI
Date: 15th APRIL 2010
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 follows:

Signature of Supervisor

-----------------------------------------------

(OFFICIAL STAMP OF SUPERVISOR)
ABSTRACT

Door is key way to access space or area. Reason to use the door was to improve security level for that area. In keeping with technological development for this time, way to access door also increasingly grows aimed to improve efficiency, security and reduce cost. Among technology that used and more commonly used is RFID, Radio Frequency Identification. RFID is technology which uses radio frequency aimed to identify and track. RFID owns a few important equipments which are tag, antenna and tag reader. Tag can be read from several centimeters and also can be read from afar until several meters depend to the radio frequency type used. Tag is vital because it keep all information of object that will in trace where all the information will keep in the memory. RFID reader is tool used by radio waves to connect RFID to one readable signal form by middleware software. RFID tag's reader use antennas to communicate with RFID chip. Reader's need vary depending in consumption purposes, and almost all purpose will need various forms readers to make. Each high technology system commonly will be having supervision system to make system that more efficient. For this project the supervision system will use Microsoft Access 2008 to build database and Visual Basic 2008 to make programmed for RFID tag. Both programs will be consolidated to aim for surveillance to access that door.
ACKNOWLEDGEMENT

Bismillahirrahmanirrahim, in the name of Allah s.w.t the most gracious, the merciful, and to our prophet Muhammad s.a.w. Alhamdulillah, at last I have finished my final year project report 1 after struggling to complete it.

I would like to thank to my project supervisor, Mr. Lokman b. Abdullah for his kindness, comments, support and concern in helping me in completing this report. He also gives me his suggestions to do the project on schedule and thanks for his patience. Although he has busy with his job but he still spends time to teach me about this project. Without him, I will face difficulty in completing this project.

Lastly, thanks to my lovely parents and also my friends for giving much and good supporting times to help me to finish this project and project report. Without them, it is so hard for me to complete this project.

Finally, I would like to thank for those individuals who have shared their suggestions and evaluations of this project.
DEDICATION

Special dedication to:
All my family members who are always concern, understanding, patient and supporting me. This project and success will never achieve without all of you.
TABLE OF CONTENT

ABSTRACT (ENGLISH VERSION) i
ABSTRACT (MALAY VERSION) ii
ACKNOWLEDGEMENT iii
DEDICATION iv
TABLE OF CONTENT v
LIST OF TABLE vii
LIST OF FIGURE viii
LIST OF ABBREVIATION x

CHAPTER 1: INTRODUCTION
1.1 Background 1
1.2 Problem Statement 2
1.3 Project Objectives 2
1.4 Scope 3
1.5 Project Planning 3
1.6 Structure of the Report 4

CHAPTER 2: LITERATURE REVIEW
2.1 Introduction 5
2.2 Historical development 7
2.3 Application 12
2.4 Operational description of RFID system 15
2.5 Related component and software 17
2.6 Advantages and disadvantages of RFID 27
CHAPTER 3: METHODOLOGY
3.1 Project Planning 29
3.2 Process Implementation 39

CHAPTER 4: DESIGN AND DEVELOPMENT
4.1 Designing The User Interface Of RFID Door Access 41
4.2 Designing The Project Setup Of RFID Door Access 44
4.3 Develop The User Interface Of RFID Door Access 46
4.4 Designing The Project Setup Of RFID Door Access 49

CHAPTER 5: RESULT, ANALYSIS AND DISCUSSION
5.1 Door Access Programming And Database 52

CHAPTER 6: CONCLUSION AND RECOMMENDATION 56

REFERENCE 57

APPENDICES
A Gantt chart PSM 1 58
B Gantt chart PSM 2 59
C Visual Basic 2008 Coding 60
LIST OF TABLE

Table 2.1: Historical development
Table 2.2: Comparison of Various Access Control Methods
Table 2.3: Examples of application in supply chain automation
Table 2.4: Examples of application in asset tracking
Table 2.5: Examples of application in people tracking
Table 2.6: Summary of selected tag attributes and compares their common characteristics
Table 2.7: Summary of Characteristics and Applications of Most Popular RFID Frequency Ranges.
LIST OF FIGURE

Figure 2.1: IFF Components 11
Figure 2.2: Milestones during the Early Days of RFID 11
Figure 2.3: Connection between Tag, Reader, and Antenna 16
Figure 2.4: RFID System Components 16
Figure 2.5: Basic RFID system 16
Figure 2.6: Typical passive tag and a photo of a partial tag microchip design 18
Figure 2.7: Some Typical Passive RFID Tags with Antenna Highlighted 24

Figure 3.1: Process Flow Chart Diagram 30
Figure 3.2: Development Flow Chart Diagram 33
Figure 3.11.1(a): Startup Window Visual Basic 2008 36
Figure 3.11.1(b): To Create Form Visual Basic 2008 37
Figure 3.11.1(c): Toolbox Toolbar 38
Figure 3.11.1(a): Common Control 38
Figure 3.10: Process flow chart 39
Figure 3.11: Door access equipments arrangement 40

Figure 4.1.1 a (a): First Design of User Interface 42
Figure 4.1.1 a (b): First Design of Administrator Database 42
Figure 4.1.1b (a): Second Design of User Interface 43
Figure 4.1.1b (b): Second Design of Administrator Database 43
Figure 4.2: Project Setup 45
Figure 4.3: Form View of User Interface 46
Figure 4.3.1 (a): Table View for card form 47
Figure 4.3.1 (b): Form View Of Card 47
Figure 4.3.1(c) : Table View Door
Figure 4.3.1 : Form View Of Door
Figure 4.3.1 : Table View Of CardDoor Manage
Figure 4.3.1 : Form View Of CardDoor Manage
Figure 4.4.1 : Window View of System properties
Figure 4.4.2 : Window View Of MyComputer
Figure 4.4.4: Window View Sharing and Security properties
Figure 5.1.1: Form View of User Interface
Figure 5.1.2: Access Authorized
Figure 5.1.3: Access Not Authorized
Figure 5.1.4: Form View of Administrator Interface and Database
Figure 5.1.5: Complete Flow of RFID Door Access System
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
</tr>
<tr>
<td>AIDC</td>
<td>Automated Identification and Data Capture</td>
</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>AVI</td>
<td>Automated Visual Inspection</td>
</tr>
<tr>
<td>EPC</td>
<td>Electronic Product Code</td>
</tr>
<tr>
<td>UHF</td>
<td>Ultra-High Frequency</td>
</tr>
<tr>
<td>UPC</td>
<td>Universal Product Code</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>HF</td>
<td>High Frequency</td>
</tr>
<tr>
<td>LF</td>
<td>Low Frequency</td>
</tr>
<tr>
<td>VB</td>
<td>Visual Basic</td>
</tr>
</tbody>
</table>
CHAPTER 1
INTRODUCTION

This chapter presents the general ideas of the research. There are basically contain six main sections in this chapter, such as background, problem statement, research objectives, research scopes, importance of the research and structure of report.

1.1 Background

Door is a moveable barrier used to cover an opening. Doors are used widely and can be opened to give access and closed more or less securely using a combination of latches and locks. Doors are nearly universal in buildings of all kinds, allowing passage between the inside and outside, and between internal rooms. The doors also used to screen areas of a building for aesthetic purposes, keeping formal and utility areas separate.

Nowadays, RFID card keys became popular as a replacement for traditional access control mechanisms such as metallic keys and combination locks. RFID also called contactless smart cards that provided information about the user and offered a more personalized method of access control, while being inexpensive to produce and program.
1.2 Problem Statement

The conventional way to access the door such as using key can easily to duplicate or steal by thief. Keys cannot control when (time and days) personnel are valid. Keys do not provide with any information of when and where someone has gained access.

At some places there were using the door guard to observe the people who are in or out from the building. Guard can only be at one place at one time. Guard can be absent or late. Records can be inaccurate or difficult to read (who, when, where), if records are kept at all. A guard service is very expensive.

By the way to improve the security when accessing the door the changes has to be made. The method must be efficiently and cost effectively reducing and preventing crime as much as possible. It also can improve the quality of the living environment for residents by reducing all forms of anti-social behavior as much as possible. By employing modern technology to fight against crime to ensure residents benefit from the latest tools available in the fight against crime.

1.3 Project Objectives

The main objective is to design a RFID Door Access with monitoring system which supported by subsequent objectives as follows:

i. To create a database using SQL language for door access monitoring system.
ii. To create a program by using the Visual Basic 6 for the door access application.
iii. To construct the simple concept of a RFID door access system.
1.4 **Scope**

This project is aimed to develop a system to develop a model door access by using the RFID technology with the monitoring system. The monitoring system will be developed using Microsoft Access and must be able to monitor functions of the door access. The outcome of this project is a stand-alone application to observe the status of the personnel that access to the specified door. In the project, there will consist of five doors, which only can be accessed by the certain position only. The monitoring system will observe the events that occur with the real-time monitoring. The card will be programmed by using the Visual Basic.

1.5 **Project Planning**

The project planning is too identified and plans to achieve the objective with the punctual time planning. The good planning can make the project is in actual track. For a good time management planning, a Gantt chart is a suitable method in applying a guide for the project proceeds.

A Gantt chart is a type of bar chart that illustrates a project schedule. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements comprise the work breakdown structure of the project. The chart will show in Appendixes A and Appendixes B.
1.6 Structure of the Report

Chapter 1: Introduction
This chapter includes of background of RFID system, problem statement, research objectives, and research scopes, project planning and structure of report. All that an entire element becomes as an initial step before go through this research.

Chapter 2: Literature Review
Chapter two discusses about literature review related with RFID door access system such as definitions and description of the technology, history, benefits and drawbacks of RFID.

Chapter 3: Research Methodology
In chapter three consist of process flow chart that describes what have been done to complete this project. This chapter will also explain the way to achieve objectives of RFID door access with the monitoring system.

Chapter 4: Result and Analysis
This chapter includes the design of the system and will discuss the result and analysis to complete this research. Discussion has also details about the research have a potential to approach at the real situation. This chapter also contains the result and analysis of the research after model build up complete.

Chapter 5: Conclusion
This chapter contains summary of main findings and brief recommendation for further study.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In this age of rapid technological advancement, wireless communication is emerging as one of the more promising and useful forms of data transfer. It is getting more and more difficult to find a person who has never talked on a cell phone, listened to the radio, or even logged onto wireless internet. And one new technology that is on its way to becoming another common, everyday use of radio frequency (RF) communication is Radio Frequency Identification (RFID).

RFID is a technology that uses tiny computer chips smaller than a grain of sand to track items at a distance. RFID use radio waves to automatically identify people or objects. RFID technology belongs to a broader group of technologies known as Auto Identification (Auto-ID), (Brown.et al, 2007). There are several methods of identification such as magnetic strip, voice recognition, biometric, but the most common is bar codes.

There are different technologies and have different applications between RFID and bar codes. The big difference between the two is bar codes are line-of-sight technology. That is, a scanner has to scan the bar code to read it, which means people usually have to orient the bar code toward a scanner for it to be read. Radio frequency identification is different. It doesn't require line of sight. RFID tags can be read as long as they are within
range of a reader. Bar codes have other shortcomings as well. If a label is ripped or soiled or has fallen off, there is no way to scan the item, and standard bar codes identify only the manufacturer and product, not the unique item. The bar code on one milk carton is the same as every other, making it impossible to identify which one might pass its expiration date first.

RFID is a technology that offers many more benefits compared to other identification technologies such as bar coding and magnetic stripe (Moroz.R, Nov 2004). The aim of most RFID systems is to increase efficiency, reduce data entry errors and free up staff to perform more value-added functions, such as providing customer service.

Because of this technology have lot of advantages, I would like to construct the RFID door access with a monitoring system is a system that implement the RFID concept to accessing the door in term of security factors and also have the monitoring system to monitor the system.

As we know, door is a movable barrier installed in the entry of a room or building to restrict access or provide visual privacy. They were constructed of stiles (vertical planks) and rails (horizontal planks) fastened together to support panels and occasionally equipped with locks and hinges.

Now we are in the 20th century, so, there were high technologies develop such as RFID that we can apply to the system such as door access to improving the security level. The System Monitor may be writing data directly into a database, allowing other processes to access the database. Normally, the System Monitor is a wrapper for whatever persistence mechanism is used, providing a consistent and 'safe' access interface for others to access the data.
## 2.1 Historical Development

<table>
<thead>
<tr>
<th>Year</th>
<th>Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>1897</td>
<td>Guglielmo Marconi invented the radio</td>
</tr>
<tr>
<td>1937</td>
<td>The U.S. Naval Research Laboratory (NRL) developed the Identification Friend-or-Foe (IFF) system that allowed friendly units such as Allied aircraft to be distinguished from enemy aircraft.</td>
</tr>
<tr>
<td>1939</td>
<td>IFF transponder invented in the United Kingdom used by the allies in World War II to identify aircraft as friend or foe.</td>
</tr>
<tr>
<td>1946</td>
<td>Leon Theremin invented an espionage tool for the Soviet Union which retransmitted incident radio waves with audio information. Sound waves vibrated a diaphragm which slightly altered the shape of the resonator, which modulated the reflected radio frequency. Even though this device was a passive covert listening device, not an identification tag, it is considered to be a predecessor of RFID technology.</td>
</tr>
<tr>
<td>1948</td>
<td>Harry Stockman released paper, titled &quot;Communication by Means of Reflected Power&quot; (Proceedings of the IRE, pp 1196–1204, October 1948). Stockman predicted that &quot;...considerable research and development work has to be done before the remaining basic problems in reflected-power communication are solved, and before the field of useful applications is explored.&quot;</td>
</tr>
<tr>
<td>1950</td>
<td>Identification Friend-or-Foe (IFF) system became the basis for the world's air traffic control systems. Early uses of radio identification were generally limited to the military, research labs, and large commercial enterprises because of the high cost and large size of components.</td>
</tr>
<tr>
<td>Year</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>1971</td>
<td>The initial device was passive, powered by the interrogating signal, and was demonstrated to the New York Port Authority and other potential users and consisted of a transponder with 16 bit memory for use as a toll device.</td>
</tr>
<tr>
<td>1973</td>
<td>Mario Cardullo's U.S. Patent 3,713,148 was the first true ancestor of modern RFID; a passive radio transponder with memory. The basic Cardullo patent covers the use of RF, sound and light as transmission media.</td>
</tr>
<tr>
<td>1973</td>
<td>A very early demonstration of reflected power (modulated backscatter) RFID tags, both passive and semi-passive, was performed by Steven Depp, Alfred Koelle, and Robert Freyman at the Los Alamos National Laboratory. The portable system operated at 915 MHz and used 12-bit tags.</td>
</tr>
<tr>
<td>1979</td>
<td>Animal tagging</td>
</tr>
<tr>
<td>1980</td>
<td>The more sophisticated RFID technologies were employed in applications ranging from identification of railroad cars in the United States to tracking farm animals in Europe. RFID systems were also used in wildlife studies to tag and track exotic or endangered species such as fish with minimal intrusion into their natural habitats.</td>
</tr>
<tr>
<td>1983</td>
<td>The first patent to be associated with the abbreviation RFID was granted to Charles Walton U.S. Patent 4,384,288.</td>
</tr>
<tr>
<td>1990</td>
<td>Electronic toll collection systems gained popularity on both sides of the Atlantic, with commercial implementations in Italy, France, Spain, Portugal, Norway, and in the United States in Dallas, New York, and New Jersey. These systems offered a more sophisticated form of access control because they also included a payment mechanism.</td>
</tr>
</tbody>
</table>
RFID card keys became increasingly popular as a replacement for traditional access control mechanisms such as metallic keys and combination locks. RFID also called contactless smart cards that provided information about the user and offered a more personalized method of access control, while being inexpensive to produce and program. Table 2.2 below compares the most common methods of access control with that of RFID access control.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>RFID card keys became increasingly popular as a replacement for traditional access control mechanisms such as metallic keys and combination locks.</td>
</tr>
<tr>
<td>1991</td>
<td>Association of American Railroads standards</td>
</tr>
<tr>
<td>1994</td>
<td>All US railcars RFID enabled</td>
</tr>
<tr>
<td>1999</td>
<td>Massachusetts Institute Of Technology Auto-id center founded</td>
</tr>
<tr>
<td>2003</td>
<td>EPCglobal system Version 1.0</td>
</tr>
<tr>
<td>2005</td>
<td>Us Department Of Defense and Wall-Mart mandates</td>
</tr>
<tr>
<td>2006</td>
<td>Many international and industry organization start selling RFID equipment that followed the open standards.</td>
</tr>
</tbody>
</table>
Table 2.2: Comparison of Various Access Control Methods

<table>
<thead>
<tr>
<th>Access Control Method</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Metallic Key          | • Does not need electricity to function  
                        • Easy to use | • Can be copied easily  
                        • Lock can be picked  
                        • Susceptible to theft |
| Combination Lock      | • Combination can be easily changed  
                        • No key to be lost or stolen | • More expensive than a key-lock  
                        • Vulnerable to eavesdropping |
| Punch Card            | • Cannot be duplicated as easily as a metallic key | • Older technology with little flexibility |
| Magnetic Strip        | • cannot be easily copied  
                        • Card readers widely available | • Prolonged use can damage card  
                        • Installation requires costly IT infrastructure |
| Smart Card            | • Same card can also be used for applications other than access control (e.g. payment)  
                        • Provides more security than Magnetic Strip Cards | • More expensive than a Magnetic Strip Card |
| RFID                  | • All the Pros of Smart Cards  
                        • Requires no contact  
                        • Can be embedded in items other than cards and under the skin | • Can be more expensive than Smart Cards |