

**IMPROVING THE MONITORING MECHANISM OF CURRENT
WAREHOUSE MONITORING SYSTEM WITH WEIGHT MONITORING**

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ABSTRACT

Current technology used in warehouse monitoring system is RFID and Barcode. These technologies function to identify products and detect product flows stock-in and stock-out of warehouse by having sensors/ detectors installed. However, product loss is still commonly happened in the warehouse working environments. It shows the limitation of signals detection range became the lack or inadequate of monitoring mechanism for RFID and Barcode technology in securing the products. This paper presents a prototype system project for leading out alternative monitoring tool by replacing the RFIDs technology implemented in current warehouse monitoring system with mass sensor – weighting scale. This prototype system is meant to test out the potential of mass sensor in secure up the current warehouse monitoring system.

ABSTRAK

Pada masa ini, teknologi yang digunakan dalam sistem pemantauan di kawasan gudang adalah RFID dan Barcode. Teknologi-teknologi ini berfungsi untuk mengenali produk-produk yang disimpan dalam gudang dan mengesan pergerakan produk semasa proses pengambilan stok dan pengeluaran stok dengan bergantung kepada pembaca RFID yang dipasang pada pintu. Walaubagaimanapun, kes-kes kehilangan produk masih berlaku didalam kawasan gudang dengan adanya teknologi RFID yang dipraktiskan. Ini menunjukkan kewujudan kekurangan kuasa pemantauan daripada teknologi RFID yang mempunyai had-had pengesanan atau pembacaan tag RFID. Thesis ini ingin memperkenalkan satu sistem prototype projek yang membawakan idea pemantauan dari segi berat berbanding kepada RFID. Thesis ini bertujuan untuk mengaji potensi pemantauan dari segi berat dalam menjaga keselamatan untuk gudang masa kini.

TABLE OF CONTENTS

| CHAPTER | TITLE | PAGE |
|---------|-------------------------------|------|
| | DECLARATION | ii |
| | SUPERVISOR'S DECLARATION | iii |
| | DEDICATION | iv |
| | ACKNOWLEDGEMENT | v |
| | ABSTRACT | vi |
| | ABSTRAK | vii |
| | TABLE OF CONTENT | viii |
| | LIST OF FIGURES | xiii |
| | LIST OF TABLES | xv |
| | LIST OF APPENDIXES | xvi |
| | | |
| 1 | INTRODUCTION | |
| | <u>Introduction</u> | 1 |
| | 1.1 Background of the Problem | 3 |
| | 1.2 Problem Statement | 5 |
| | 1.3 Statement of Purpose | 5 |
| | 1.4 Objectives of the Study | 5 |
| | 1.5 Scope of the Study | 6 |
| | 1.6 Thesis Organization | 6 |
| | | |
| 2 | LITERATURE REVIEW | |
| | 2.1 What is warehouse? | 8 |

| | | |
|-------|--|----|
| 2.2 | Introduction of Monitoring System to Warehouse | 11 |
| 2.2.1 | Inconsistency of Human Power | 11 |
| 2.2.2 | Counterfeiting Inconsistency of Human Power | 12 |
| 2.2.3 | Automated warehouse management | 13 |
| 2.3 | Technology used in Warehouse Monitoring System | 14 |
| 2.3.1 | Current technology used – RFID | 14 |
| 2.3.2 | Why RFID but Not Barcode? | 15 |
| 2.3.3 | How RFID is being implemented in a Warehousing Environment | 18 |
| 2.3.4 | Weakness/ Limitation of RFID | 19 |
| | 2.3.4.1 Range of detection | 19 |
| 2.3.5 | Countermeasures to the Limit of Detection Range | 20 |
| | 2.3.5.1 Extending Detection Range by Add Power to RFID Tag | 20 |
| | 2.3.6 Install more RFID Readers | 21 |
| 2.4 | What-if Scenario – A concept towards Continuous Improvement | 23 |
| | 2.4.1 What-if tag is removed from the goods? | 24 |
| 2.5 | Reverse Thinking Approach – A Creative Problem Solving Method | 26 |
| | 2.5.1 Elevator Car Overload Warning System | 27 |
| | 2.5.2 Weighting Scale – TB830 Twin Beam Scale | 28 |
| 2.6 | Generating Idea into the Project | 29 |

3 METHODOLOGY

| | | |
|-------|-------------------------------|----|
| 3.1 | Introduction | 30 |
| 3.2 | Research Design | 31 |
| 3.2.1 | Analysis and Design Approach | 31 |
| | 3.2.1.1 Qualitative Research | 32 |
| | 3.2.1.2 Quantitative Research | 32 |
| | 3.2.1.3 Descriptive Research | 33 |

| | | |
|-------------|----------------------------------|----|
| 3.2.2 | Standard Document | 33 |
| 3.3 | Development Methodology | 34 |
| 3.3.1 | Hardware Development Methodology | 34 |
| 3.3.1.1 | Six Sigma | 34 |
| 3.3.2 | Software Development Methodology | 35 |
| 3.3.2.1 | Prototyping Approach | 35 |
| 3.3.2.1.1 | Throwaway Prototyping | 36 |
| 3.3.2.1.2 | Evolutionary Prototyping | 36 |
| 3.3.2.2 | SDLC Steps – Prototyping | 38 |
| | Negotiated Approach | |
| 3.3.2.3 | Operational Framework | 40 |
| 3.3.2.3.1 | Initiation | 41 |
| 3.3.2.3.1.1 | Preliminary Investigation | 41 |
| 3.3.2.3.2 | Analysis and Design | 41 |
| 3.3.2.3.2.1 | Logical Model | 42 |
| 3.3.2.3.2.2 | Physical Model | 48 |
| 3.3.2.3.3 | Development | 48 |
| 3.3.2.3.3.1 | Flow Chart of the System | 49 |
| 3.3.2.3.3.2 | Procedure for Weight | 50 |
| | Alteration | |
| 3.3.2.3.3.3 | Interface Design | 51 |
| 3.3.2.3.4 | Implementation | 58 |
| 3.3.2.3.5 | Integration and Test | 59 |
| 3.3.2.3.5.1 | Functional Requirement | 59 |
| 3.3.2.3.6 | Documentation and | 60 |
| | Reporting | |
| 3.3.2.3.6.1 | Instrumentation | 61 |
| 3.3.2.3.6.2 | Software and Hardware | 61 |
| | Requirement | |
| 3.4 | Summary | 61 |

4 IMPLEMENTATION

| | |
|-------------------|-----------|
| 6.1 Conclusion | 86 |
| REFERENCES | 88 |
| APPENDIXES | 90 |

LIST OF FIGURES

| FIGURE | TITLE | PAGE |
|--------|--|------|
| 1.1 | How good load/unload and go through RFID/ Barcode scan | 2 |
| 2.1 | Example of how goods places in pallets by pallets, at different platforms | 9 |
| 2.2 | Los Angeles Unified School District, Career Opportunities within the fields of Storekeeping and | 10 |
| 2.3 | Smart Tag | 15 |
| 2.4 | Large and small RFID tag | 15 |
| 2.5 | Manufacturing Floor | 18 |
| 2.6 | Warehouse/ Distribution | 18 |
| 2.7 | RFID based indoor navigational aid for persons with sever visual impairments | 20 |
| 2.8 | How RFID readers might get installed in warehouse | 22 |
| 2.9 | Warehouse RFID | 25 |
| 2.10 | Practical Procedure of Reverse Thinking | 26 |
| 2.11 | Erzgebirge Car Lift Elevator | 27 |
| 2.12 | TB830 Twin Beam Scale | 28 |
| 2.13 | Intercomp Part 100011 Battery Operated Indicator | 28 |
| 3.1 | SDLC Phases | 38 |
| 3.2 | System Operational Framework | 40 |
| 3.3 | Warehouse Environment - Platforms | 43 |
| 3.4 | Warehouse Environment - Pallets | 44 |
| 3.5 | Relationship between system and device | 45 |
| 3.6 | ERD | 46 |

| | | |
|------|---|----|
| 3.7 | System Architecture | 47 |
| 3.8 | Procedure for Weight Alteration | 50 |
| 3.9 | Interface Design – Initializing page | 51 |
| 3.10 | Interface Design – Homepage 1 | 52 |
| 3.11 | Interface Design – Homepage 2 | 52 |
| 3.12 | Interface Design – Login Page | 52 |
| 3.13 | Interface Design – Homepage 3 | 53 |
| 3.14 | Interface Design – Graph Presentation | 53 |
| 3.15 | Interface Design – History Records | 54 |
| 3.16 | Interface Design – Homepage 4 | 54 |
| 3.17 | Interface Design – Register Form | 55 |
| 3.18 | Interface Design – Search Form 1 | 55 |
| 3.19 | Interface Design – Search Form 2 | 55 |
| 3.20 | Interface Design – Search Form 3 | 56 |
| 3.21 | Interface Design – Search Popup Window | 56 |
| 3.22 | Interface Design – Delete Form | 56 |
| 3.23 | Interface Design – Real Time Data From device | 57 |
| 3.24 | Interface Design – Security Code | 57 |
| 3.25 | Interface Design – Alarm Form | 58 |
| 4.1 | System Flowchart | 63 |
| 4.2 | System Architecture | 64 |
| 4.3 | MS. Visual Studio 2010 – Install Page | 65 |
| 4.4 | MS. Office 2010 – Install Page | 65 |
| 4.5 | MS. ACCESS 2010 – Startup Page | 66 |
| 4.6 | Connect to database 1 | 67 |
| 4.7 | Connect to database 2 | 67 |
| 4.8 | Connect to database 3 | 68 |
| 4.9 | Connect to database 4 | 68 |
| 4.10 | ProEssential v7 – Install Page | 69 |
| 4.11 | Proessential v7 - Add References 1 | 70 |
| 4.12 | Proessential v7 - Add References 2 | 70 |
| 4.13 | GSM Modem – Install Page 1 | 71 |
| 4.14 | GSM Modem – Install Page 2 | 72 |

| | | |
|------|--------------------------------|----|
| 4.15 | GSM Modem – Install DLL | 72 |
| 5.1 | Testing – Login Phase | 79 |
| 5.2 | Testing – Weight Alteration | 80 |
| 5.3 | Testing – Graph Presentation 1 | 81 |
| 5.4 | Testing – Graph Presentation 2 | 81 |
| 5.5 | Testing – Graph Presentation 3 | 82 |
| 5.6 | Testing – Notification 1 | 82 |
| 5.7 | Testing – Notification 2 | 83 |

LIST OF TABLES

| TABLE NO | TITLE | PAGE |
|-----------------|------------------------------------|-------------|
| 3.1 | Database Design | 48 |
| 3.2 | Functional Requirements | 60 |
| 3.3 | Instrumentation | 61 |
| 3.4 | Software and Hardware Requirements | 61 |

LIST OF APPENDICES

| APPENDIX | TITLE | PAGE |
|-----------------|--------------|-------------|
| A | Gantt Chart | 90 |
| B | User Manual | 94 |

CHAPTER 1

INTRODUCTION

In this chapter, a brief idea of the project is introduced in order to give out overall information related to the topic of the project. Details such as problem statement, project objective and project scope specify the whole project requirements.

1. Introduction

A warehouse is a commercial building for storage of goods. Warehouses are used by manufacturers, importers, exporters, wholesalers, transport businesses, custom, etc. They are usually large plain buildings in industrial areas of cities and towns. They usually have loading docks to load and unload bulks of goods from trucks. The major processes included in warehousing are Receiving, Put Away, Order preparation/ picking, shipping and Inventory Management (cycle counting, addressing).

Traditionally, security guards being hired to look after the goods ensuring the safety of the goods. Having human element in physical security became a must in guarding the warehousing area. However, having human element in monitoring the

warehousing area for 24hrs, 7 days a week is something impossible to be done although they were assigned working in shifts. The inconsistent of human behavior is the biggest weak point in guarding the goods in warehouse because human gets exhausted, lazy, sleepy, lack-motivated, and some other negative behaviors that can affect the security performance. Cruelly, employer requests for 100% resiliency of the system all the time. Hence, incorrect information is unavoidably input from time to time as human error is inevitable (Sexton, Thomas, & Helmreich, 2000). Then, Radio-frequency Identification (RFID) and Barcode being introduce in covering the human's lack of monitoring power on the warehousing area as Warehouse Monitoring System.

“The concept of the RFIDs and barcodes is allowing a sensor (RFID reader/ Barcode reader) to read, from a distance and without line of sight, a unique identifier that is provided (via a radio signal) by an “inexpensive” tag attached to an item(Warehousing and Analyzing Massive RFID Data Sets)”. It (RFID) is commonly used for location objects (Xu & Gang, 2006).

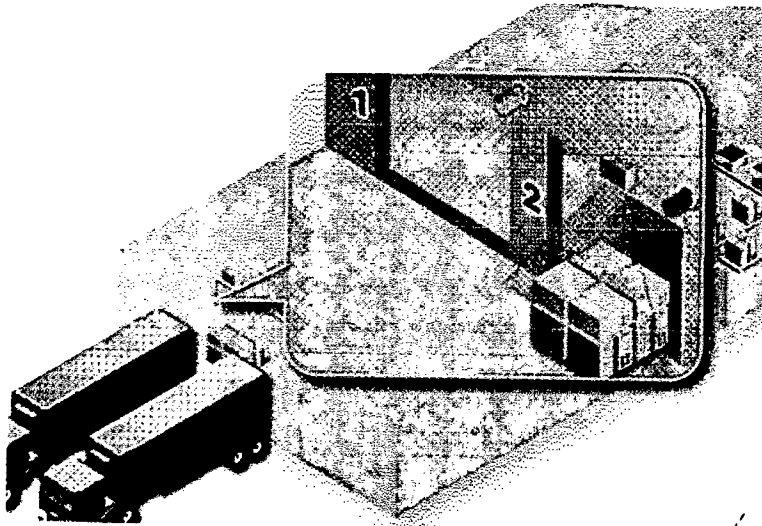


Figure 1.1 How goods load/ unload and go through RFID/ Barcode scan

The objectives of creating Warehouse Monitoring System are to reduce loss of goods, increase inventory accuracy, and reduce labor costs (as the number of guards hired reduced).

The starting point in this project is based on the businessman's doubts to the effectiveness and efficiency that RFIDs and Barcode gives to them. It is because

goods losing occurred still even after the great amount of cost they had gave out for the technology of RFID and the professional training they provided to their employees. Talking about businessman mind, one of the important business goals is reduce operating cost. The process of large amount of these “inexpensive” tags (RFIDs/ Barcode) daily still bothers these businessmen. Besides, the undetectable loss of goods in great amount causes warehouse owners starting to seek for some other technology in replacing these less efficient RFIDs/ Barcode that they are paying so much now. In term of computer system or network, intruder/ perpetrator always find a weak point of the system (known as security hole) to break in. Same thing goes to the monitoring system, the weak point is meant to go through the reader. “RFID readers and tags do not have 100% accuracy in all instances. Even with Ultra-High Frequency (UHF) the read ranges of the reader can only reach 30 feet (9.14 meter) (Smart Border Alliance RFID Feasibility Study Final Report).” Avoiding the reader’s sensor causing the great technology of RFIDs becomes useless.

In term of choosing best warehouse monitoring system, there is an important point stated that the system must insist on a user-friendly system. Bears in mind that store keepers who’s employed in the warehouses are all adults in age range of 40s. “The age scale ranges from 20 up to 63 years. The mean age is 36 years with a standard deviation of 7.3. About 60% of workers are less than 36 years old and 40% are above 36 years old (Survey results of Short and Long-term consequences of age in work teams)”. Providing them with professional training of configurations of RFIDs/ Barcodes might hardly do as most of the people do not like attend training. Businessman thinks about their employee’s training methodology and training costs. Hence, it will be a trouble if their payment does not give the result they expected.

1.1 Background of the Problem

This project is based on the current situation and problem faced by most of the warehouse owners related to the unidentified/ undetectable loss of goods in their own warehouses. In most of the warehouse, the strategy was

done great. Stock-in, stock-out from the entrance of the warehouse with RFIDs/ Barcode scanner right at the entrance of the warehouse. However, they forgot about one simple common thing, which is the tag/ barcode sticker was all on the boxes/ cartons of the goods. Human become weak when greedy comes around. Imagine, warehouse full of goods just like a bank full of cash. There are no guarantees that the warehouse owner hires a group of honest workers.

The only way not to alert the RFIDs scanner is not having any tag go through it. The workers may always bring along other containers to steal away the goods. As an example, Adidas warehouse load a bulk of shoes into the warehouse. The barcode sticker is printed on the boxes, bears in mind that there are always rejected goods (defectives). Greedy workers may intentionally mix up the defectives and the goods and send out from the warehouse without alerting the scanner. Some just cut off the barcode stickers and sending out bulk of goods to other destination.

There are goods that do not have barcode when they freshly sent from the manufacturer. The warehouse's workers required to print out barcode stickers themselves for all these goods. Such as bicycle, mandarin oranges (during Chinese New Year), antiques... Intentioned miss out goods can easily happen without notice.

There is also other method in stealing away the goods without notice by the RFIDs. Liquid goods such as detergent, carbonated drinks, liquor, and other liquid products always got steal without alerting the RFIDs system. They either drank it then place back the container (for those edible drinks) or they swap into another container.

The warehouse owners had invented a big amount of cost for the technology and provided professional training of RFIDs to their employees. However, human elements always strongly argued in term of trustworthy. With those tricky methods, hoping for an ideal way where all goods will pass through the scanner WITH their tags sometime it's impossible.

1.2 Problem Statement

From the above discussion about problems faced by warehouse owner in terms of unidentified/ undetectable losing of goods in their warehouse, the problems can be listed as below:

- 1 Lack or inadequate of monitoring mechanism of RFIDs in monitoring the goods of the warehouse from tricky and greedy workers. Existing monitoring devices are RFIDs and Barcode.
- 2 Theft still happening even with the RFID technology implemented.

1.3 Statement of Purpose

The purpose of this project is to enhance existing monitoring system mechanism in warehouse by replacing existing monitoring system technology/device – from RFIDs/ Barcode to Weighting Scale device with expectation that weighting scale works better in detecting losing of goods in term of sensitivity and accuracy.

1.4 Objectives of the Study

The objectives of the study are:

- 1 To design system architecture for replacing weighting scale as the new monitoring tool/ device which expect more sensitive than RFIDs/ Barcode in detecting losing of goods.
- 2 To develop weighting scale monitoring system and prototype model.
- 3 To develop software for the proposed monitoring system.

1.5 Scope of the Study

The scopes of this project are:

- 1 The study focused on error detection in the monitoring system of the warehouse.
- 2 The monitoring system development and implementation focused on the error detection in losing of good's weight.
- 3 The implementation of the monitoring system shall limited to prototype model environment.
- 4 The testing of system shall be limited to laboratory environment.

1.6 Thesis Organization

This thesis is divided into six chapters and each chapter is inter-related to one another in terms of the project's flow. Below is the general idea of the content for each chapter:

- 1 Chapter 1
Introduction to the project presented along with the background of the problems, problem statement, statement of purpose, objectives of the study and scope of the study.
- 2 Chapter 2
Literature review related to the project is presented.
- 3 Chapter 3
Operational framework presented as the overall research process.
- 4 Chapter 4
Analysis and design conducted in this chapter which reported all project activities and their outcomes.

5 Chapter 5

Implementation of the proposed monitoring system is presented. Experiment and testing conducted and results are presented along with discussions of the results.

6 Chapter 6

Benefits, summary, conclusion and further work are presented as the last chapter in this thesis organization.

CHAPTER 2

LITERATURE REVIEW

In this chapter, research and analysis is taking place in order to get further understanding towards details of the information related to the project. Analysis and studies towards researches resulting to better understanding and lead way from existing system to a better system in counterfeiting problems of the existing system.

2.1 What is a Warehouse?

Before going further to know about the Monitoring system, I should also get to know brief information about the concept of the Warehouse. By understanding the warehousing environment and the needs/ requests from the management groups, then only I can justify the efficiency, availability and also the security levels of the monitoring system that I am going to implement for the warehouse.

A warehouse is a commercial building for storage of goods. Warehouses are used by manufacturers, importers, wholesalers, transport businesses, customs, etc. They are, usually, large plain buildings in industrial areas of cities and towns. They,

usually, have loading docks to load and unload goods from trucks. Sometimes, warehouses load and unload goods directly from railways, airports, or seaports. They often have cranes and forklifts for moving goods that are usually placed on ISO standards pallets loaded into pallet racks. These stored goods can include any raw materials, components, or finished goods associated with agriculture, manufacturing, or commerce. (<http://en.wikipedia.org/wiki/Warehouse> Warehouse)



Figure 2.1 Example of how the goods placed in pallets by pallets, at different platforms A-Z

From what have mentioned in Wikipedia encyclopedia, I understood that a warehouse is a giant room partitioned into different platforms stores up variety of goods in large amount each unload from railways, airports, or seaports. I also realized in the perception of thieves, this is a bank full of cash.

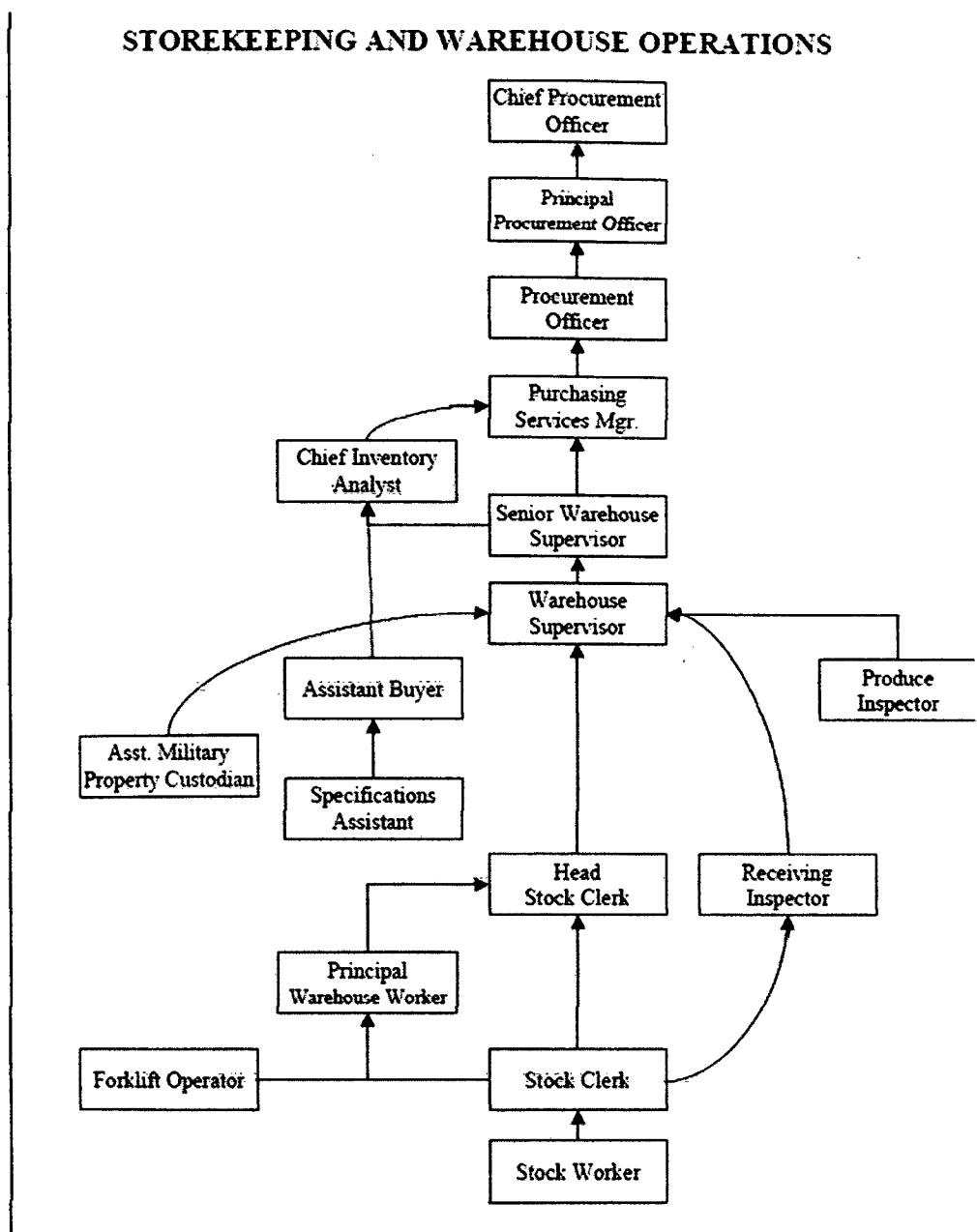


Figure 2.2 Los Angeles Unified School District, Career Opportunities within the fields of Storekeeping and Warehouse Operation

From the Figure 2, I understood how an organization chart of a standard warehouse should be. I am aware that the upper level workers (such as supervisor, purchasing services manager, procurement officer) are handling management jobs, while lower level workers will actually be handling the goods loading and unloading procedures.

2.2 Introduction of Monitoring System to Warehouse

2.2.1 Inconsistency of Human Power

Incorrect information is unavoidably input from time to time as human error is inevitable (Sexton, Thomas, & Helmreich, 2000).

“An organization is a system of interdependent human beings, and their characteristics affect both its structure and functions. Human relations management studies the characteristics and inter-relationships of individuals and groups within organization and takes account of these factors when designing and administering those organizations.” (BCM: Conference Communication, August, 2002, Auditing Human Factors in Maintenance Management)

“What was shocking was that there were no security guards on duty at the warehouse, enabling the thieves to coolly drive away an eight-tonne lorry packed with 542 boxes containing about 10,800 units of Western Digital hard disks worth an estimated RM4 million at 5.20am.” (Eric, October, 2010, 10,000 Hard Drives Stolen in Malaysia)

“Serbado, for his part, said he used to be a security guard but quit his job. He said Dolantes approached him and asked if he could help them in hauling the sacks of rice for a price.” (Visayas, June, 2008, 3 Workers caught stealing rice from Cebu warehouse)

I understand that the human factor always did the best influence that is unavoidable in affecting the performance of one system/ management, such as laziness, stamina, level of motivation, level of observation and some other factors. Having human element to effectively monitoring the warehousing area for 24hrs, 7 days a week is something impossible to be done although they were assigned working in shifts. Cruelly to say, employer requests for 100% resiliency of the system all the time. That is why “Autómation” term came up. Besides, reliability of human power not high.

2.2.2 Counterfeiting Inconsistency of Human Power

“Automated monitoring provides a reliable, cost-effective alternative. A computerized system increases accuracy by providing continuous monitoring, centralized data collection and simplified reporting.” (Gayle Wilton, Marketing Manager, Rees Scientific Corporation, August 2008, Manual Vs. Automated Lab Monitoring).

“Some warehouses are completely automated, and require no workers insider. Pallets and product move on a system of automated conveyors, cranes, and automated storage and retrieval systems coordinated by programmable logic controllers and computers running logistics automation software. Bear in mind that the land is expensive, that is why the warehouse owner want every inches of the land efficiently used, less workers and more goods on the land. These high-bay storage areas are often more than 10 meters (33 feet) high, with some over 20 meters (65 feet) high.” (<http://en.wikipedia.org/wiki/Warehouse> Wikipedia Encyclopedia)

“Meanwhile the square feet range of warehouse available out there is around 4,000 – 300,000 feet square. “ (<http://www.warehousesinmiami.com> Miami Warehouses for Lease and Miami Warehouses for Sale)

From the above 3 information, I realized that automation of system is meant to be a system programmed to do repetitive jobs that can continuously working in replacing the inconsistency of human power in term of stamina and also human error-free. Besides, I understood that a warehouse is required to function efficiently in order to gain the optimum profit for the company. In order to do so, the facility must be properly slotted in a way that addresses which storage medium a product is picked from pallet rack, and how they are picked, such as pick-to-light, pick-to-voice, or pick-to-paper). With a proper slotting plan, a warehouse can improve its inventory rotation requirements, such as first in, first out (FIFO) and last in, first out (LIFO). This is because in business, the cost of products differ every day, sometime old stock's cost is higher and required to out before the new stock in order to get back certain amount of profit. In this case, FIFO gains more profit to the company.