UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Design and Development of CIM System – Lifter Platform

Thesis submitted in accordance with the partial requirements of the
Universiti Teknikal Malaysia Melaka for the
Bachelor of Manufacturing Engineering (Robotic and Automation)

By

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DECLARATION

I hereby, declare this thesis entitled "Design and Developments Computer Integrated Manufacturing System – Lifter Platform" is the result of my own research except as cited in the references.

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To my beloved mother, Rahana bt. Md Noh and my father, Pata Ariffin b. Md Tahir

To my grateful supervisor, Mr Shariman b. Abdullah

To my siblings and my friends

To Nurul Hamizah bt Baharan.

Thank you for the motivation and full support

ABSTRACT

Computer Integrated Manufacturing (CIM) describes the complete automation of a manufacturing plant. Computers control all the various processes while digital information ties everything together. Components include computer aided design, manufacturing and process planning (CAD/CAM/CAPP); computer and direct numerical control machine tools (CNC/DNC); flexible machining systems (FMS); automated storage and retrieval systems (ASRS); and automated guided vehicles (AGV). Robotics, automated conveyance, and computerized scheduling and production controls are also important parts of the system. Lifter platform is one of the parts of the CIM system. The lifter is use to transfer pallet from one conveyor to other conveyor in automated production line system. The target of this project is to design and develop the lifter platform in CIM system. To achieve the target, the design drawing and the components selection is include in methodology of the project. The result during the implementation process will be analyzed to identify the problem occurred. The solution of the problem should be got from the discussion therefore the project will achieve the objective of this project.

ABSTRAK

Pembuatan Berintegrasi Komputer (CIM) menjelaskan satu sistem automasi yang lengkap dalam sesuatu pelan pembuatan. Komputer mengawal pelbagai proses manakala informasi digital mengumpulkan semua menjadi satu. Komponen terdiri daripada rekabentuk berbantukan computer, pembuatan, perancangan proses (CAD/CAM/CAPP); Mesin kawalan sistem berkomputer (CNC/DNC); sistem mesin yang feksibel (FMS); sistem simpanan automasi (AS/RS); dan kenderaan berpandukan automasi (AGV). Robotik, alat pengangkut automatik, penjadualan berkomputer, dan kawalan produksi merupakan bahagian yang penting dalam sesuatu sistem. 'Lifter Platform' juga merupakan salah satu bahagian di dalam sistem pembuatan berintegrasikan komputer. Alat ini digunakan untuk memindahkan satu objek dari satu sistem alat pengangkut ke alat pengangkut yang lain. Matlamat projek ini adalah untuk merekabentuk dan membina 'Lifter Platform' dalam satu sistem pembuatan berintegrasikan komputer (CIM). Untuk mencapai matlamat ini, lukisan rekabentuk dan pilihan komponen diperjelaskan dalam bahagian metodologi projek ini. Keputusan yang diperolehi semasa melakukan experiment dianalisis dan bagi mengenalpasti masalah-masalah yang mungkin timbul semasa menjalankan projek ini. Jalan penyelesaian untuk mengatasi masalah-masalah tersebut akan dicapai dalam perbincangan yang dilakukan supaya keputusan yang diperolehi akan menepati objective sebenar projek ini.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

AGV	-	Automated Guided Vehicle
AS/RS	-	Automated Storage and Retrieval System
BOM	-	Bill of Material
CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
CAPP	-	Computer Aided Process Planning
CIM	-	Computer Integrated Manufacturing
CNC	-	Computer Numerical Control
DFM	-	Design for Manufacturing
DNC	-	Direct Numerical Control
FIG	-	Figure
FMS	-	Flexible Manufacturing System
LCD	-	Liquid Crystal Display
PLC	-	Programmable Logic Controller
SEN	-	Sensor
SOL	-	Solenoid
SPL	-	Stop Pin Location Left
SPR	-	Stop Pin Location Right
TOC	-	Theory of Constraints

CHAPTER 1
INTRODUCTION

1.1 What is CIM system?

Computer integrated manufacturing is a technology, tool or method used to improve entirely the design and manufacturing process and increase productivity by using computers to help people and machines to communicate. It also a series of integrated activities and operations involving the design, materials selection, planning, production, quality assurance, management and marketing of discrete consumer and durable goods in deliberating the integration of automated systems logical organization of individual engineering, production and marketing/support functions into a computer integrated system. The architecture for integration of multiple technologies through computers, linking each individual island of automation to a closed loop business system give the integration of computer aided design, automatic material handling, robotics, process technologies, manufacturing planning & control, computer aided test, and computer aided manufacturing focuses on the computer as the center of control of the entire factory, starting from the computerization of the fabrication and assembly processes to the information flow for production control, quality, maintenance, material handling, and inventory control in a totally integrated system.

It encompasses the entire realm of processes a part undergoes from receipt of the material to when it is shipped by involving the use of computers to assist in the design, handling, processing, and cataloging of materials as they flow through the

manufacturing processes. Not computer controlled, but is the use of the computer assets to assist in difficult areas of manufacturing. Computer integrated manufacturing links traditional islands of manufacturing automation, the people that work with and support them, and the systems that control them requires manufacturing industries to hire well-educated and highly skilled individuals with knowledge in the areas of technical computing, manufacturing process integration, mechanical and electronic systems implementation, process control, and quality; use of electronic technology to streamline traditionally separate phases, including concept, design, manufacture, analysis, and maintenance, into a single process in order to reduce lead time and improve quality of the product concept of a semi- or totally-automated factory in which all processes leading to the manufacture of a product are integrated and controlled by computers. The use of computers and computer technologies in a manufacturing environment that, as a minimum, utilizes information created for one purpose for another purpose in its broadest definition, a company strategy of utilizing computer-based technologies to achieve the goals of the company an approach to the organization and management of a firm, in which the functions of design, manufacturing, and production management are mutually rationalized (i.e., making to conform to reason) and completely coordinated, through the use of appropriate levels of computer and information/communication technologies.

The integration of the total manufacturing enterprise through the use of integrated systems and data communications coupled with new managerial philosophies that improve organizational and personnel efficiency use of computer hardware, software, and communications networks in all aspects of a manufacturing company including inventory control, quality control, planning, cost accounting, design, and manufacturing (machine control). Also utilizes the computer, not only to automate the design, control, assembly, and planning, but to link these processes into an organizational entity control of information flow and material or product flow to best serve the customer informational marriage between customer desires, corporate goals, ease of production, and whatever else makes the company more profitable needs to be a strategic

organizational tool. A tool that can allow dynamic responses to changing trends uses automation to reduce redundant information input, redundant storage, in whole, reducing redundant efforts in the manufacturing environment uses a shared database with computer software modules running in parallel to reduce design time, number of design cycles, and overall production costs effective utilization of computer technology in the management, control, and operation of the entire manufacturing process by utilizing all resources, including information, to best serve the customer; typically incorporating together the following technologies: computer aided manufacturing, computer aided design, computer aided process planning, computer aided quality control, and computer aided in philosophy in which the computer plays a central role for planning and controlling the manufacturing process. An open system that combines planning, sales, purchasing, production planning & control, computer aided design, computer aided manufacturing, and computer aided quality control through a centralized database so all data can be accessed and used for control purposes in using of the computer to organize, integrate, and disseminate information product design to shipping.

The concept by which all elements of the factory (i.e., people, equipment, materials, computers) are organized and integrated to produce high quality products in the most efficient and least cost manner management philosophy that provides the appropriate level of product design and production control; it also provides the shop flexibility necessary to compete in future domestic and international markets deals with the integration of manufacturing activities and support facilities using single information source that involves common databases, control of production, shipment of products, and communication among a wide range of decision makers. The strategic goal that a firm strives to achieve over time; a continually evolving integrative process in computerized integration of all aspects of design, planning, manufacturing, distribution, and management both a methodology and a goal, rather than an assemblage of equipment and computers. Its control and communication structure that integrates company-wide functions, including computer aided design, computer aided manufacturing, computer aided materials management, numerically controlled machine

1.2 Problem Statement

The problem of this project is to design and development a lifter platform in CIM system. The purpose of this system is to assemble the 17" LCD monitor. The assembly process is dividing into 3 main processes: side frame cover assembly process, front cover assembly process and back cover assembly process. The first station will assemble the side frame cover to the main bodies. Then the pallet will transfer to other conveyor by lifter unit. Then the process continues with front cover assembly process. The product will be flip before sent to next station. The last assembly process is assembling the back cover of the product. The design should be synchronize with master conveyor. When the lifter performs the operation, it should not crash the conveyor. The CIM system needs to be design similar to the industrial technology.

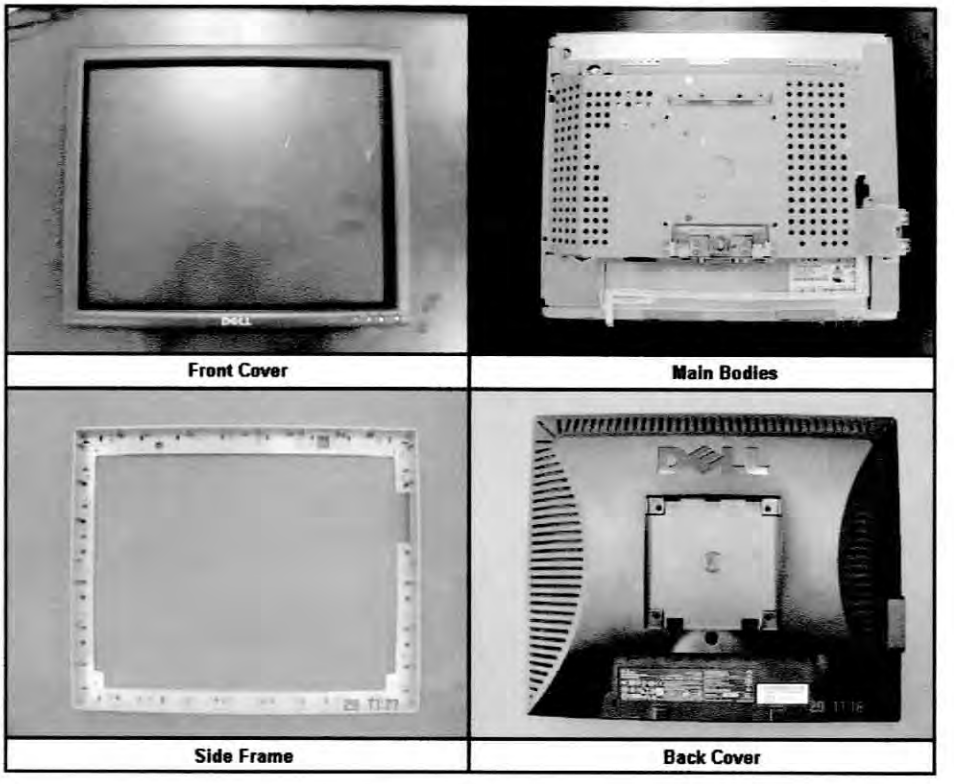

Figure 1.1: Product Parts (17" Dell LCD Monitor)

1.3 Objective of Project

Objective of the project:

a. To enhance knowledge about the industrial CIM system
b. To design the lifter platform in CIM system.
c. To develop the lifter platform in CIM system
d. To learn and investigate the major and minor problem during the modeling of the system
e. To design and develop the pallet and jig to hold the 17" LCD panel during the assembly process.

1.4 Scope of Project

The scope of the project

a. The lifter platform can transfer the pallet from one conveyor to other conveyor.
b. The lifter will perform the operation without crash the conveyor.
c. The lifter operation are synchronize with master conveyor using PLC
d. The jig and the pallet must hold the 17" LCD panel firmly during the assembly process.

CHAPTER 2
LITERATURE REVIEW

2.1 Computer Integrated Manufacturing

According to Donald P. Williams, 1988, CIM involves the total integration of all elements, data and product, involved in a manufacturing process. This integration involves everything from product design to automated manufacturing and assembly. In an even broader sense, computer integrated manufacturing involves all aspects of business from entry of a purchase order through shipment of the final product.

Companies do not turn to computer integrated manufacturing simply for the sake of automation. CIM generally involves a change in manufacturing philosophy and a major management commitment to implement. In general, the benefits and improvements resulting from the use of CIM are:

a. Improved product quality
b. Reduced labor costs; direct and indirect
c. Reduced inventories
d. Reduce manufacturing cycle time

2.2 CIM Equipment

In figure 2.1, the equipment have been used to teach the principles of computer integrated manufacturing for schools range from small table-top systems to system comprised of full-sized machine tools and robots.

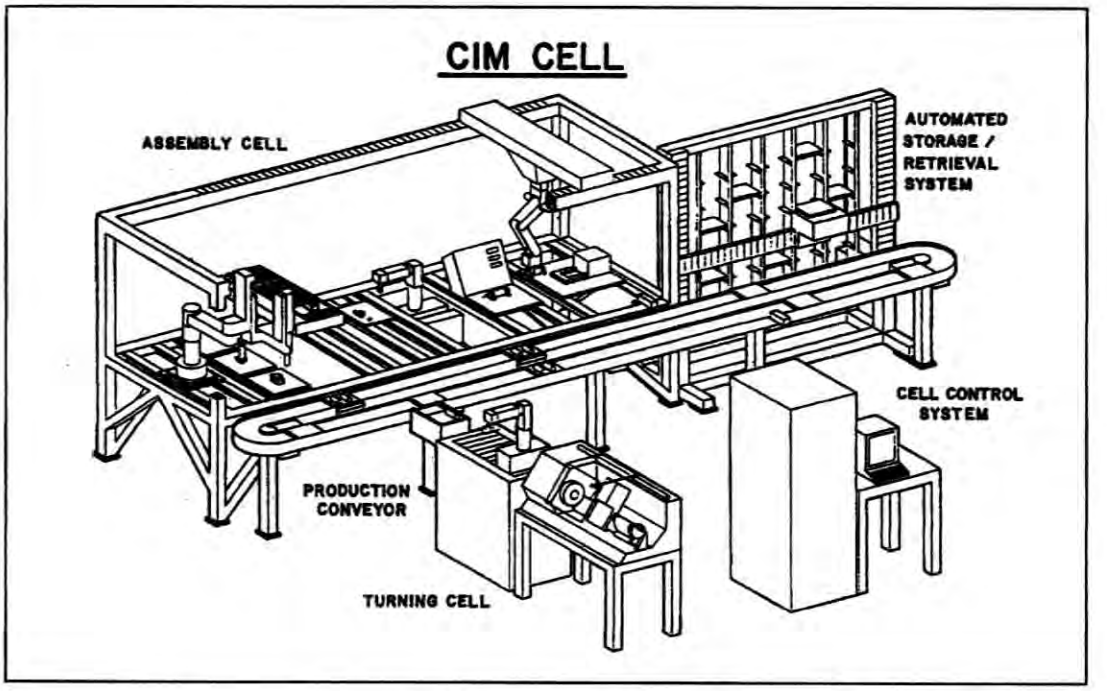

Figure 2.1: Computer Integrated Manufacturing System (Donald P. Williams, 1988)

The table-top systems usually involve the handling and machining of wax or plastic. The equipment used is very small with limited capabilities. Although these small systems attempt to simulate those found in industry, it is difficult for student to relate to actual equipment and procedures used in industry. The controls and software needed to operate these simple systems generally are not representative of that needed in industrial application.

At the other end of the scale, the systems using full-sized industrial equipment generally requires a major initial investment and is very costly to operate and maintain. The control, software and operating procedure are usually representative of industry standards. However, in most cases, the size, speed and power of the large equipment hinders or prohibits student interface with the systems. There is also a concern that damages from an accident due to miss programming can be very costly to repair.

The system that has been developed for use in teaching the principles of CIM utilizes industrial quality hardware in a configuration which encourages student interaction in a safe manner. The system utilizes a number of individual control systems which are interfaced in a hierarchical arrangement to provide control of each system. The software has been designed to permit efficient operation of the system for a given product along with the flexibility to permit the manufacture of other products including expansion capability for additional machine and assembly stations.

2.2.1 Overview of CIM System

The computer integrated manufacturing system consists of five (5) major modules (see Figure 2.1):

a. Automated Storage and Retrieval System (AS/RS)
b. Production Conveyor System
c. Turning Cell
d. Assembly Cell
e. Computerized Control System

The initial product that can be produce in the CIM system is a pneumatic cylinder (see Figure 2.2). The pneumatic cylinder was chosen as a product for a number of reasons, including:

a. Representative of an industrial product
b. Require parts that are milled and turned
c. Includes purchased parts, i.e. piston ring and seal
d. Family of parts can be manufactured with relative ease
e. Completed assembly can be tested

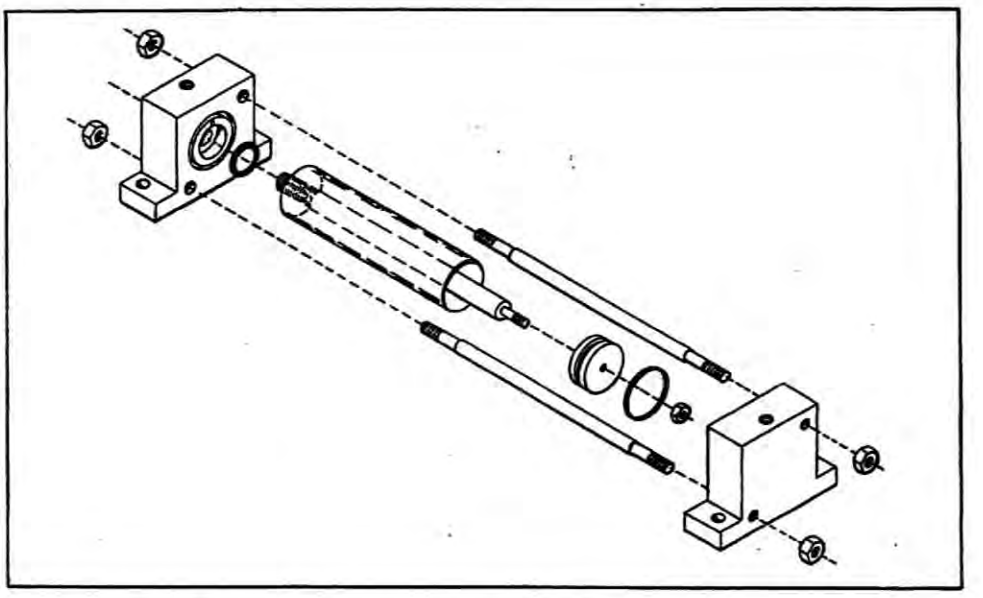

Figure 2.2: Pneumatic Cylinder Being Manufacture in CIM System (Donald P.Williams)

The system can be used to produce any assembly that is within the size and weight constraints of the equipment. For example, a system configuration for the manufacture of printed circuit boards has been prepared along with the pneumatic cylinders. This configuration can be used for teaching both mechanical and electrical courses wherein the students gain a deeper appreciation for the system through identification with the specific products being produced.