UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF CIM CONTROL SYSTEM USING PLC

Thesis submitted in accordance with the requirement of the National Technical University College of Malaysia for Degree of Bachelor of Engineering (Honours) Manufacturing (Robotic and Automation)

By

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APPROVAL

This thesis submitted to the senate of UTeM and has been accepted as fulfilment of the requirement for the degree of Bachelor of Manufacturing Engineering (Honours) (Robotic and Automation). The members of the supervisory committee are as follows:

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(MR AZRUL AZWAN BIN ABD. RAHMAN)

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ABSTRACT

This project is to make an analysis and development of the programmable logic controller (PLC) for the computer integrated manufacturing (CIM) which mean that by making a conveyor line and adding the CIM behaviour. This project also will be combining with other final projects (workstation) and this project (conveyor) will be the main features of the project. Other projects that will involve in this project are the feeder station, automatic colour sorting station, quality inspection station and the assembly station. The method used to make this thesis is by making of the ideology and research of the PLC, conveyor system, and CIM. All the data and input from the literature review chapter are use in the methodology chapter as the source of information and planning. The method to accomplish this project is by implement 5 phase of project methodology which is the planning phase, identification of requirement phase, designing phase, construction phase and lastly the implementation phase. All these phases play an important role in completing this project where if there are some mistake or delays from one of the phase, it can cause the entire project can not be completed or there will be trouble in continuing the next phase. All the data that acquired will be used for the studying the system and the outcome will be a conveyor system that will carried and moved the LCD screen to each workstation.

ABSTRAK

Projek ini adalah bertujuan untuk membuat analisis dan pembangunan Kawalan Program Logic (PLC) yang digunakan untuk Pembuatan Terpadu Komputer (CIM) di mana ia akan dilakukan dengan menggunakan pembawa dan kemudian akan ditambah dengan cirri-ciri CIM. Projek ini juga akan digabungkan bersama-sama projek tahun akhir yang lain (stesen kerja). Projek ini akan menjadi sebahagian yang terpenting di dalam menjayakan projek gabungan ini. Projek yang lain dan akan terlibat di dalam projek ini adalah stesen pemberi, stesen pengasingan warna automatic, pengkelasan kualiti dan stesen pemasangan. Kaedah yang digunakan untuk menjayakan tesis ini ialah dengan membuat kajian dan mengambil ideologi-ideologi yang boleh di guna pakai berkenaan dengan PLC, Pembawa, dan juga CIM. Kesemua data yang diperolehi dari ulasan pembacaan di gunakan di dalam bab metodologi sebagai sumber maklumat dan perancangan yang akan dibuat. Kaedah yang digunakan untuk melaksanakan projek ini dengan jayanya ialah dengan mengaplikasikan kesemua 5 fasa metodologi projek iaitu fasa perancangan, fasa mengenalpasti kehendak projek, fasa membentuk, fasa pembinaan dan yang terakhir sekali ialah fasa aplikasi. Kesemua fasa-fasa ini memainkan peranan yang penting didalam melaksanakan projek ini di mana jika terdapat sedikit kesalahan atau kelewatan dari fasa sebelumnya sudah tentu ia akan memberikan tekanan kepada pembikinan projek ini. Ini kerana sudah tentu projek tidak akan dapat dilaksanakan dan diteruskan untuk fasa seterusnya. Kesemua data yang diperoleh akan digunakan di dalam kajian dan pembelajaran system ini. Hasil dari projek ini nanti ialah untuk menghasilkan sebuah mesin pembawa yang akan membawa skrin LCD ke setiap stesen kerja.

DEDICATION

Special dedication to:
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I also would like to thanks my parent, all my friends and lecturers who have done a lot of things and helped me to fulfil and finished this thesis. I also like to send my best of luck to everyone whom have and will take the final year project and hopefully they can complete and finished their project accordingly.

Finally I hope that with this project it can be used to help and improve for human life standard. Not just in the industrial but for everyday life.

Hassanul Sazali Bin Ahmaddin

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LIST OF ABBREVIATIONS, SYMBOLS SPECIALIZED NOMENCLATURE

CAD	-	Computer-aided Design
CAM	-	Computer-aided Manufacturing
CAQ	-	Computer-aided Quality Control
CASA	-	Computer and Automation Systems Association
CIM	-	Computer Integrated Manufacturing
CNC	-	Computer Numerical Control
CPU	-	Central Processing Unit
CRT	-	Cathode Rays-tube
DIN	-	Deutsches Institut für Normung (German Institute for Standardization)
DNC	-	Direct Numerical Control
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
FBD	-	Function Block Diagram
FMS	-	Flexible Manufacturing System
ft	-	Feet
I/O	-	Input/output
IEC	-	International Electrotechnical Commission
in	-	Inch
LAD	-	Ladder Logic
LCD	-	Liquid Crystal Display
MPI	-	Multi Point Interface
NC	-	Numerical Control
NEMA	-	National Electrical Manufacturers Association
PLC	-	Programmable Logic Controller
PP&C	-	Production, Planning and Control

SKU	-	Stock Keeping Unit
SME	-	Society of manufacturing Engineers
SR	-	Set / Reset
STL	-	Statement List
TTY	-	Text Terminal

CHAPTER 1

INTRODUCTION

In this chapter it will be discussed about the introduction of this project where it will be focusing on the background of the project. As the title of the chapter, this also includes the basic and overall description of the project. To knows and making a research what the important things to do is by finding it problem and does it have been research before or similar to it. In this chapter also will telling the objectives and the purpose of this project.

This project is actually to make an analysis and development of the programmable logic controller (PLC) for the computer integrated manufacturing (CIM) which mean that by making a conveyor line and adding the (CIM) behaviour. The used of PLC in this project is to control the system and develop an automated system. This project also will be combining with other final projects (workstation) and this project (conveyor) will be the main features of the project. Other projects that will involve in this project are the feeder station, automatic colour sorting station, quality inspection station and the assembly station.

Firstly to make sure this project is running on the right track is by determined and discussing the right product to be made and designing a better way to control or operate the system. When the product has been decided then it can be continued with the processes involved. This is because there are a lot of ways to programming the PLC controller and there is a lot of time needed to familiarise with the interface. The product that will be used to be assembly is the liquid crystal display (LCD) monitor

and there are a lot of things to be considered when trying to assembly the LCD. Before starting with the programming with the PLC controller, the main thing needed here is the structural of the conveyor system and it workflows.

Conveyor system is the medium to make the product transferred or moved from one destination to other. This project can only be success if the conveyor workflows are running smoothly and nothing problems is happens. Beside as the transferring device, conveyor also gives the highest impact to the industry. This because the chosen of conveyor like it length, types and application are playing a big role in choosing the conveyor system. The environmental of the working area that the conveyor will be operated is also depend and must be consider as important part in making a conveyor system. For an example, if the conveyor are used in the ice cream factory it need to be made from high quality stainless steel or by using a coated steel to prevent the conveyor from rusting. Component of the conveyor also must be made from non-rusting steel and high quality because it needs to stand the temperature under 0 ^{0}C. Conveyor system can make the whole system failure to operate accordingly if the conveyor is malfunction or the programming of the conveyor system itself is wrong. This can cause the company to lose a lot of time and production.

When all the problem is defined with the mechanical part are connected and join with the wiring, next is to do the correct programming and studying the sequential or processes that involve. The task in this project is to make the programming of the conveyor system by using PLC as the main programming. The PLC model that will be used in the conveyor is the Siemens PLC. The programming software used is the SIMATIC STEP-7. This software is compatible with the hardware that will be used. And by using this software, all the program that have been created can be download to the PLC by using the suitable cable and communication port from the computer. All the information about the title of this project can be read at the literature review section.

1.1 Problem Statement

Computer integrated manufacturing is a large area in manufacturing and it combine the use of activities. Even all the machine is controlled individually or synchronously but the main operation to move the product from station to station and from machine to other machine is controlled by the PLC. The main problem now is how to develop a new PLC programming and analyse it movement and operation. This have been the problem because there are a lot of things got to be consider and not just look at the conveyor operation but also all the equipment, tools, controller, it state, cycle time and working procedure. The PLC programming is depends on the conveyor system that will be made as the main system to move the product. So here what the most important is by making the design of the conveyor and know the station is taking places. After all the design is complete and have been analyse then the conveyor working procedure can be made to set the PLC programming as to made it autonomous.

1.2 Objectives of the Project

The objective of this project is to integrate the conveyor system in CIM by using PLC controller to control the working procedures. Also to develop an integrated conveyor system that will be attached with assembly stations and a system that can be improved for further research.

1.3 Scope of Project

The scope of this project is to analyse and designing the suitable design of the conveyor to be used in the system and also to develop a PLC as the programming of the conveyor operation.

1.4 Project Planning

Table 1-1: Gantt Chart for PSM 1

Scope		Weeks													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Understand the title and discuss with the supervisor									SEMESTER BREAK					
2	Finding article and journal of the project title.														
3	Gather all data and article of SIMATEC PLC														
4	Learning the design and all the calculation involve														
5	Learning on electrical circuit and diagram														
6	Gathering information on I/O device that will be used														
7	Learning how to use ladder diagram														
8	Test the software and circuit in simulation														
9	Make draft report of the project														
10	Complete and submit the full report														

Table 1-2: Gantt Chart for PSM 2

Scope		Weeks													
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1	Assemble the conveyor system									SEMESTER BREAK					
2	Start to programming the PLC														
3	Test run the system and find out any problem occur														
4	Early detection stage (hardware and software)														
5	Re-check the project planning														
6	Troubleshoot the system by making false and error														
7	Make the program and system more easy														
8	Make the final test run of the project														
9	Make draft report of the project														
10	Complete and submit the full report														

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to Computer Integrated Manufacturing (CIM)

The definition of CIM by the Computer and Automation Systems Association of the Society of manufacturing Engineers (CASA/SME) are CIM is 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. Analysis and Design Of PLC in CIM is a project that analyse and designing a CIM by using PLC as the programming and it controller. The meaning of CIM if we look at it narrower we could get is the on-line computer control and linking together of all function in a manufacturing plant. CIM and automation have an exclusive bond where automation is to working or operate with the use of machine, electrical drive, machine tools and other by controlled itself without the need of many human resource. The relationship between CIM and automation are like the physical production activities that take place in the factory can be distinguished from the information-processing activities. The heart of CIM is CAD/CAM. Computer-aided design (CAD) and computer-aided manufacturing (CAM) systems are essential to reducing cycle times in the organization. CAD/CAM is a high technology integrating tool between design and manufacturing. CAD techniques make use of group technology to create similar geometries for quick retrieval. Electronic files replace drawing rooms. CAD/CAM integrated systems provide design/drafting, planning and scheduling, and fabrication capabilities. CAD

provides the electronic part images, and CAM provides the facility for toolpath cutters to take on the raw piece.

2.1.1 CIM activities

In the CIM there are some activities that lead to the making of the CIM system itself. The definition of the computer terminology in manufacturing are include the,

- **CAD (Computer-aided Design)** – this activity comprises computer supported design, drafting, and engineering calculation. Since engineering is also involved in product testing, NC program generation, and other computer supported functions, the term CAE (Computer-aided engineering) is often used.
- **CAP (Computer-aided planning)** – this activity is concerned with the computer-aided generation of a technological plan to make the product. The process plan describes the manufacturing processes and sequence to make the part.
- **CAM (Computer-aided manufacturing)** – this activity defines the functions of a computer to control the activities on the manufacturing floor, including direct control of production equipment and management of material, cutting tools, fixtures and maintenance.
- **CAQ (Computer-aided quality control)** – this activity combines all ongoing quality control work of a manufacturing system. In some cases it is termed CAT (Computer-aided testing), which is somewhat restrictive in its meaning.
- **CAD/CAM** designates the sum of the activities **CAD, CAP, CAM,** and **CAQ**.
- **PP&C (production, planning and control)** – this function is the organisational activity of CIM. It is concerned with manufacturing resources planning, materials requirement planning, gross requirement planning, time phasing, order release, and manufacturing control.

All the activities above are an important part in CIM system technologies (figure 2.1) and if there any of the activities fail to perform or take part, it will make the system not working efficiently.