GRAPHICAL CIM PROCESS MONITORING SYSTEM

NURSHEDA ZAINUDIN

MAY 2006

"I accepted that have been read this kind of report. In my opinion this kind of report suppose in the scope and quality for purpose to award the Degree of Bachelor In Electrical Engineering (Industrial Power)."

Signature : .....

Supervisor Name : EN. SHAHRUDIN ZAKARIA

Date : 4 MAY 2006

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NURSHEDA BINTI ZAINUDIN

This Report Is Submitted In Partial Fulfillment of Requirements For The Degree of Bachelor In Electrical Engineering (Industrial Power)

Fakulti Kejuruteraan Elektrik
Kolej Universiti Teknikal Kebangsaan Malaysia

May 2006

"Hereby, I declare that this report is a result of my own research idea accept for works that have been cited clearly in the references."

Signature : .....

Writer's Name : NURSHEDA ZAINUDIN

Date : 4 MAY 2006

ACKNOWLEDGEMENT

First of all thanks to Allah SWT The Mighty that gave me an opportunity to complete this report on time, without His blessed I might be not complete this report on time. Secondly, thanks to my supervisor, Mr. Shahrudin Zakaria with his patienance to guide me through the process to make this project and report. Also million thanks to the lecturers and technician of KUTKM especially Mr. Ahmad Zubir Jamil and Mr. Syakrani because all of the helpers and advice that been given. Next is to my parents that gave me morale support through out completed this project and give me strength not to give up. Last but not least to my fellow friends, thanks a lot because of the support and advice that had been given to me through out this process of completing my project and report. All of the help and kindness will be always remain in my heart forever.

Thanks.

ABSTRACT

By using PLC, CitectSCADA version 5.0 software and RB-CIMS-100 the graphical monitoring system will be develop. The system show the user overall process of RB-CIMS-100 graphically. Besides that this system also can collaborates with the hardware which means by using this project user can get the monitoring data from the hardware. The project also will allow user to gather information about each station and user will be notify if any fault occurs in certain station. So that user will be easily track down the cause of the fault and which station is involved.

ABSTRAK

Dengan menggunakan PLC, perisian CitectSCADA versi 5.0 dan RB-CIMS-100 satu sistem pemantauan berdasarkan grafik akan dibangunankan. Sistem ini akan menunjukkan proses keseluruhan yang berlaku di RB-CIMS-100 secara grafik. Selain itu sistem ini turut berkebolehan berinteraksi dengan perkakasan iaitu RB-CIMS-100. Ini bermaksud dengan adanya projek ini pengguna dapat mengumpul data yang diperolehi dari RB-CIMS-100. Projek ini turut membenarkan pengguna mengumpul maklumat mengenai setiap stesen dan aku memberi amaran sekiranya berlaku sebarang kepincangan di stesen-stesen. Ini akan dapat memudahkan pengguna untuk memeriksa sebab kepincangan berlaku dan stesen mana yang terlibat.

TABLE OF CONTENTS

CHAPTER	DESCRIPTION	PAGES
	SUPERVISOR RECOGNITION	
	TITLE	**i**
	ADMISSION	**ii**
	DEDICATION	**iii**
	ACKNOWLEDGEMENT	**iv**
	ABSTRACT	**v**
	ABSTRAK	**vi**
	TABLE OF CONTENTS	**vii**
	LIST OF TABLE	**ix**
	LIST OF FIGURE	**x**
	LIST OF ABBREVIATION	**xi**
1	**INTRODUCTION**	
	1.1 Introduction	1
	1.2 The Objective	2
	1.3 The Project Scope	2
	1.4 The Problem Statement	3
2	**LITERATURE REVIEW**	
	2.1 Thesis 1 : Process Control Utilizing Citect Software	4
	2.2 Thesis 2 : Operator Interface Design For Industrial Control	7
	2.3 The Development Of Graphical Monitoring System	8
3	**PROJECT BACKGROUND**	
	3.1 Method Been Used	9
	3.2 The Graphical Process	10
	3.3 The Programmable Logic Controller	14
	3.4 Supervisory Control And Data Acquisition	25

3.5 CitectSCADA Version 5.0 28

4 METHODOLOGY

4.1 The Configuration Of Citect 31

4.2 The Chart Flow How To Use Citect 41

4.3 The Gantt Chart 42

5 RESULT

5.1 The Interface View 43

5.2 The Problem 55

6 DISCUSSION AND SUGESSTION

6.1 Discussion 57

6.2 Sugesstion 58

7 CONCLUSION 60

REFERENCESS

LIST OF TABLE

NO	TITLE	PAGES
3.1	Information About CJ Series PLC	11
4.1	The Address in Variable Tag Properties	36

LIST OF FIGURES

NO	TITLE	PAGES
3.1	The Dimension of CJ (Front and Side View)	11
3.2	The Dimension of CJ (Upper and Bottom View)	12
3.3	The PLC	15
3.4	The Flow Chart About How Does PLC Works	16
4.1	The Dialog Box for Creating New Project Folder	32
4.2	The Dialog Box for Computer Setup Wizard	33
4.3	Drawing Layout	34
4.4	Variable Tag Properties	35
4.6	RB-CIM-100 Layout (Offline)	37
4.7	RB-CIM-100 Layout (Online)	38
4.8	Main Menu of RB-CIM-100	39
4.9	The Navigation Page	40
5.1	The Menu Page	44
5.2	The Main Layout Page	45
5.3	The Main Layout (On Stage)	46
5.4	The Main Layout (Fault Stage)	47
5.5	The Hardware Page	48
5.6	The Alarm Page	49
5.7	The Summary Page	50
5.8	The Dialog Box To Login	51
5.9	The Menu Page (After User Login)	52
5.10	The Dialog Box To Create New User	53
5.11	The About Developer Page	54
5.12	The Shutdown Confirmation	55

LIST OF ABBREVIATION

CIM	–	Computer Intergrated Manufacturing
SCADA	–	Supervisory Control And Data Acquisition
PLC	–	Programmable Logic Controller

CHAPTER 1

INTRODUCTION

This chapter will give an introductory to this project. The introduction are include objectives, scopes and problem statement.

1.1 Introduction

In typical modernization world especially after the revolution of industrial sector. The world had facing the new creation and invention that would like the attention of the world population. This modernization had made the world inventor to think out of the box in order to create tools or machines that will help the world citizen life much more easier.

For example to produced a bottled of sauce need a lot of job and worker if it is done in conventional ways. But after the industrial revolution and the machine had been invented, number of worker need is reduced and so do the human power is replaced with machineries that can work and do job faster and efficiently.

Besides revolution of industrial sector, control engineering has also evolved over time. In the past humans was the main source for controlling a system. Furthermore recently electricity has been used for control and early electrical control was based on relays. These relays allow power to be switched on and off without a mechanical switch.

It is common to use relays to make simple logical control decisions. The development of low cost computer has brought the most recent revolution, the Programmable Logic Controller (PLC). The advent of the PLC began in the 1970s, and has become the most common choice for manufacturing controls. PLCs have been gaining popularity on the factory floor and will probably remain predominant for some time to come. Most of this is because of the advantages they offer.

a) Cost effective for controlling complex systems.
b) Flexible and can be reapplied to control other systems quickly and easily.
c) Computational abilities allow more sophisticated control.
d) Trouble shooting aids make programming easier and reduce downtime.
e) Reliable components make these likely to operate for years before failure.

1.2 Objectives

The objectives by doing this project are include :

a) To design the software that can be collaborates with the RB-CIMS-100;
b) To gather monitoring data from the RB-CIMS-100 without any difficulties;
c) To provide graphical monitoring system to the user which can give the user information about the process that is been going on;
d) To gather information about the problems that might be occur through out the process;
e) To easily track down the problem if it is occur during the process;

1.3 Scopes

Generally all projects have their own scopes and limitation. It is important because these scopes will play roles as guidance to this Graphical CIM Process Monitoring System. The scope of the project is to create graphical monitoring system process by using CitectSCADA version 5.0. The graphical monitoring process that will be creating based on the process that happen in RB-CIMS-100. Besides that the software can collaborates with the RB-CIMS-100 without any difficulties. The

software also can work individually where it does not connected to the RB-CIMS-100 the user still can observe the process. It is for educational learning purpose.

1.4 Problem Statement

In this 'real world' there are a lot of things to be done in order to fulfill our requirement. All the facilities that had been provided always makes out life much more enjoyable and easier. But in order to make this happen, a lot of tools had been created. Some of the tools that been created sometimes need an improvement if it does not suitable with present period. It is same with this project, even though there are existence of software to monitor the process that been done in RB-CIMS-100 but the software is incomplete. Besides that it also has a lot of interference pages where it is hard to manage it. The user need to click to every page if the users want to observes each station. Most of all, the existence program are not user friendly. This project hopefully will overcome this problem since for this project the layout for CitectSCADA is consisting only one page only. Which means all stations can be observe in one layout.

CHAPTER 2

LITERATURE REVIEW

This chapter will gives information about the project that had been done by other person by using the same software which is CitectSCADA but might be different version of this software.

2.1 Thesis 1: Process Control Utilizing Citect Software

The thesis entitle Process Control Utilizing Citect is written by Mike Smith from University of Queensland. The thesis is about to show the practical aspects of computer control and factory automation with the use of a small practical pumping station in the University of Queensland Control Laboratory and factory standard computer control equipment [1]. The software that been used is Citect and this software used to see the operational of pumping station in that selected university.

The work in completing the thesis has been divided into two sections [1]. The first is the process control code that is used to automate the system. The second is creating a user interface to the process, so an operator can control the system without having to be a skilled process control programmer.

All the techniques and basic commands used in the coding of programmable logic controllers (PLC). It is the coding for the PLC that automates the processes of the plant or factory being controlled. The coding is used in CX-Program by creating ladder diagram so that the pump will operates accordingly with correct sequence. All of the equipment used in the demonstration meets normal industry standards, and

could be found in automation systems around the world. Although this is a very small demonstration of process control compared to most industrial applications, but the processes and principles used for this thesis are still the same regardless of the size of the system [1]. Using the information explained in this thesis, along with an understanding of the process that the system undertakes, it is possible to automate any system, improving the time, cost, and most importantly the repeatability of the end product.

Usually large factory always want to reduce the cost of producing the product but increase the profitability. So by sing this Citect software the cost can be reduce since the pump will used PLC. The PLC is used as controller such as how many water will be put in the pump at one time, when it will be operate, and what will the pump do if there are any fault. PLC will be configure to do all this task, so less human energy is needed. Here the cost of worker is been reduce. Beside that, by having this controller the damage of pump also less since the PLC is set to stop if any fault occur.

Computers are an essential factory control tool used to increase product quality and production flexibility. Computer control can, in turn, make a company more competitive. Since customers are asking for more reliable products of a consistent, reliable standard, rather than volumes of products of questionable quality. Process control gives a company many incentives. Reduction of cost is not usually the main justification for the installation of an automated process control system. High standards of quality control of a product are at present not consistently achievable by manual operation.

Automated control creates a more flexible plant, making it possible to change operations and products while still maintaining repeatability, improved batch reporting and traceability of products, greater safety for the plant and personnel as well as the end consumers. However computer control does have some disadvantages. A substantial investment in application software, hardware and software engineering is required, often along with the upgrading of many sensors and actuators around a factory. Greater levels of technical and engineering efforts are required, and these often equal or sometimes outweigh the benefit achieved by

reducing process staffing levels. Having a highly technical process controlling the factory means that highly trained staff are needed to supervise and modify the automated control process. Unfortunately for the profit margin, highly skilled staff are often highly paid. Duplication and redundancy of systems control are often required to ensure that an automated control system stays fully operational. Redundancy is used to ensure that for any single computer control fault around the plant such as a disabled network, or bad communications to a particular valve will not cause the control system to fail to control the final product [1].

This thesis demonstrates the principles of computer control and factory automation using a water pumping station at simulating a factory situation. The pumping station comprises two small tanks with analog level sensors, 2 open or shut valves driven by actuators, a flow controller and flow sensor, and various manually operated valves. The water is pumped from a larger storage around the system using a small three-phase motor making it possible to use analog control to vary the rate at which the water is pumped to the two smaller tanks. He use how to produce mayonnaise to simulate the pump operation. This pumping station models a small factory process in the mixing of ingredients to make mayonnaise [1]. Although this is a relatively simple operation, many of the methods used to control the system are identical to methods commonly used in industries around the world.

The software required to control such a system is divided into two separate components. These components are the control software and the supervisory control and data acquisition (SCADA) software. The control software is constructed of logical programming rungs, telling the programmable logic controller PLC what to do, while the SCADA software collects and displays data for an operator to view.

The PLC's programming is the controlling code of the factory process, while the SCADA software only asks the PLC for individual values of particular memory addresses in the PLC. It is by using the SCADA that an operator can enter the rate of flow required, but it is the controlling ladder logic that actually makes that rate of flow happen. The ladder logic not only gets data from the values coming back to the PLC, it can also receive data from the SCADA software. This makes it possible for an operator to set a valve to open, or to set a particular flow through a pipeline.

However he use Allan Bradley SLC 500 PLC. Citect is used as the SCADA package for this factory simulation. It has capabilities that far outreach those required for this system, but is suitable for a plant with any number of inputs and outputs to be controlled Wizcon, Citect, Fix Dmax and WonderWare are the four most widespread factory control software brands used today [1].

A lot of problem occur during this finished up this thesis. Some of the problem are depends upon the PLC. As a result the objective for this thesis was achieved. He managed to operate the pump accordingly to it operation methods and also can control it from the computer.

2.2 Thesis 2 : Operator Interface Design For Industrial control

The thesis entitled Operator Interface Design For Industrial Control is written by Gareth Talamini for University of Queensland [2]. Propose of doing this thesis is to see the operation of Queensland Magnesia (Operations) Pty Ltd (QMAG). The Citect software used as tools to monitor system besides that this thesis also analyse the common structure of operation of QMAG. The software also has a lot of sequence since the process for QMAG are many and quite complicated [2].

This thesis also tell about the importance of having centralized monitoring system since it will reduce the cost and also makes the work more easier than before. By having this kind of system it much easier to supervised the process. This thesis also gave overview of PLC and so do the Citect. All important pages such as summary page, alarm page and hardware page is been created. This pages been created since there are a lot of work to be done in QMAG.

The thesis also show the result that been gained and also the interface layout of the process. The problem that occur during the project been done also is stated here.

2.3 The Development of Graphical Monitoring System

Since CIM are develop in rapid ways. Everyday there will be a changes and the new technology development of CIM. So to occupy with this development it is possible to have graphical monitoring system. It is very useful since CIM is been used widely in the manufacturing sector lately. By having graphical monitoring system it is much easier and much more convenient to the operator in the manufacturing factory. It is because the graphical layout will look same as the real process, so even though the operator does not been trained he/she still can monitor the system easily.

The improvement that been make to this system by having this graphical monitoring system is it monitor manufacturing process. Besides that, the user will be notifying if any fault occur to through out the process. Besides that the graphical monitoring system should be user friendly as possible. The user can gather use and important information easily.

CHAPTER 3

PROJECT BACKGROUND

This chapter will give a background of this project including its theory and the basic concepts that need to be understand to make sure this project will be completed.

3.1 Method Been Used

1) Do research through out resources such as books, journal, and online website and user's manual of the software. This is the part where literature review been done. It is important because from this method almost all the information can be gather and will be used in future. Besides that it also most easiest method to be used.

2) By using CitectSCADA version 5.0 software to develop graphical of RB-CIMS-100 overall process. This software will be used to design the RB-CIM-100 virtually and been program that it will collaborate with the RB-CIM-100.

3) By using CX-Programmer software to understand program for programmable logic controller.

3.2 The Graphical Process

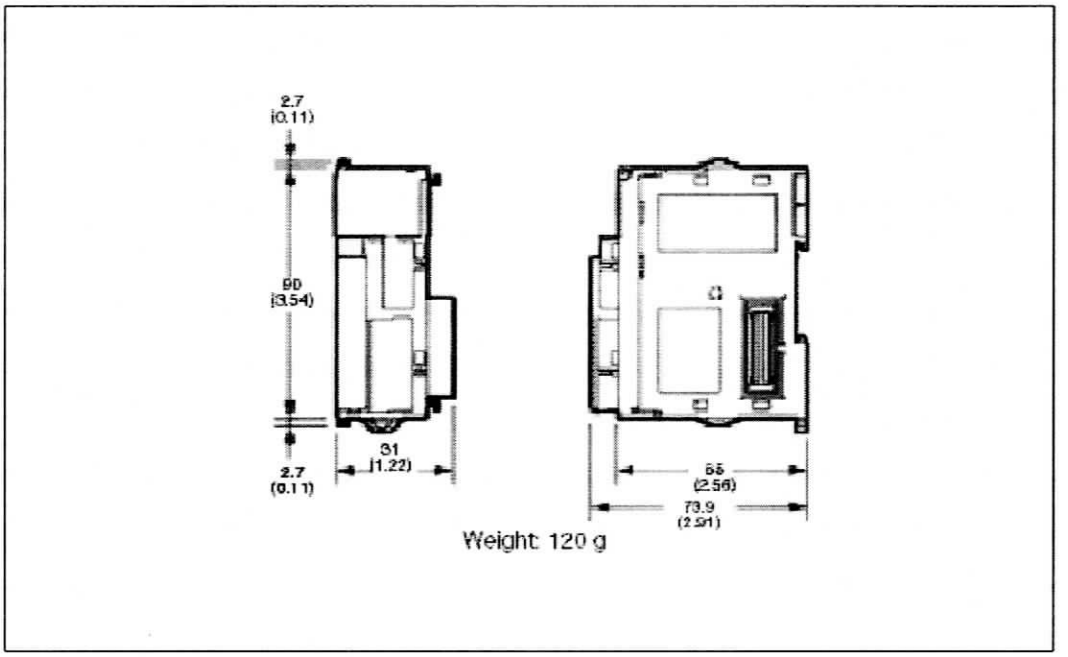
Graphical CIM process monitoring system will be develop using CitectSCADA version 5.0. This software will be develop upon the process that happened through out the RB-CIMS-100. The RB-CIMS-100 has eight stations with one station act as dummy so that it would be used in future if it is need. The station are including detect acrylic, engrave the design that had been set, disc casing loader, pressed station, open disc casing, insert disc in disc case (detecting text), closed the disc casing, dummy. All of these stations can operate as individual or connect together (networking). Overall it was seven station that will be design in CitectSCADA version 5.0. The graphical design should fill this requirement which is CitectSCADA version 5.0 can collaborates with RB-CIMS-100. CitectSCADA version 5.0 will show all the process in only one layout with some important indicator button. By using this software the process will be monitor and if fault occur it will be detect by the software. Besides that this software also responsible to show place where is the fault occur.

CitectSCADA, industrial automation software, enables customers to increase return on assets by delivering highly scalable, reliable control and monitoring systems to reduce operating costs, improve productivity and product quality. Easy-to-use configuration tools and powerful features enable end users and system integrators to quickly develop and deploy solutions for any size manufacturing automation application. The benefits using CitectSCADA version 5.0 are maximize the productivity, improve product quality, reducing operating and maintenance cost, integrate with existence system, to preserved capital investment and to secure and protected the investment. The PLC that will be use is CJ1M13 (see Table 3.1). The CJ1M extends the CJ1 Series to meet the reduced requirements of more compact machine designs with greater functionality, less memory and built-in I/O. The CJ1M provides a low-cost solution for applications with lower I/O counts and shorter programs compared to the more powerful CJ1G/H CPUs. All CJ1 Series use the same instruction set and I/O modules, so existing programs and equipment can be easily reused in small and large-scale installations. A common memory area and powerful serial link among nine CJ1M CPUs can help integrate processes or coordinate activities.

Table 3.1 Information about CPU unit for CJ1M

Model	Number of I/O points	Maximum number of Expansion Racks	Maximum number of connect-able Modules	Program capacity	Data memory capacity	LD instruction processing speed	Built-in ports	Mountable options	Built-in I/O
CJ1M-CPU12	320	None	10 Modules	10 Ksteps	32 Kwords (DM only, no EM)	100 ns	Peripher-al port and RS-232C port	Memory Card (compact flash)	None
CJ1M-CPU13	640	1 Rack	CPU Rack: 10 Modules Expansion Rack: 10 Modules	20 Ksteps					
CJ1M-CPU22	320	None	10 Modules	10 Ksteps					10 inputs and 6 outputs Inputs: 4 interrupt inputs (pulse catch); 2 high-speed counter inputs (Phase differential: 50 kHz; Single phase: 100 kHz) Outputs: 2 pulse outputs (2 points for positioning, 100-kHz speed control, and PWM output)
CJ1M-CPU23	640	1 Rack	CPU Rack: 10 Modules Expansion Rack: 10 Modules	20 Ksteps					

Figure 3.1 Dimension Of CJ1 (front and side position)



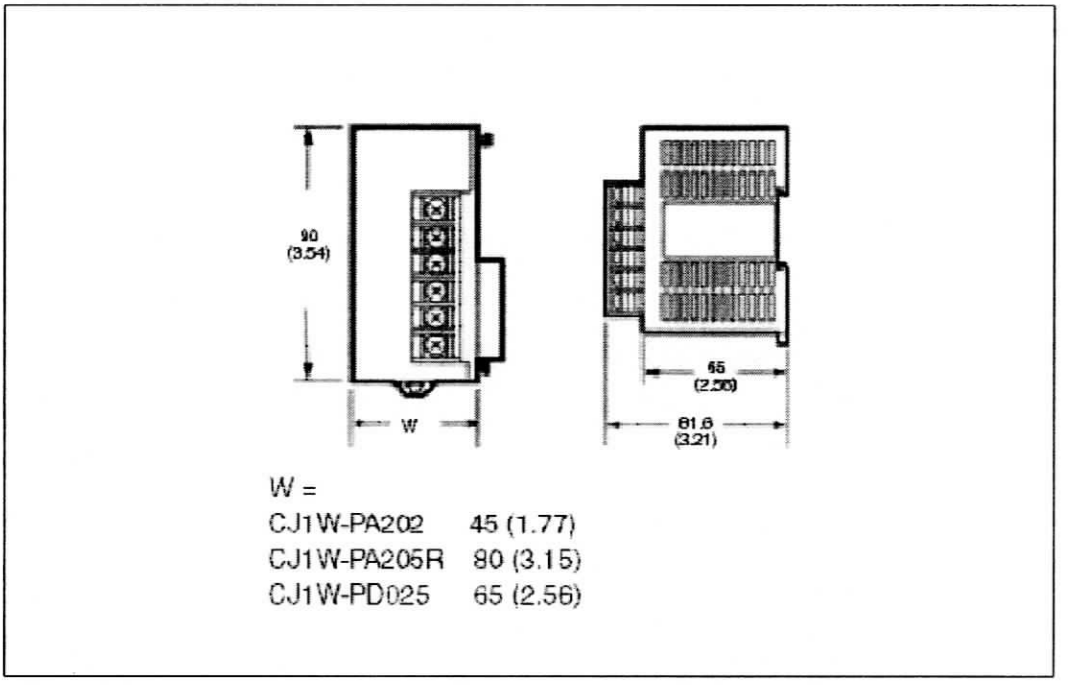


Figure 3.2 Dimension of CJ1 (Above and Bottom Positon)

Computer Integrated Manufactured also known as CIM is involving many computer technologies. CIM interprets between manufactured and technology. It is revolution from the technology of manufactured. This technology develop rapidly and quick where almost everyday there are new technologies will appear. That's why eventhough people with industry knowledge sometimes could not ketch up with the development of CIM technology. CIM is integrated between business, engineering, manufacturing and management information.

The most extremely changes between Japanese and Europe company can be seen by Shiego Shingo (1988) most Europe company implemented the increment as the changes in application of technology. Whereby for Japanese company their changes are increase and continuity and they usually involving man power. Japanese approaches is low cost and high technology.

CIM can help reducing time, less workers needed and produce good quality of product. That is the advantage using CIM in factories. Since CIM involved many process in manufacturing to produce product, therefore most effective system that can monitor the process is needed. It is because without effective monitoring system it might be make the factory that use CIM become unmanageable.