IMPLEMENTATION OF SCADA (SUPERVISORY CONTROL AND DATA ACQUISITION) FOR FMS 200

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This report is submitted in partial fulfillment of requirement for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours.

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UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
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Tajuk Projek : IMPLEMENTATION OF SCADA FOR FMS 200……

Sesi Pengajian : 2008/2009……..

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For my beloved parent,
You helped me through a time when nobody else could have.

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ABSTRACT

This project is proposed the implementation of SCADA for FMS 200 which is located at Lab Automation. SCADA system is created for Flexible Manufacturing System and this system has 8 stations that use to assemble rotating mechanism. The form of SCADA usually refers to centralized system which is used to the monitor and control entire sites from one computer. Most of the FMS 200 control actions are performed automatically by programmable logic control before SCADA is being implemented to this system. Beside than, all the 8 stations is control manually from the sites by technician if error happen. For example likes resetting, starting and stopping or controlling any kind of activity of the system at the control panel of each station. By using SCADA, it can monitoring on quantity product being produce, air pressure existence, electric supply power, machine condition, products condition and product measurement. Apart from that, it also can control all the 8 station from the main computer without need to go each station to reset and activating the system if errors happen. As a conclusion, this project has been successfully done. By having this system, it will give benefit to human specially on monitoring system and equipment or machine in industry.

ABSTRAK

Projek ini bertujuan untuk mengaplikasikan SCADA yang sedia ada kepada FMS 200. Ia bertujuan untuk memantau dan mengawal operasi FMS 200 yang terletak di makmal automasi. FMS 200 ini mempunyai 8 stesyen, dimana ia berfungsi untuk pemasangan 'rotating mechanism'. Sebelum SCADA diaplikasi kepada FMS 200, sistem tersebut dikawal sepenuhnya oleh PLC dan dikawal secara manual dari setiap stesyen oleh juruteknik. Setiap stesyen dikawal secara berasingan dari panel kawalan tersendiri. Dengan adanya SCADA yang akan dipasang pada satu komputer utama untuk membolehkan ia berinteraksi dengan PLC. Daripada komputer tersebut, proses sistem FMS 200 dapat dipantau dan dikawal segala – segala operasinya seperti hasil produk, angin pneumatik, bekalan kuasa elektrik , kedudukan pallet, keadaan produk dan sukatan produk. Maka Juruteknik tidak perlu pergi ke setiap stesyen untuk menghidupkan atau mematikan sistem tersebut jika berlaku masalah kepada sistem tersebut. Secara kesimpulannya, SCADA ini membawa banyak kebaikan kepada manusia terutamanya dalam pemantauan dan pengawalan sistem serta peralatan dalam industri.

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LIST OF ABBREVIATION

SCADA	–	Supervisor Control and Data Acquisition
FMS	–	Flexible Manufacturing System
PLC	–	Programmable Logic Control
PIC	–	Programmable Integrated Circuit
SAC	–	Single Acting Cylinder
DAC	–	Double Acting Cylinder
OFN	–	Oxygen Free Nitrogen
TIM	–	Timer
CNT	–	Counter
NOP	–	No Operation
I/O	–	Input Output
LD	–	Ladder Diagram
ST	–	Structure Text
IL	–	Instruction List
FBD	–	Function Block Diagram
RAM	–	Random Access Memory
GUI	–	Graphical User Interface

CHAPTER I

INTRODUCTION

Chapter I is about the summary of the project, why this kind project be make, the purpose of the project to the human used at the future, objective of the project and how was this project will be make by showing the project flow chart.

1.1 Background

Supervisory Control and Data Acquisition (SCADA) is generally refers to an industrial control system: a computer system monitoring and controlling a process. The process can be industrial, infrastructure or facility based as described below:

i. Industrial processes include those of manufacturing, production, power generation, fabrication, and refining, and may run in continuous, batch, repetitive, or discrete modes.

ii. Infrastructure processes may be public or private, and include water treatment and distribution, wastewater collection and treatment, oil and gas pipelines, electrical power transmission and distribution, and large communication systems.

iii. Facility processes occur both in public facilities and private ones, including buildings, airports, ships, and space stations. They monitor and control HVAC, access, and energy consumption.

This SCADA can be created by using many kind of software. For example is Citect SCADA, CX – Design, CX – Supervisory, Visual Basic and other more kind of software. This software is depending on the PLC that user use to interface with the SCADA. This project was using the CX – Supervisory because it was the software come together with the FMS 200. This software is use to create Graphical User Interface (GUI).

Graphical User Interface is the pages that will be use as the interface to control the system. At this GUI the user will be able control and monitor the system. Example of the GUI will be more detail at chapter IV, there will show the shape of the GUI.

A flexible manufacturing system (FMS) is a manufacturing system in which there is some amount of flexibility that allows the system to react in the case of changes, either predicted or unpredicted. This flexibility is generally considered to fall into two categories, which both contain numerous subcategories. The first category, machine flexibility, covers the system's ability to be changed to produce new product types, and ability to change the order of operations executed in a part. The second category is called routing flexibility, consisting of the ability to use multiple machines to perform the same operation in a part, as well as the system's ability to absorb large-scale changes, such as in volume, capacity, or capability. There are 8 stations involve in FMS 20. These 8 stations are stated below.

i. Body Feed – Positioning
ii. Pick and Place Bearing
iii. Press Bearing in Hydraulically
iv. Pick and Place shaft and verify.
v. Pick and Place cover.
vi. Fit Screws.
vii. Robot Screw driving.

viii. Unloading, storage and palletization of final assembly.

The project is basically based on the software called SCADA which is implemented on FMS 200. The main control computer will be able to display the quantity of product being produce, air pressure existence, electric supply power, machine condition, products condition and product measurement. Apart from that, it also can control all the 8 station from the main computer without need to go each station to reset and activating the system if errors happen. With this system, it will easily alert human if there is any problem happen and all the information can be monitored from this main computer

1.2 Project Objective

The objective of project is to ensure that the project following on the right plan and what the project really wants to achieves. Besides than it also to ensure the positive progress of the development system and also to ensure that the main objective will be realized. Below are the objectives of the project:

i. To implement the main system that can collect data and monitoring all 8 stations of Flexible Manufacturing System 200.

ii. Doing the practical and theories research with proper analysis on SCADA system on Flexible Manufacturing System 200.

iii. Upgrade station 1 by install proximity inductor sensor.

1.3 Scope of the Project

The scope of this project is to determine the methods in used and knowledge that will be gained by the students before and after in completing the Project Sarjana Muda. Below are the scopes of this project:

i. SCADA familiarization

Study about SCADA from journal and book based on the application and the functional of SCADA work as wall as the benefit of SCADA in the implementation process.

ii. FMS 200 familiarization

Study about FMS 200 from the manual provided by SMC training Company. Then, doing experiment on all the 8 station to identify all the technologies that uses in FMS 200 such as sensor, pneumatic, hydraulic, PLC, motor and arm robot. Moreover, finding research on the FMS 200 in the internet based on identical journal.

iii. Implement SCADA on FMS 200

Doing research on CX – supervisor software provided by SMC training Company before implementing SCADA on FMS 200 because the software is used to set SCADA to FMS 200. This will be followed by the implementation SCADA on FMS 200 and troubleshoot if errors occurred and write accumulate the result observed.

1.4 Problem Statement

Flexible Manufacturing Machine is needed in all manufacturing factory where a large scale of machine needed. Humans are usually the main control and monitor all of the system. However, there are maybe some errors occurs cause by human itself such as bad quality of product, wrong counting of product and low machine safety. Thus, SCADA is the best alternative to solve the monitoring system and control all kind of large scale of machine. Furthermore, the number of products being produce, air pressure, electric supply, machine condition, product measurement and on – off system on each station of Flexible Manufacturing Machine directly can be monitored overall by the main control computer. Also, the presence of alarm condition will notify the human operator if there is any problem occurred and all the

information can be collected from this main computer without the need to go to the all machine stations.

1.5 Methodology Briefly

This part is about how the project will be created and the flow of the project to complete this Project Sarjana Muda. This part is just be explain briefly and will be more detail at chapter III.

i. Project Planning

- The first step is meeting up with the supervisor requiring how to achieve this 2 objectives and proper planning for PSM 1 and Gantt chart was created for project planning.

ii. Familiarize FMS 200

- The second step is to accumulate all the knowledge and researches about FMS 200 regarding on what types of technology that it uses to operate in assembly bearing.

iii. Research SCADA

- The method in used is same as familiarize on FMS 200, where proper understandings are needed to achieve on second objective which is, doing the practical and theories research with proper analysis on SCADA system on Flexible Manufacturing System 200.

iv. Implement SCADA and finishing

- The implementation of SCADA on FMS 200 can be done once the operation of SCADA is understood. Troubleshoot if the SCADA if there is any possible

error. Then prepare the final result to supervisor by demonstrating the SCADA operating system. Lastly summit the final report and prepare for presentation.

1.6 Project Structure

This report contains five chapters that will explain the details about this project. The first chapter is the project introduction. This chapter contains the project introduction, project objectives, project problem statement, and project work scope.

The second chapter is the literature review which contains the findings of the research regarding to the topic of SCADA. Most of the researches are about the past studies that related to the concept of the system that is going to be built.

The third chapter is the Project Methodology. This chapter will explain the project framework from the beginning until it is completed. Flowchart for each of the development is attached for further understanding.

The fourth chapter will be on the current results of the project. This means that the project is still on progress. This chapter will show what have been done for this project and what have not been done yet, problems and solution for the problems occurred and others.

The last chapter is about the application of the project, discussion and conclusion of the project. This chapter also contains suggestions to improve this project for future works. The conclusion for this project is also showed in this chapter.

CHAPTER II

LITERATURE REVIEW

In order to execute this project, literature review must be done to comprehend the whole system and decide the best inputs, outputs and devices. From literature review, there will be an analysis concerning the advantage and disadvantage for each phase in this project. Equipment and part manuals include information such as dimension, operation and specification.

2.1 SCADA (Supervisory Control and Data Acquisition)

It generally refers to an industrial control system: a computer system monitoring and controlling a process. The process can be industrial, infrastructure or facility based as described below:

- Industrial processes include those of manufacturing, production, power generation, fabrication, and refining, and may run in continuous, batch, repetitive, or discrete modes.

- Infrastructure processes may be public or private, and include water treatment and distribution, wastewater collection and treatment, oil and gas pipelines,

electrical power transmission and distribution, and large communication systems.

- Facility processes occur both in public facilities and private ones, including buildings, airports, ships, and space stations. They monitor and control HVAC, access, and energy consumption.

2.1.1 SCADA System Concept

The term SCADA usually refers to centralized systems which monitor and control entire sites, or complexes of systems spread out over large areas. Most control actions are performed automatically by remote terminal units or by programmable logic controllers. Host control functions are usually restricted to basic overriding or supervisory level intervention.

For example, a PLC may control the flow of cooling water through part of an industrial process, but the SCADA system may allow operators to change the set points for the flow, and enable alarm conditions, such as loss of flow and high temperature, to be displayed and recorded. The feedback control loop passes through the RTU or PLC, while the SCADA system monitors the overall performance of the loop.

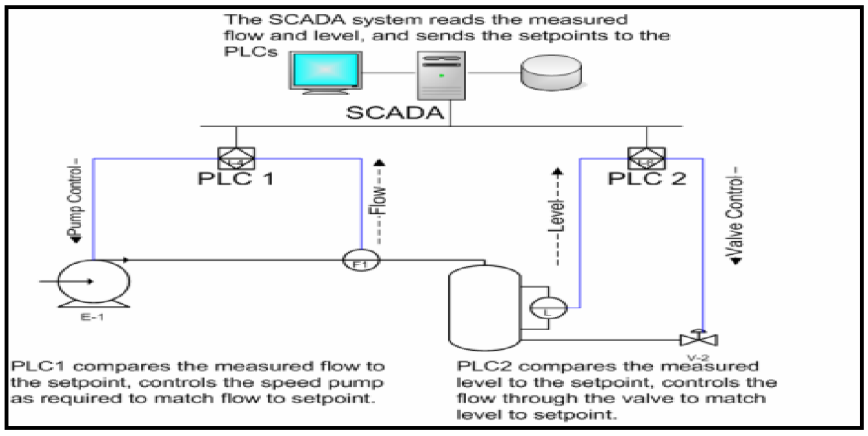

Figure 2.1: Connection between SCADA and equipment

Data acquisition begins at the RTU or PLC level and includes meter readings and equipment status reports that are communicated to SCADA as required. Data is then compiled and formatted in such a way that a control room operator using the HMI can make supervisory decisions to adjust or override normal RTU (PLC) controls. Data may also be fed to a Historian, often built on a commodity Database Management System, to allow trending and other analytical auditing

SCADA systems typically implement a distributed database, commonly referred to as a tag database, which contains data elements called tags or points. A point represents a single input or output value monitored or controlled by the system. Points can be either "hard" or "soft". A hard point represents an actual input or output within the system, while a soft point results from logic and math operations applied to other points. Most implementations conceptually remove the distinction by making every property a "soft" point expression, which may, in the simplest case, equal a single hard point. Points are normally stored as value-timestamp pairs: a value and the timestamp when it was recorded or calculated. A series of value-timestamp pairs gives the history of that point. It's also common to store additional metadata with tags, such as the path to a field device or PLC register, design time comments, and alarm information.