DEVELOPMENT OF DISTRIBUTED CONTROL SYSTEM (DCS)

USING TEMPERATURE PROCESS CONTROL PLANT

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BEKC

2008/2009

SUPERVISOR'S DECLARATION

"I hereby declared that I have read through this report entitle "Development of Distributed Control System (DCS) Using Temperature Process Plant" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrument and Automation)

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DEVELOPMENT OF DISTRIBUTED CONTROL SYSTEM (DCS) USING TEMPERATURE PROCESS CONTROL PLANT

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A Report Submitted In Partial Fulfillment of Requirements for The Degree of Bachelor In Electrical Engineering (Control, Instrument and Automation)

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2008/2009

STUDENT DECLARATION

"I declare that this report entitle "Development of Distributed Control System (DCS) Using Temperature Process Plant" is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : FAZLI IDWAN BIN DOLKAFRI

Date : 11 MAY 2009

Specially dedicated to

My beloved parents, sisters and brothers.

Thank you for the endless support and encouragement

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ABSTRACT

Temperature process is much been used in heavy industry sector. Customary, temperature process plant can be assessed at exploration areas oil and oil refining area. Basically these temperature plant areas very large to carry every process follow level. This is very hard to control inside whole process a time. This project more converging to invent and produce system Supervisor Control and Acquisition (SCADA) intend to combine whole process and displayed in screen. Qualities system this are such as mimic diagram, process flow diagram, natural and adapt with future information management. Objective of this project are generating Graphical User Interface (GUI) use software CX- Designer or Citect SCADA as display in screen for display see and control process in temperature plant from afar. This intend to ease something process can be monitored from time to time and identify problems quickly. At every process which operates shall be regulated by Programmable Logic Circuit (PLC). PLC this was necessary programmed follow process specification is wanted. SCADA's system need to communicate with PLC to carry out system SCADA

ABSTRACT

Loji suhu banyak digunakana dalam sector industry berat. Kebiasaanya logi suhu ini boleh didapati di kawasan cari gali minyak dan kawasan penapisan minyak. Pada dasarnya loji suhu ini berkeluasan yang sangat besar bagi menjalankan setiap proses mengikut peringkat. Maka sangat sukar untuk mengawal keseluruhan proses dalam satu masa. Projek ini lebih menjurus untuk mereka cipta dan menghasilkan system Supervisor Control and Acquisition (SCADA) bertujuan menggabungkan keseluruhan proses dan dipaparkan pada skrin. Sifat-sifat system ini adalah seperti mimic gambarajah, gambarajah aliran proses, alam dan sesuaikan dengan pengurusan maklumat akan datang. Objektif projek ini adalah menghasilkan Graphical User Interface (GUI) menggunakan software CX-Desinger atau Citect SCADA sebagai paparan pada skrin untuk paparan melihat dan mengawal proses di loji suhu dari jauh. Ini bertujuan memudahkan sesuatu process dapat dipantau dari semasa ke semasa serta mengenalpasti masalah dengan cepat. Pada setiap proses yang dijalankan akan dikawal oleh Programmable Logic Circuit (PLC). PLC ini perlu diprogramkan mengikut spesifikasi proses yang dikehendaki. Sistem SCADA perlu berkomunikasi dengan PLC untuk menjalankan system SCADA

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CHAPTER 1

INTRODUCTION / LITERATURE REVIEW

1.1 Introduction of Process Control

Generally, process control is a statistic and engineering discipline that deals with architecture, mechanisms and algorithms for controlling the output of a process. For example, heating up the temperature in a room is a process that has desire outcome to reach and maintain a defined temperature constant over time. Here, the temperature is the controlled variable. At time, it is the input variable since it is measured by a thermometer and decides whether to heat or not to heat. The state of the heater is called the manipulated variable since it is subject to control action.

A commonly used control device called programmable logic controller or a PLC is used to read a set of digital and analog inputs, apply a set of logic statements, and generate a set of analog and digital outputs. Using the example in the previous paragraph, the room temperature would be an input to the PLC. The logical statements would compare the set point to the input temperature and determine whether more or less heating was necessary to keep the temperature constant. The PLC output would then either open or close the hot water valve, an incremental amount, depending on whether more or less hot water was needed. A large and more complex system can be controlled by a Distributed Control System (DCS) or SCADA system

1.2 Problem Statement

Presently, the process plant is the most popular industry in any country. However, they might encounter so many problems in their operation. One of the problems it is quite difficult to detect fault by using conventional system. This is happens because process plant and the control room have some limitation in distance. So it takes long time to inspect rectify that problem. Also, a problem is the conventional system only allows a single workstation to monitor the process. Therefore, the data management proper process can't be done. Among the recommended solution to this problem is to implement the DCS system (Distribute Control System) to will integrate the GUI (Graphical User Interface) develop using Citect SCADA with a PLC controlled process plant.

1.3 Project Objectives

There are two main objectives to be achieved in this project, they are:

i. To develop DCS system that will allow several workstations to be monitored and controlled.

ii. To develop system that will include features such as alarm, data logging, mimic diagram, process flow diagram, thus make system more efficient and presentable

1.4 Scope of work

The scope of this project will cover on:

i. The development of GUI by using Citect SCADA / CX-Designer

ii. The process plant controlled by PLC

iii. Proper interfacing between hardware, software and PLC

1.5 Literature Review

A literature review is an evaluative report of information found that related to the selected area of study. This review will describe the summaries, evaluate and clarify of this literature. It should give a theoretical base for the research and help to determine the nature for this research. In this section, it will be discussing about the theory and concepts that is accordingly to the project in details. Also, it will inform about the perspective and method that have been using in this project. It is also discuss software on previous generation of sorting system. Through the literature review for this project, it can identify and evaluate technical issues about sorting system reliability. Below are the parts that are included in this section:

1) Distribute Control System

2) Human Machine Interface

3) SCADA

4) PLC

5) Serial Port

1.5.1 Distribute Control System

A Distributed Control System (DCS) refers to control system usually of a manufacturing system, process or any kind of dynamic system, in which the controller element are not central in location but are distributed throughout the system with each component sub-system controlled by one or more controllers. The entire systems of controllers are connected by networks for communication and monitoring.

DCS is very broad term used in a variety of industries to monitor and control distributed equipment. There are:

i. Electric power grids and electrical generation
ii. Traffic signals
iii. Oil refining plants
iv. Chemical plants
v. Pharmaceutical manufacturing
vi. Sensor networks

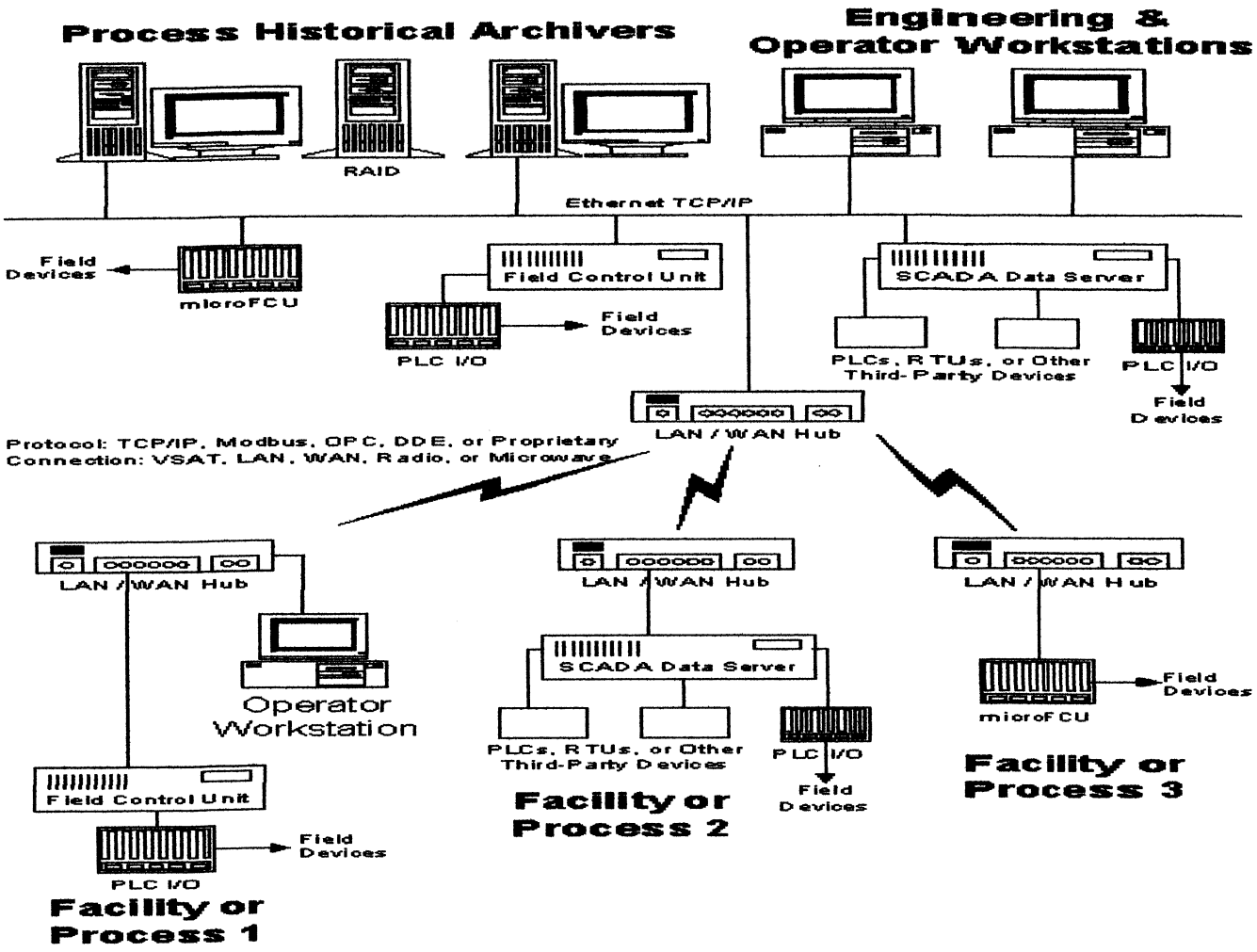

Figure 1.1 Distribute Control System Architecture

A DCS typically uses custom designed processors as controllers and uses both proprietary interconnection and protocols for communication. Input and output modules form component parts of the DCS. The processor receives information from input modules and sends information to output modules. The input modules receive information from input instruments in the process and transmit instructions to the output instruments in the field. Computer buses or electrical buses connect the processor and modules through multiplexers / demultiplexers. Buses also connect the distributed controllers with the central controller and finally to the Human Machine Interface (HMI) or control consoles.

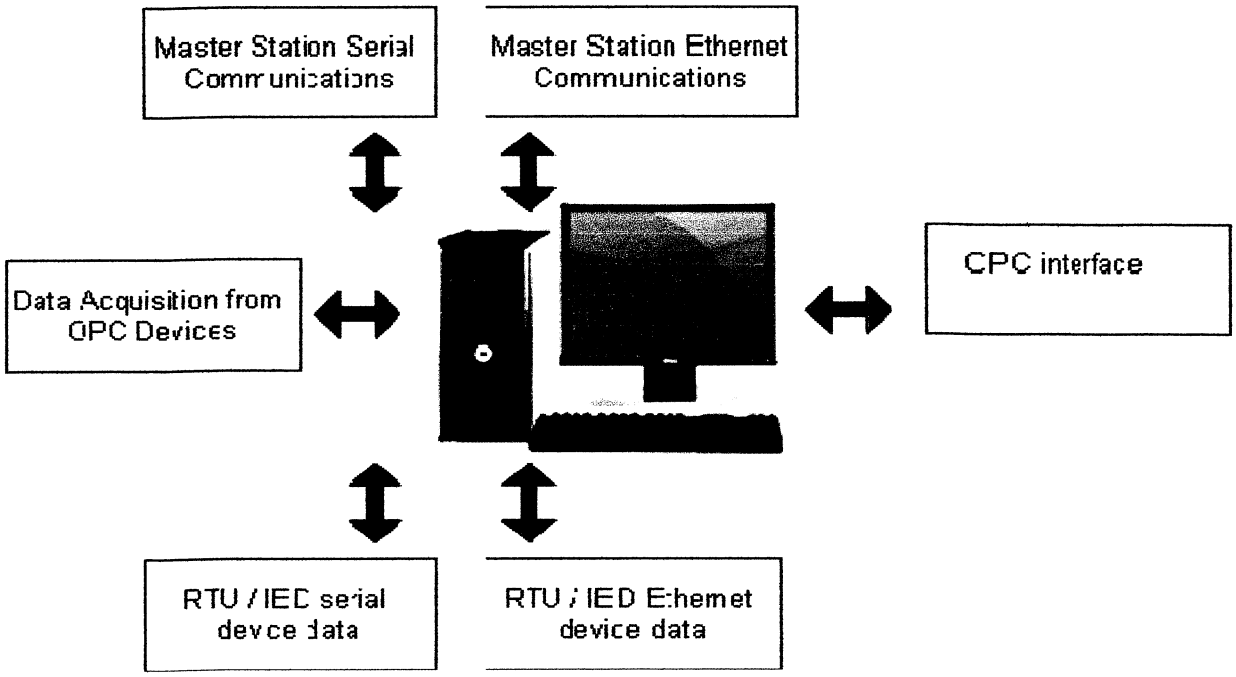

Figure 1.2 Communication of SCADA

1.5.2 Human Machine Interface

Human Machine Interfaces (HMI) are operator interfaces terminal with users interact in order to control other devices. Some HMI include knobs, level, and controls. Other provides programmable function keys or a full key pad. Devices that include a processor or interface to personal computers (PCs) are also available. Many HMI include alphanumeric or graphic displays. For ease of use, these displays are often backlit or use standard messages. When selecting HMI, important considerations include devices supported and devices controlled. Device dimensions, operating temperature, operating humidity and vibration and shock rating are other important factors.

Many HMI include flat panel display (FPDs) that use liquid crystal display (LCD) or gas plasma technologies. In LCDs, an electric current through a liquid crystal solution that is trapped between two sheets or polarizing material. The crystals align themselves so that light cannot pass, producing an image on the screen. LCDs can be monochrome or color. Color display can use a passive matrix or an active matrix.

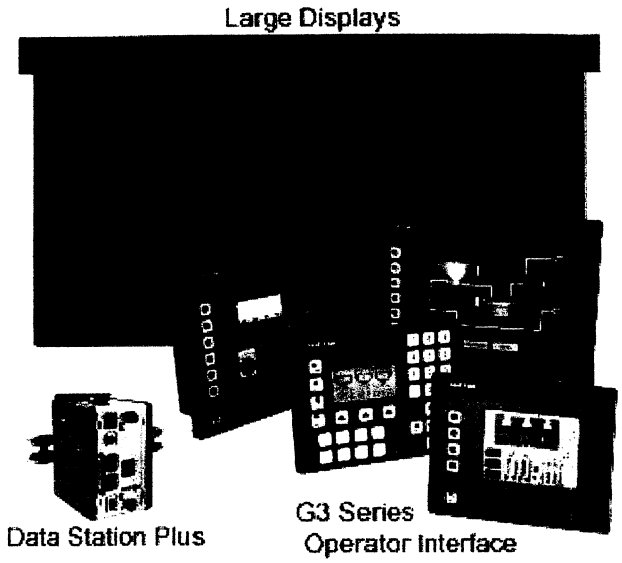

Figure 1.3 Human Machine Interface (HMI)

Passive matrix display contains a grid of horizontal and vertical wires with an LCD element at each intersection. In active matrix displays, each pixel has a transistor that is switched directly on or off, improving response times. Unlike LCDs, gas plasma displays consist of an array of pixels, each of which contains red, blue, and green sub pixels. In the plasma state, gas reacts with the sub pixels to display the appropriate color

Human machine interfaces differ in terms of performance specifications and I/O ports. Performance specifications include processor type, random access memory (RAM), and hard drive capacity, and other drive options. I/O interfaces allow connections to peripherals such as mice, keyboards, and modems. Common I/O interfaces include Ethernet, Fast Ethernet, RS232, RS422, RS485, small computer system interface (SCSI), and universal serial bus (USB). Ethernet is a local area network (LAN) protocol that uses a bus or star typology and supports data transfer rates of 10 Mbps. Fast Ethernet is a 100 Mbps specification. RS232, RS422, and RS485 are balanced serial interfaces for the transmission of digital data. Small computer systems interface (SCSI) is an intelligent I/O parallel peripheral bus with a standard, device-independent protocol that allows many peripheral devices to be connected to the SCSI port. Universal serial bus (USB) is a 4-wire, 12-Mbps serial bus for low-to-medium speed peripheral device connections.