DEVELOPMENT OF SCADA FOR SERVO CONTROLLED PICK AND PLACE SYSTEM

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APRIL 2009

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation & Automation)"

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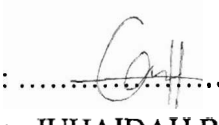
"I hereby declared that this report is a result of my own work except for the work that have been cited clearly in the references".

Signature : 

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ABSTARCT

This project is about the development of Supervisory Control and Data Acquisition (SCADA) for servo controlled pick and place system. In this project, SCADA will be the central system that control and monitors all the data from sensors and transducers in the system. This project comprises of integration between Supervisory Control and Data Acquisition (SCADA), programmable logic control, pneumatics and electrical actuators in two main sites which is master station and remote site. Master station consist of SCADA host which is a single computer that running CX-Designer software, a sophisticated Human Machine Interface (HMI) that responsible to communicate with field instrument. While remote site, consist of programmable logic controller (PLC) and field instrument. The completion of this project will produce a complete industrial prototype automation system that will be used for teaching and learning purposes in automation subject.

ABSTRAK

Projek ini adalah mengenai pembangunan SCADA untuk sistem pengangkatan dan penyimpanan barangan yang dibantu oleh kuasa. Dalam projek ini, SCADA akan menjadi pusat sistem yang mengawal dan mengawasi data daripada *sensor* dan *trandusers* di dalam sistem tersebut. Projek ini adalah integrasi SCADA, PLC, pnuematics dan elektrik pemaju melalui dua bahagian utama *master site* dan *remote site*. Di bahagian master station terdapat satu komputer yang menjalankan perisian CX-Designer iaitu HMI yang bertanggungjawab untuk berkomunikasi dengan. mesin pengangkatan dan peyimpanan barangan. Manakala, bahagian remote site mengandungi PLC dan. Projek ini akan menghasilkan satu mekanisme automasi industri yang lengkap khusus untuk proses pengajaran dan pembelajaran kahsnya dalam matapelajaran automasi.

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GLOSARY

SCADA	-	Supervisory Control and Data Acquisition
PLC	-	Programmable Logic Controller
RTU	-	Remote Terminal Unit
RS	-	Remote Station
HMI	-	Human Machine Interface
MMI	-	Man Machine Interface
CMS	-	Centre Monitoring Station

CHAPTER 1

INTRODUCTION

1.1 Definition

SCADA is an acronym that stands for Supervisory Control and Data Acquisition. A SCADA system is a common process automation system which is used to gather data from sensors and instruments located at remote sites and to transmit and display this data at a central site for either control or monitoring purposes. SCADA is widely use in power plants, oil and gas refining, transportation, telecommunication, various treatment plants and in control of waste and water.

SCADA system basically measurement and control system. It not a real time control but is placed in addition to real time control for controlling process external to SCADA. A SCADA system can be relatively simple, such as one that monitors environmental conditions of a small office building or incredibly complex, such as a system that monitors all the activity in a nuclear power plant. A SCADA system example application is in pipeline system where its gather information of a leak on a pipeline has occurred, carrying out necessary analysis and control, such as determining if the leak is critical and displaying the information in a logical and organized way.

SCADA systems are the heart of the modern industrial enterprise raging from mining plants, water and electrical utility installation to oil and gas plant. SCADA technology has evolved over the past 30 years as a method of monitoring and controlling

large process but not many students familiar with this automation system process. It is crucial for students to familiar with this SCADA system in order to expose then with a real life automation industries.

1.2 General Description (Project Overview)

This project comprises of integration of Supervisory Data and Data Acquisition (SCADA), programmable logic controllers (PLC), pneumatics and electrical actuators. In this project, SCADA will be the central system that control and monitors all the data from sensors and transducers in the system. There are two main sites in this project which are master site and remote site. Master site consist of SCADA host which is a single computer that running CX-Designer software, a sophisticated Human Machine Interface (HMI) that responsible to communicate with field instrument. While remote site, consist of programmable logic controller (PLC) and field instrument. The completion of this project will produce a complete industrial prototype automation system that will be used for teaching and learning purposes in automation subject.

1.3 Problem Statements

The goal of this project is to develop a training kit machine for UTeM students specialize in Automation. This training kit will use an up to date approach of teaching and learning concept especially for practice and application. Even though students were exposed more to PLC as a main control of automation system but the development of SCADA in this training kit is crucial to expose them with the real life of process control in automation industries. In automation industries, PLC will run a pre programmed process, but monitoring each of the process individually can be difficult, usually because they are spread out over the system. Unlike SCADA, PLC's historically also had no standardized method to display or present data to an operator. Furthermore, this training kit will upgrade PLC training equipment that usually based on simulation which in the

reality makes the teaching and learning process not so effective. The integration of Supervisory Data and Data Acquisition (SCADA), programmable logic controllers (PLC), pneumatics and electrical actuators will produce a complete industrial training kit machine that will attract student to be more enthusiasm in the process of learning.

1.4 Project Objectives

The main objectives of this project are:

- To develop SCADA for the servo controlled pick and place system.
- To use SCADA as the central system that control and monitors all the data from sensors and transducers in the system servo controlled pick and place system.
- To produce complete industrial prototype automation that will be used for teaching and learning purposes.

1.5 Project Scope

The project scopes for implementation of this project are:

- This project comprises of integration between SCADA, PLC, pneumatics and electrical actuators for a complete servo controlled pick and place system.
- Developing the SCADA using the CX-Designer software.

CHAPTER 2

LITERATURE REVIEW

This chapter will discuss about the sources or articles that were related to the project. All the information and details of the project were from the source and research that have been done before.

2.1 SCADA System Overview

SCADA is acronym for Supervisory Control and Data Acquisition. SCADA is a kind of software application program used in utility infrastructures as a computer-based monitoring and control system that centrally collects, displays, and stores information from remotely-located data collection transducers and sensors to support the control of equipment, devices, and automated functions. The system is composed of collecting information, transferring it back to a central control site or main station computer, conducting the necessary analysis and control, and then displaying the data on an operator screen. SCADA is handy for keeping a process in control as well as to diagnose potential problems with the machinery or manufacturing processes. SCADA usually use in power plants, oil and refining, transportation, telecommunications, various treatment plants and in control of waste and water.

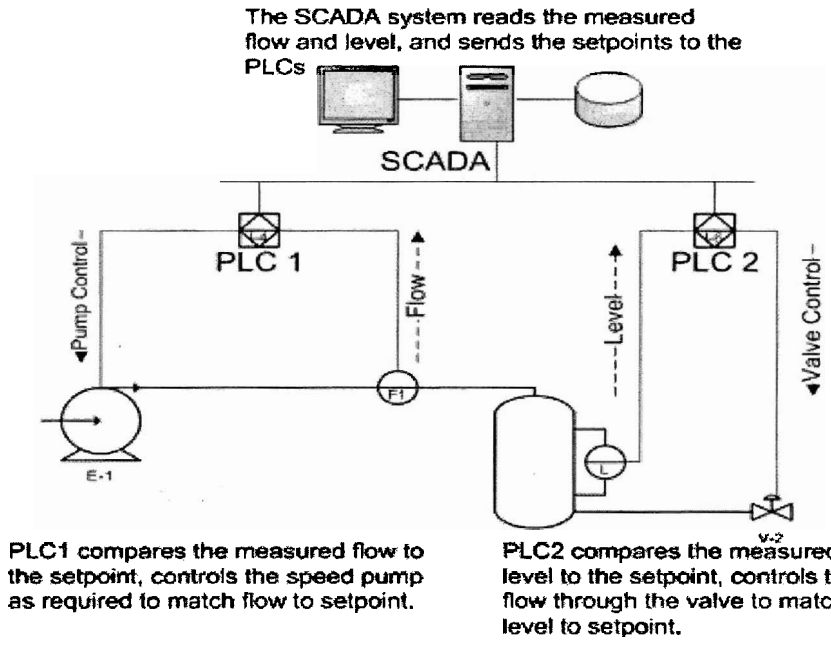

Figure 2.1: Example of real life SCADA system

2.1.1 SCADA Systems Concepts

A SCADA system includes input/output signal hardware, controllers, HMI, networks, communication, database and software. SCADA system is the central system that control and monitor of such a site or system. A Remote Terminal Unit (RTU) or a Programmable Logic Controller (PLC) automatically performed the remote site control. Host control functions are almost always restricted to basic site over-ride or supervisory level capability.

Data acquisition begins at the RTU or PLC level and includes meter readings and equipment statuses 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 appropriate supervisory decisions that may be required to adjust or over-ride normal RTU (PLC) controls. Data may also be collected in to a Historian, often built on a commodity Database Management System, to allow trending and other analytical work.

2.1.2 Human Machine Interface

A Human-Machine Interface (HMI) is the apparatus which presents process data to a human operator, and through which the human operator controls the process. The HMI industry was develop because the needed for a standardized way to monitor and to control multiple remote controllers, PLC and other control devices. An HMI may also be linked to a database, to provide trending, diagnostic data, and management information such as scheduled maintenance procedures, logistic information, detailed schematics for a particular sensor or machine, and expert-system troubleshooting guides.

2.1.3 SCADA Main Components.

There are three main components in SCADA systems which are field instrumentation and control equipment, communications network, remote terminal unit (RTU) and remote stations (RS) and central monitoring station (CMS).

The Field Instrumentation or equipment refers to the sensors, meters and actuators, valves, relays or motors that are directly interfaced with the plant, equipment or pipeline. It is this equipment that will generate the analog and/or digital signals that will be monitored at the Remote Station. The signals are designed for compatibility with the RTU (Remote Terminal Unit) or PLC (Programmable Logic Control) located at the remote stations

The Remote Station is located at the remote plant, equipment and monitoring station that is being monitored and controlled at the Central Monitoring Station's computer(s). The remote station can consist of either a RTU or PLC unit(s).

The Communication Network is the communication medium(s) that are utilized for the transfer of data (information) within the SCADA network system. The communication network can consist of wire lines, radio, cable or satellite VSAT terminals.

The Central Monitoring Station (CMS) is the central monitoring and control station within the SCADA network system. The system can consist of one or several control/monitoring workstations. The Man Machine Interface (MMI) program provides the link between the operator and the SCADA network system for both monitoring and control of the system.

2.1.4 Benefits Of SCADA

- Control units function as PLCs, RTUs, or DCUs;
- Control units perform advanced measurement and control independent of the central computer;
- PID control continues, even if communications to the main computer are lost;
- Control units have many channel types to measure most available sensors;
- Systems are compatible with our own or other vendors' HMI software packages; and
- Control units have their own UPS; during ac power loss, they continue to measure and store time-stamped data;

2.2 Pick And Place System

Pick and place system are the manipulators that designed to perform repetitive picking and placing in production floor at the automation industries. There are employed because of their precision and cost effectiveness. The pick and place systems are assembly and assist with sorting, picking, assembly, parts kitting, machine tending, packaging, boxing, palletizing and material handling. There are many different types of pick and place systems and each of it differ term of specifications, features, and applications. The example of pick and place system are portable material handling systems, pick and place robot manipulators, plant wide material handling systems, and pick and place machines.

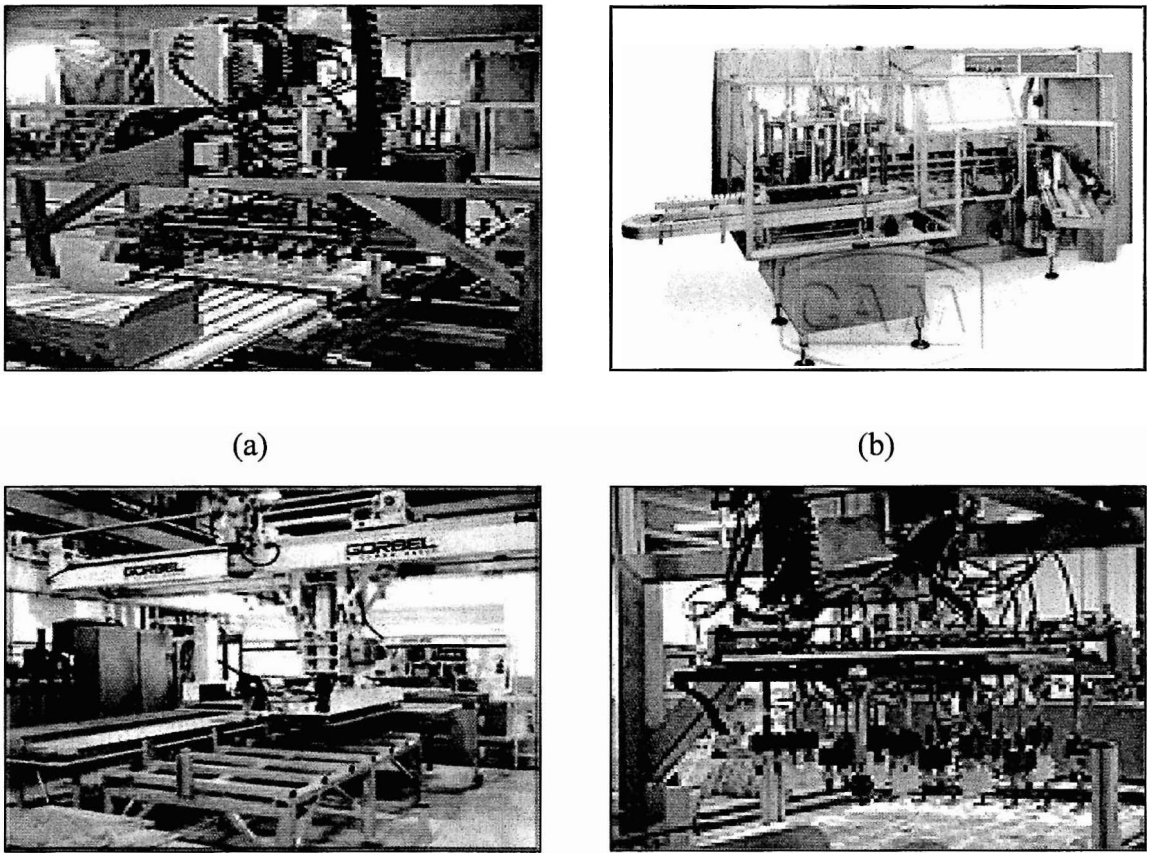

Figure 2.2: (a-d) Example of pick and place system