AQUACULTURE CONTROL METHOD FOR CATFISH FERTILIZATION SYSTEM (WEB-BASED SCADA SYSTEM)

Mohd Iskandar bin Md Sulaiman

Bachelor of Electrical Engineering (Industrial Power)

May 2010

"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 (Industrial Power)"

Signature : .....

Supervisor's Name : MR. MASLAN BIN ZAINON

Date : 11 MAY 2010

AQUACULTURE CONTROL METHOD FOR CATFISH FERTILIZATION SYSTEM (WEB-BASED SCADA SYSTEM)

MOHD ISKANDAR BIN MD SULAIMAN

This Report Is Submitted in Partial Fulfillment of Requirements for the degree of Bachelor of Electrical Engineering (Industrial Power)

Faculty of Electrical Engineering
Universiti Teknikal Malaysia Melaka (UTeM)

MAY 2010

"I hereby declared that this report is a result of my own work expect for the excerpts that been cited clearly in the reference"

Signature : .....

Name : MOHD ISKANDAR BIN MD SULAIMAN

Date : 11 MAY 2010

ACKNOWLEDGEMENT

First of all, I would like to express my thankfulness and gratitude to Allah S.W.T who has given me all the strength that I needed to complete this progress report.

Secondly, in complete this project and progress report; I was in contact with many people, researchers, academicians and practitioners. They have contributed towards my understanding and thought. With this opportunity, I wish to express my sincere appreciation to my supervisor, Mr. Maslan Zainon, for encouragement, guidance critics and friendship. I am also very thankful to my panel Mrs. Rahifa Ranom and Mr. Syed Najib Syed Salim for their guidance, advices and motivation. Without their continued support and interest, this project and progress report would not have been same as presented here.

I am also indebted to University Teknikal Malaysia Melaka (UTeM) for funding and deserve special thanks for their assistance in supplying the relevant literatures.

Last but no least, I wish to express my sincere appreciation also extends to all my colleagues and other and my family members who provided assistance at various occasions.

Thank you.

ABSTRACT

This research is focusing on the design and development of an effective aquaculture method to supervise, control and monitor the catfish fertilization process environment using the PLC and SCADA systems. The aim of the project is to monitor and control the Catfish Fertilization System environment process using the PLC and SCADA systems through online. User can observe and control the Catfish Fertilization System directly online without always to go the plant. The monitoring and control systems involved the water temperature, pH water, water flow, oxygen level and water level. The system will be integrated with their output devices such as water pumps, water heater and water cooler with the dedicated piping and electrical wiring systems. All these parameters can be controlled and monitored using the web-based SCADA system. In this project, a programmable logic controllers (PLC) is used for interfaced and controlled the system between hardware part and software part (SCADA). This data acquisition will be processed and presented on SCADA to show the result. This project focuses on the software development using IntegraXor SCADA for Aquaculture Control Method for Catfish Fertilization System. The expected result from this project research is that this system can be monitored and controlled remotely in real-time using web IntegraXor SCADA. The completed system is expected to enhance baby catfish's survival rate by at least 50% and to be further commercialized for small and medium aquaculture industries.

Keywords: Aquaculture, Catfish Fertilization, Control, PLC, SCADA

ABSTRAK

Penyelidikan ini adalah tertumpu kepada rekaan dan pembangunan mengenai satu kaedah akuakultur yang berkesan bagi menyelia, mengawal dan memantau persekitaran kolam anak ikan keli bagi proses persenyawaan dengan menggunakan sistem pegawal logik boleh aturcara atau *Programmable Logic Controller (PLC)* dan sistem kawalan penyeliaan dan pemerolehan data atau *Supervisory Control and Data Acquisition* (*SCADA)*. Tujuan projek ini dilaksanakan adalah untuk memantau dan mengawal persekitaran kolam anak ikan keli bagi proses pensenyawaan dengan menggunakan sistem PLC dan sistem SCADA menerusi talian terus atau jalur lebar. Pengguna boleh memerhati dan mengawal proses pembenihan ikan keli secara langsung dalam talian tanpa perlu ke kolam ikan. Pemantauan dan kawalan parameter yang terlibat adalah suhu air, nilai pH air, aliran air, kandungan paras oksigen dan paras air. Sistem ini akan disambungkan dengan peranti-peranti keluaran seperti pam-pam air, pemanas air dan pendingin air dengan perpaipan khusus dan juga sistem pendawaian elektrik. Semua parameter ini membolehkan pengguna untuk mengawal dan memantau aktiviti dengan menggunakan jaringan sistem asas SCADA. Dalam projek ini, pengawal logik boleh aturcara (PLC) akan bertindak sebagai medium atau perantara yang mengawal sistem antara bahagian perkakasan dan bahagian perisian (SCADA). Pemerolehan data ini akan diproses dan dipersembahkan oleh sistem SCADA untuk menunjukkan hasil projek ini. Tujuan utama projek ini adalah tertumpu mengenai pembangunan perisian yang menggunakan IntegraXor SCADA untuk mereka bentuk sebuah sistem akuakultur bagi mengawal proses pembenihan anak ikan keli. Keputusan yang didapati daripada penyelidikan projek ini akan menunjukkan bahawa sistem ini dapat dipantau dan dikawal secara jauh dalam masa nyata menggunakan jaringan jalur lebar menerusi IntegraXor SCADA. Sistem ini dijangka dapat meningkatkan kadar kehidupan anak ikan keli sekurang-kurangnya 50% dan berupaya untuk dikomersialkan bagi industri-industri akuakultur kecil dan sederhana di dalam dan luar negara.

Kata kunci: Akuakultur, Persenyawaan Ikan Keli, Kawalan, PLC, SCADA.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

GUI	-	Graphical User Interface
IOs	-	Input Output
PLC	-	Programmable Logic Controllers
RTU	-	Remote Terminal Unit
SAGE	-	SCADA Animation GUI Editor
SCADA	-	Supervisory Control and Data Acquisition
SVG	-	Scalable Vector Graphics

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

This chapter will discuss the background of the Web-Based SCADA System for the Aquaculture Control Method for Catfish Fertilization System, the aims and specified objectives of the project, the scope and also the problem statements. The project outline is also listed at the end of this chapter.

1.1 Background

In Malaysia nowadays, aquaculture industries are expanding as a result of Malaysian government effort to promote such industries in their long term enhancement plan for fishermen, farmers and entrepreneurs alike. A statement announced by Malaysia's Ministry of Agriculture back in January 2008 stated that Malaysia is currently lacking of fish livestock especially in monsoon season [Refer to the Appendix A for the newspaper statement] [17]. Aquaculture is the farming of freshwater and saltwater organisms such as finfish, molluscs, crustaceans and aquatic plants [21]. The first three weeks of the baby catfish's lifecycle is crucial or hard period to control the catfish environment tank for fertilization process. Have several parameters are needed focusing for the fertilization process period, such as oxygen level, water temperature, pH level, water flow and water level. These parameters are very important to make sure the survival life for the baby catfish to available level growth. In conventional system, the rated of the baby catfish are successful to life until available level growths are below 30%. So, within this new aquaculture control method for Catfish Fertilization System, the rated of the baby catfish are successful to life until available level growth can push up a range 50% above.

This research is focusing on the design and implement of an effective aquaculture method to supervise, control and monitor the catfish fertilization process environment using the Automation system. The Automation systems are used in this project is Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition (SCADA) system. Basically, the function of the PLC System in this project acts as the medium between the SCADA System and the Catfish Fertilization Plant. Besides that, the PLC system will be the main controlled for the plant. SCADA system can divide with two part are; Stand-Alone SCADA and Web-Based SCADA. Figure 1.1 showed the general block diagram of the project.

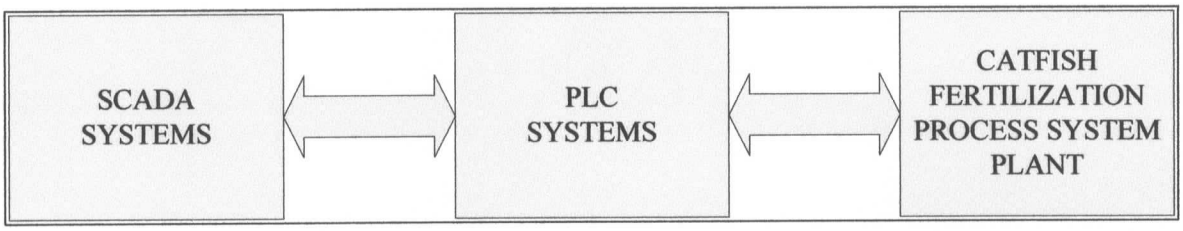

Figure 1.1: General Block Diagram

A Stand-Alone SCADA is the local network SCADA systems and the system will installed and can be accessed on the project PC only. While, a Web-Based SCADA is the world wide web SCADA systems and can be accessed via the browser (online) at anywhere.

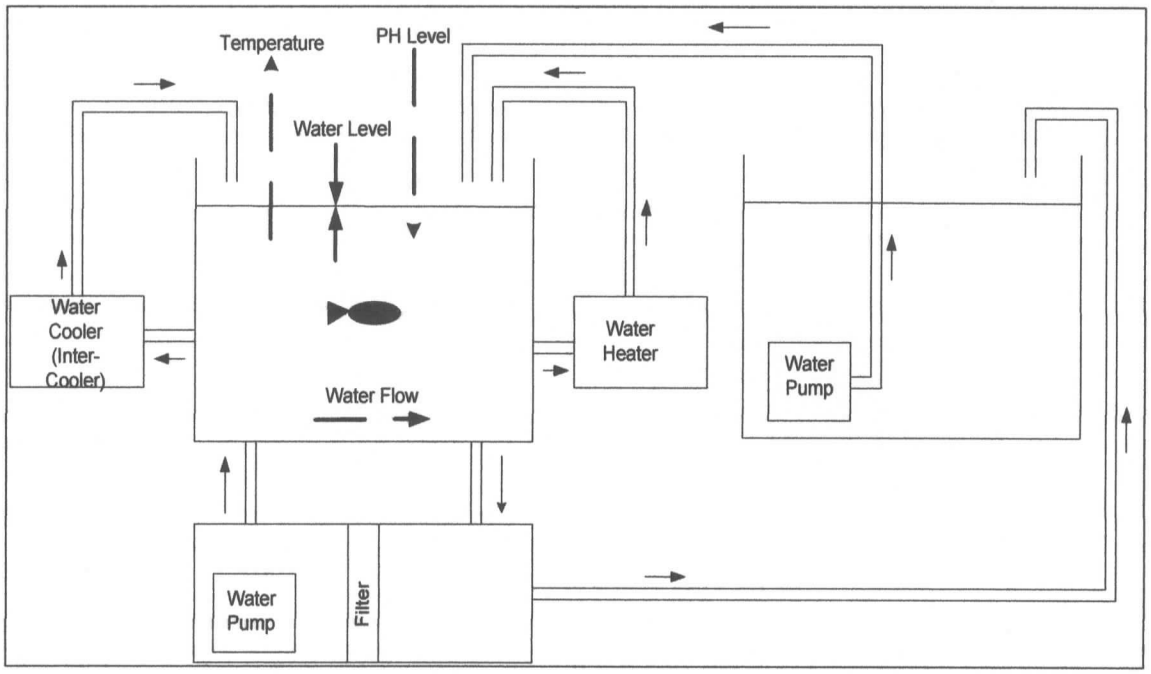

Figure1.2: Catfish Fertilization System Sketch

Refer to the Figure 1.2 above, it shows the overall system on the potential method on how to control the stated water parameters (controlled variables) for catfish fertilization. The system is a closed-loop system, where any changes on the controlled variables or parameters such as oxygen level, water temperature, pH level, water flow and water level of the tank will be detected by the respective sensors also known as analogue input device. Then, the signals are detected from the input devices will be sent to the controller (PLC System). Finally, the SCADA system can monitor and collect the data. For example, a PLC can control the pH level of the water through part of a certain process, but the SCADA system can allow users to change the set points for parameters and enable alarm condition, such as loss of acid or alkaline level, to be displayed and recorded.

1.2 Problem Statement

Nowadays, the percentage of the survival baby catfish from first day until the available grow level (more than three weeks above) is very low. This period is very critical part for the growth of the baby catfish. It needs more attention on several parameters such as oxygen level, water temperature, pH water, water level and water flow in the tank. Users must alert all these parameters in standard requirements for the baby catfish for every hour. For an enhance and more practical way to breed catfish, the new method of the web-based SCADA system is promoted. It can monitor and control the baby catfish fertilization process remotely and more hygiene.

1.3 Objectives

The aim of the project is to monitor and control the Catfish Fertilization System through the Web-Based SCADA system. The specified objectives of this project are to:

1. Design and implement of web-based SCADA system software for Catfish Fertilization Process.
2. Monitor and analyse the Catfish Fertilization Process via the Web-based SCADA system on the real-time data.
3. Introduce and analyse the effectiveness of the new method for Catfish Fertilization Process.
4. Analyse and compare the new system with conventional system for Catfish Fertilization Process.

1.4 Scope

To focus on this project, the scope must be stated for avoiding the wrong path. The specified scopes of this project are to:

1. Design the Graphical User Interface (GUI) using the Inkscape 0.46 + SAGE version software.
2. To build the Web-Based SCADA System using the IntegraXor SCADA software.
3. To control the Input & Output Devices using the Direct Logic PLC (KOYO Electronics).
4. To setup the communications between the IntegraXor SCADA and PLC.

1.5 Project Outline

Chapter 1 presents the Introduction part; Background of the Web-Based SCADA System of the Aquaculture Control method of the Catfish Fertilization System, aim and project objectives, project scopes, and the project outline. In addition, Chapter 2 covers the Literature Review part. In this chapter several SCADA systems for automatic system and others successful project are related will be discussed. Chapter 2 covers the Theoretical part. In this chapter are discussed the theory knowledge of the PLC, HMI and SCADA System. Next, Chapter 4 covers the Project Methodology. In this chapter the structure or block diagram of the project will be showed. Design of the Graphical User Interface (GUI); arrangement of communication code; simulation; integrate software and hardware are also discussed in this chapter. On the other hand, Chapter 5 will represent the Result and Analysis for this project. Second lastly, Chapter 6 will represent the Discussion for this project. At the end of this project, Chapter 7 will represents the Summary and Conclusion where are discussed the conclusion drawn from this work and also suggestions for future work.

CHAPTER 2

LITERATURE REVIEW

This chapter will discuss the examples of related project, comparison of previous research, summary of previous project, development Web-Based SCADA system for Catfish Fertilization process, a conclusion and a Ecava Sdn Bhd Visit.

2.1 Web Based Interface to SCADA System

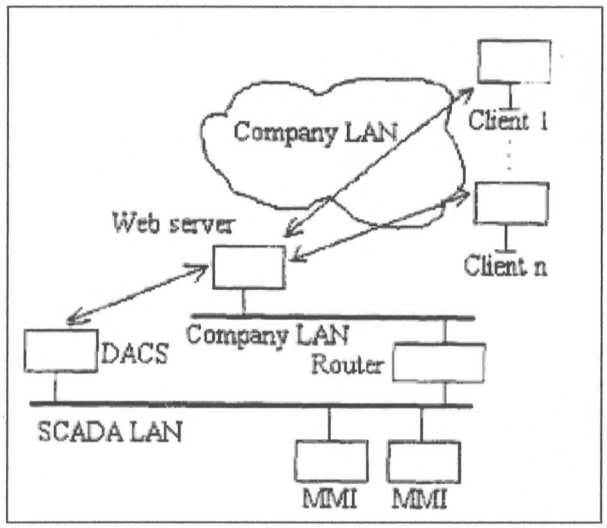

Figure 2.1: Intranet and SCADA system connection

Users working in different departments in electric power company need access to SCADA data. The problem is to provide access to SCADA data from the various locations in the company at low cost and in a secure way. An intranet and SCADA system

interconnection based on industry accepted communication standards is presented as a solution. Through a link to SCADA data acquisition and control server, Web server from the intranet brings SCADA real-time and historical information to users via a single front end, the familiar Web browser. The presented solution provides an information layer that is independent of the operating system, lowers hardware, software and administrative costs while improving reliability and security. Through a link to the Internet SCADA information access can be provided anywhere in the world. [1] Figure 2.1 above shows that the Intranet and SCADA system connection.

2.2 A Web-Based Remote Access Laboratory Using SCADA

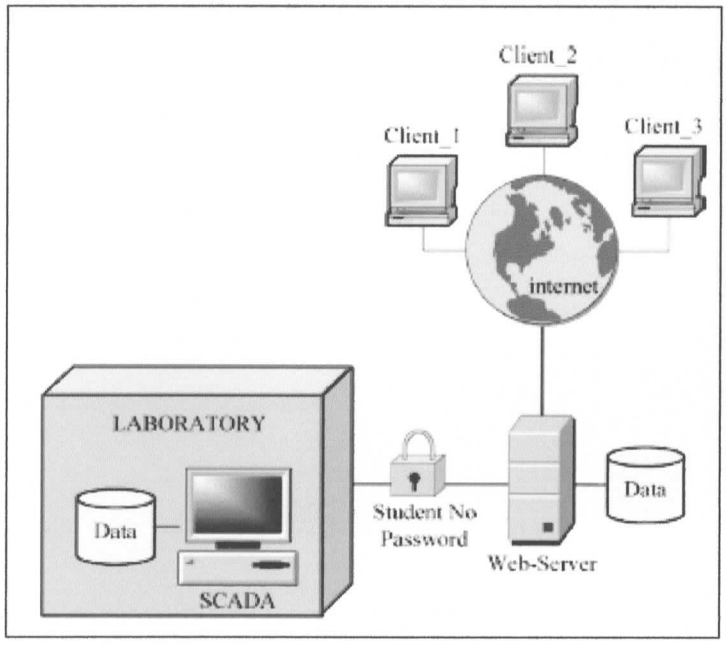

Figure 2.2: Web-based remote access real-time laboratory schema

The Internet provides an opportunity for students to access laboratories from outside the campus. This paper presents a Web-based remote access real-time laboratory using SCADA (supervisory control and data acquisition) control. The control of an induction motor is used as an example to demonstrate the effectiveness of this remote laboratory, using real instruments (a two-level inverter, measurement equipment, a magnetic powder brake and an ac/dc converter). A programmable logic controller (PLC) was programmed to