DEVELOP THE SCADA SYSTEM FOR AUTOMATIC FISH FEEDER

ABDUL FAIZ BIN ABDUL ROHIM

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Faculty of Electrical Engineering
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MAY 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 Mechatronic Engineering"

Signature : .....

Supervisor's Name : MR. SYED NAJIB BIN SYED SALIM

Date : 11 MAY 2009

"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 : ABDUL FAIZ BIN ABDUL ROHIM

Date : 13TH MAY 2009

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ABSTRACT

This project represents an investigation about the application of Supervisory Control and Data Acquisition or SCADA for Automatic Fish Feeding system. SCADA system is a computer monitored system which was developed in order to manage and control the system with real time. The aim of the project is to monitor and control the automatic fish feeding system. The graphical user interface (GUI) was used to monitor the whole system. The monitored systems involved are the pallet level in main tank, infrared (IR) sensors condition, valves, and robot's movement. The automatic fish feeder system was controlled by button switches that are provided on GUI. The control system involves robot's movement for feeding process at specific ponds. In this project, IR sensors were used. By using these sensors, signal was transmitted to the personal computer (PC) as well as receiving the signals from the PC. Serial cable RS232 was used as communications protocol for data acquisition devices between programmable logic controller (PLC) and PC. This data acquisition will be processed and presented on GUI to show the result. This project focuses on software development using CitectSCADA to design the SCADA system for automatic fish feeding system. The results from the research of this project showed that the automatic fish feeder system can be monitored and controlled using CitectSCADA. Suggestions for future work were also included.

ABSTRAK

Projek ini mmbentangkan kajian terhadap pengunaan sistem "*Supervisory Control And Data Acquisition*" atau SCADA untuk sistem pemberian makanan ikan secara automatik . Sistem SCADA adalah pemantauan melalui komputer yang dibangunkan untuk mengurus dan mengawal sistem dengan pantas. Matlamat projek ini adalah untuk menyelia dan mengawal sistem pemberian makanan ikan secara automatik. Pengantaramuka grafik pengguna (GUI) digunakan untuk meyelia keseluruhan sistem. Sistem penyelian melibatkan tahap makanan dalam tangki utama, keadaan penderia infrared (IR), injap dan pergerakan robot. Sistem pemberian makanan secara automatik dikawal dengan menggunakan butang suis yang diletakkan di dalam pengantaramuka grafik pengguna. Sistem kawalan melibatkan pergerakan robot untuk proses pemberian makanan pada kolam yang tertentu. Dalam projek ini, penderia infrared (IR) telah digunakan. Dengan mengunakan penderia ini, isyarat di hantar kepada komputer peribadi dan juga menerima isyarat daripada komputer peribadi. Kabel bersiri RS232 digunakan sebagai protokol komunikasi untuk pemerolehan data daripada perkakasan diantara " *Programmable Logic Controller*" dan komputer peribadi. Pemerolehan data ini akan di proses dan ditunjukkan dalam pengantaramuka grafik pengguna untuk mengeluarkan keputusan. Projek ini memberi fokus terhadap pembangunan perisian mengunakan CitectSCADA bagi membangunkan sistem SCADA untuk sistem pemberian makanan ikan secara automatik. Keputusan yang diperolehi hasil daripada perlaksanaan projek ini menunjukkan bahawa sistem pemberian makanan secara automatik boleh di selia dan dikawal menggunakan perisian CitectSCADA. Penyelidikan lanjutan turut dicadangkan.

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1.5 Project Outline

Chapter one represents the introduction; overview of SCADA system for automatic fish feeder system; aim and specified objectives of the project; scope of the project; and the project outline. In addition, chapter two covers the literature review. In this chapter several SCADA systems for automatic system will be discussed. Chapter three covers the methodology of the project. In this chapter the structure or block diagram of the project will be showed. Design of GUI; arrangement of communication code; simulation; integrate software and hardware are also discussed in this chapter. On the other hand, chapter four presents the result and discussion for experiments to measure the time taken for IR sensor to ON. Lastly, chapter five discuss the conclusion drawn from this work and also suggestions for future work.

Figure 1.6 shows the overall workflow involved to complete this project. This project is divided into two parts which are the developing the automatic fish feeder system and the SCADA system for automatic fish feeder system. In this project, both parts are integrated after they are complete so that the result can be observed. This project is divided into two so that two persons can participate. Based on Figure 1.6, the workflow is divided into two parts so that it is clearer for each person. This report only focuses about development of the SCADA system for automatic fish feeder system. The scope is on developing the prototype of automatic fish feeder system for pond type only. The green flows show that both parts have same scopes.

In methodology stage, the red flows show the workflow for developing the automatic fish feeder and the blue flows shows the workflow for developing the SCADA system. In this project, the SCADA system is developed for prototype of automatic fish feeder system using the CitectSCADA software. The graphical user interface (GUI) is designed as user interface after fully understanding the ladder diagram process. OMRON type of programmable logic controller (PLC) has been selected to be used in this project. The GUI design and input/output (I/O) device addressing must be related with prototype design for arrangement of communication on GUI. Simulation is executed before integrated with prototype controller to observe the preliminary result. CitectSCADA system is integrated with controller of prototype system after both of parts are complete. The serial cable is used as communication protocol between them. In this case, the green flows show that both parts are working together to observe the final result.

In the result stage, several experiments are done to obverse the result such as robot's movement, feeding system, control system and monitor system. In this project, the result is observed on GUI using personal computer (PC) to analyze the effectiveness of SCADA system for Automatic Fish Feeder system.

1.4 Scope

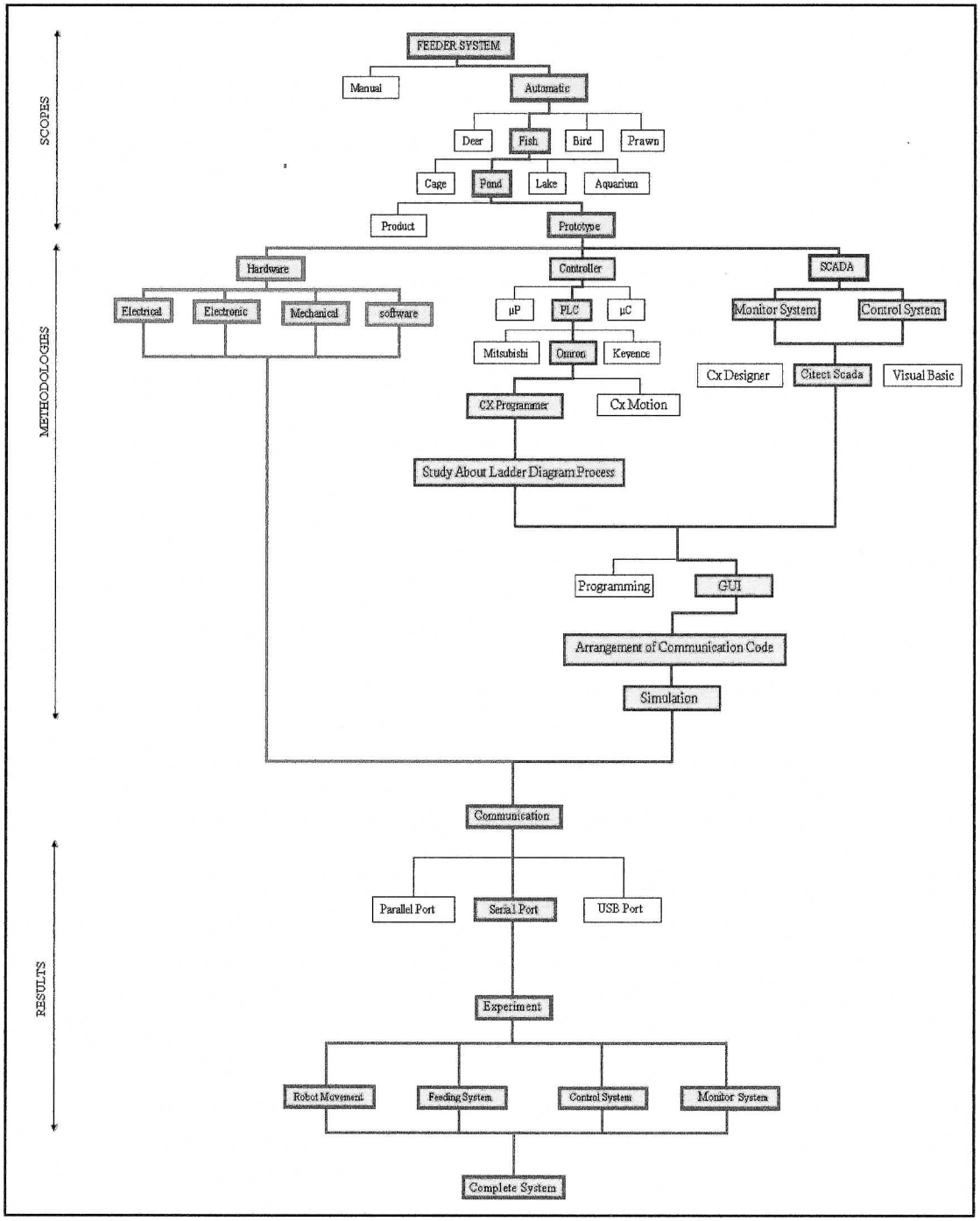

Figure 1.6: Project Workflow

1.2 Problem Statement

Nowadays, fish breeders face difficulty in monitoring and controlling large areas of automatic fish feeder system simultaneously because it involves many parts and devices. In this case, the operation cost will increase too because many of them need to monitor and control the whole system so that it operates smoothly. Besides that, they could not quickly detect the device's failure if the system breaks down. The maintenance service will take time to detect which device is failing to operate properly. In this case, the feeding process will stop for a long time to allow maintenance service. If the feeding process does not operate at time set up beforehand, the fishes in ponds will be affected. The maintenance cost will also increase because the maintenance team will face difficulty in detecting failure in system that consist a lot of parts and devices.

1.3 Objective

The aim of the project is to monitor and control the Automatic Fish Feeder system through the personal computer (PC). The specified objectives of this project are to:

1. Investigate an automation system control by SCADA system in industrial application
2. Develop Graphical User Interface (GUI) using CitectSCADA software
3. Integrate CitectSCADA software with Programmable Logic Controller (PLC) to show the result from both communication in GUI
4. Monitor and control an Automatic Fish Feeder system using personal computer (PC) system as user interface
5. Analyze the effectiveness of SCADA system for Automatic Fish Feeder system

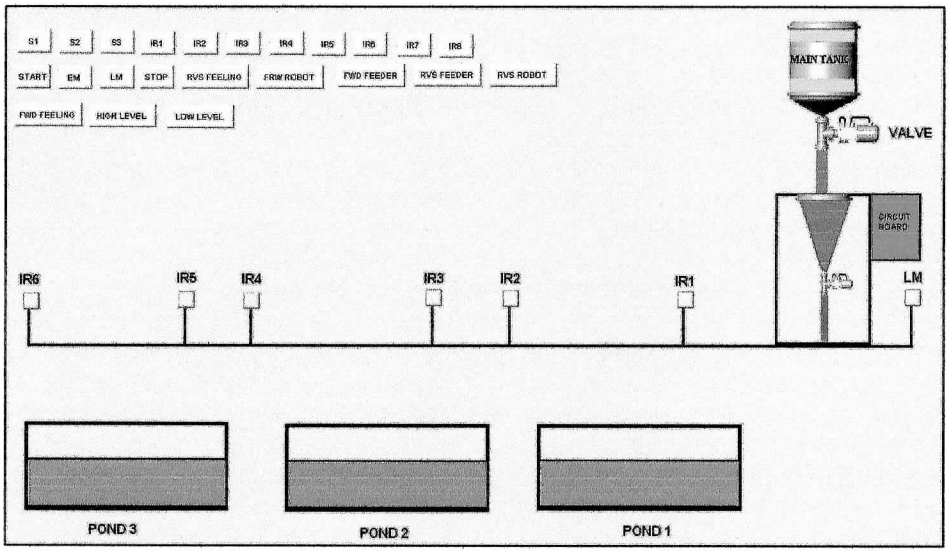

Figure 1.5: GUI Design

CitectSCADA software is chosen in this project to monitor and control the automatic fish feeder system. Figure 1.5 shows the Graphical User Interface (GUI) design and it is related with prototype design in Figure 1.1. After both systems are completed, serial cable RS232 is used to communicate PLC and PC to observe the result. In order to monitor, color changes is set for each graphical (symbol) to distinguish between ON and OFF device condition. In order to control, buttons are provided in GUI to control the feeding process. Users only need to push the button depending on their desire. High and low indicators are also designed in main tank to relate with prototype design. In addition, indicators also change its color to alert users about amount of pallet in main tank. GUI in Figure 1.5 shows initial condition when automatic fish feeder system does not operate. Final result will be explained in detail in chapter 4.

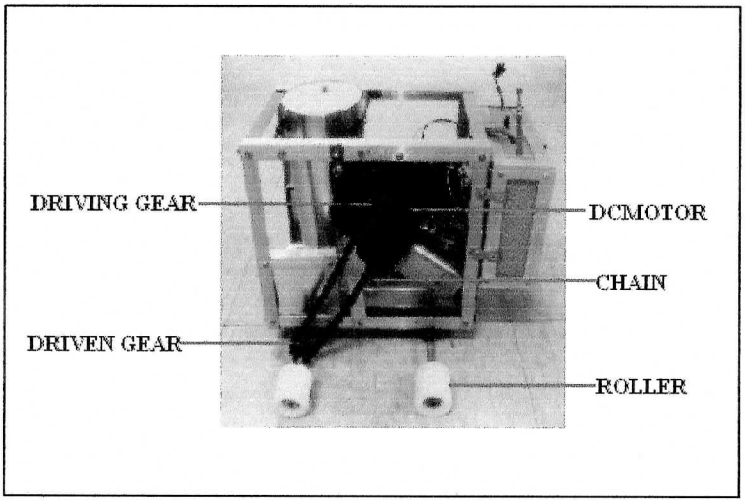

Figure 1.3: Robot Feeding

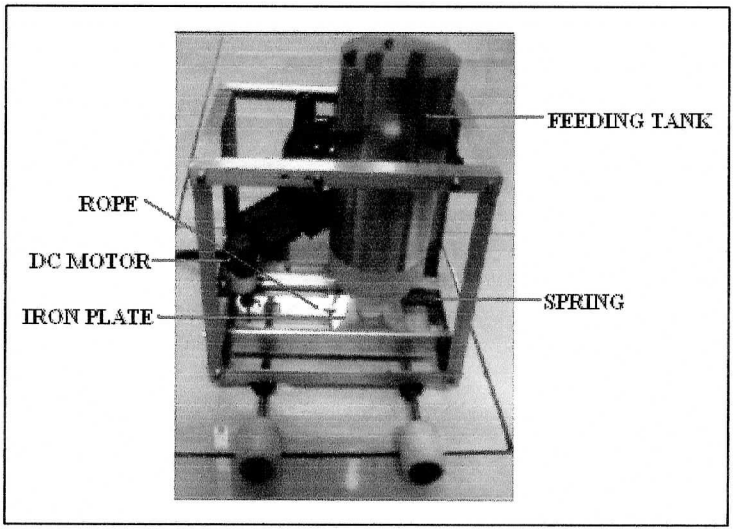

Figure 1.4: Valve System

in main tank. The alarms are in form of lamps for alerting the users about the amount of pallet in the main tank; either in high or low level.

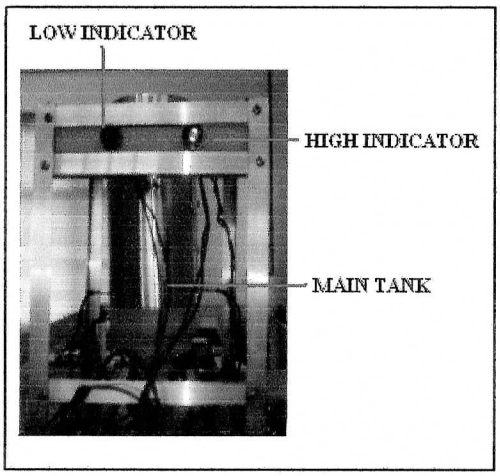

Figure: 1.2: Main tank

The robot feeding's function is to feed certain pond depending on amount desired as shown in Figure 1.3. It can be forwarded and reversed in order to complete the whole feeding process. It also operates through wireless due to used radio frequency wave. This robot used the DC motor that will convert the electrical power to mechanical power via gear that mounted on main shaft. The gear that mounted on main shaft is called the driving gear and gear mounted on roller shaft called as driving gear. The chain is used to transmit the power from driving gear to driven gear. In this prototype, six infrared sensors and one limit switch are used to control the feeding process. The circuit board is provided to attach all circuits and wire connections. The DC motor is used to open and close the pallet valve on main tank and feeding tank. The iron plate is used to prevent pallets from falling from tank. The iron plate is opened and closed back by the motor which pulls the rope assembled on it during opening, and releasing the rope due to spring that assembled on iron plate during closing. These are shown in Figure 1.4.

CHAPTER 1

INTRODUCTION

This chapter will discuss the overview of the SCADA system for Automatic Fish Feeder 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 Overview of SCADA system for Automatic Fish Feeder System

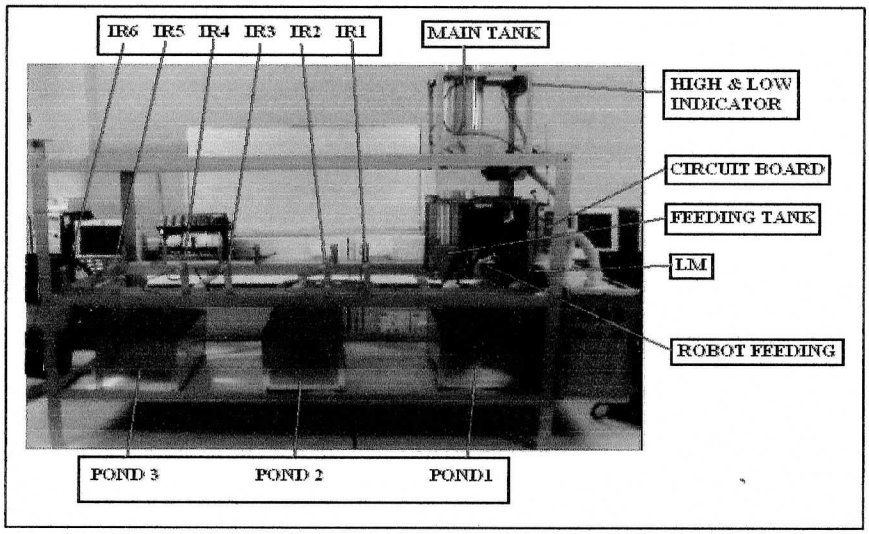

Figure 1.1: Prototype of Automatic Fish Feeder System

The prototype of Automatic Fish Feeder system as shown in Figure 1.1 has been developed to integrate with CitectSCADA software. It consist of the main tank, robot feeding, feeding tank, motor valve, ponds, sensors and circuit board as shown in Figure 1.1. The main tank's function is to refill the pallet into the feeding tank before the robot feeding process starts as shown in Figure 1.2. The alarms are provided as additional device