AUTOMATIC LEVEL CONTROL

MOHD IRNAIMAN BIN BAKIR

This Report Is Submitted in Partial Fulfillment of the Requirements for the award of Bachelor of Electronic Engineering (Industrial Electronic) With Honours

Faculty of Electronic Engineering and Computer Engineering
Universiti Teknikal Malaysia Melaka

May 2008

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : **AUTOMATIC LEVEL CONTROL**

Sesi Pengajian : **2007/08**

Saya .....**MOHD IRNAIMAN BIN BAKIR**.....
(HURUF BESAR)
mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (√) :

☐	**SULIT***	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
☐	**TERHAD***	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	**TIDAK TERHAD**	

(TANDATANGAN PENULIS)

Alamat : Batu 24 ½ Kg. Bukit Senggeh, 77500 Selandar, Melaka

Tarikh: 2 Mei 2008

Disahkan oleh:

(COP DAN TANDATANGAN PENYELIA)

CHAIRULSYAH WASLI
Lecturer
Faculty Electronics and Computer Engineering (FKEKK)
Universiti Teknikal Malaysia Melaka (UTeM),
Locked Bag 1200,
Ayer Keroh, 75450 Melaka

Tarikh: 9/5/08

"I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources."

Signature : 

Writer : MOHD IRNAIMAN BIN BAKIR

Date : 2 Mei 2008

"I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronic) With Honours"

Signature : 

Supervisor's Name : CHAIRULSYAH WASLI

Date : 9/5/08

DEDICATION

Dedicated to my beloved family (mak, ayah, along, abg Pi, abg Yen, Bobod, Ciah adik) and friends

And everything is possible with you by my side my love Siti Nurmala binti Mohd Osman

ACKNOWLEDGEMENT

Firstly, I'd like to thank God because with His blessing I'm able to prepare this report and final project for Universiti Teknikal Malaysia Melaka.

Thousands of thank to my supervisor En Chairulsyah Wasli for his support, guidance and advise during the completion of this final project.

Special thank to my friends Mr. Wan Ahmad Fairuz, Mr. Abdullah Haniff, Mr. Khairul Ashriq, Mr. Azman, Mr. Abdul Hadi and all my housemate for giving me support and encourage me to finish this report.

This project would not have been like this if they had not given great support and encouragement on me when other academic assignments and test has pressured me. The golden glory for me was during accomplishing this project is when my project successfully completed in the right path.

Finally I would like to express my deepest gratitude to my fellow friends, my beloved family and last but not least Siti Nurmala binti Mohd Osman for all the encouragement and inspiration. To everybody who is involved in preparing this report either direct or indirect, I would like to say thank you very much.

ABSTRACT

Automatic level control is a project that has been purpose to replace the existing system. This project is to control the water level in a water tank whether it is at low level or high level. The method used in this project is also differing from what has been used before. Before, the water level is controlled with a float ball but now this project will use switch sensor. Other than this sensor, water pump and valves will also be used to control the water flow into the tank. The valves will act as the key for the pipes. When the sensor detects the water level, the water pump will start to act as a controller. All the action will be controlled by a system, which we call controller. The controller that will be used is PLC (P*rogrammable Logic Control)*. PLC will determine when will be the best time for the water to flow out of the tank, when the valves need to be open or close or what ever it is that the sensor need to do when it detects the water and how long its going to take to fill up the tank or to empty the tank.

ABSTRAK

Automatic level control ini adalah salah satu projek yang telah diusulkan untuk menggantikan sistem yang sedia ada. Projek ini adalah untuk menyukat paras air tangki semasa aras tinggi atau aras rendah. Kaedah yang digunakan juga berbeza dengan yang sebelumnya. Sebelum ini paras air ditentukan dengan menggunakan pam pelampung manual, tetapi projek ini menggunakan pam pelampung elektronik sebagai penyukat. Selain daripada penyukat ini, motor pam air dan injap digunakan untuk mengawal kemasukan air ke dalam tangki. Tugas injap ini adalah sebagai kunci bagi paip tersebut. Apabila *sensor* mengesan tahap sukatan air, maka injap yang berfungsi sebagai kunci akan mula memainkan peranan. Segala kerja-kerja ini akan dikawal oleh satu sistem yang dinamakan sebagai pengawal. Pengawal yang digunakan ialah PLC (*programmable Logic Control*). PLC ini akan menentukan bilakah masa yang sesuai untuk air keluar dari tangki, bila masa injap perlu ditutup atau dibuka, apa yang perlu dilakukan oleh *sensor* apabila dapat mengesan air dan berapa lama masa akan diambil untuk memenuhkan atau mengurangkan air.

ABSTRAK

Automatic level control ini adalah salah satu projek yang telah diusulkan untuk menggantikan sistem yang sedia ada. Projek ini adalah untuk menyukat paras air tangki semasa aras tinggi atau aras rendah. Kaedah yang digunakan juga berbeza dengan yang sebelumnya. Sebelum ini paras air ditentukan dengan menggunakan pam pelampung manual, tetapi projek ini menggunakan pam pelampung elektronik sebagai penyukat. Selain daripada penyukat ini, motor pam air dan injap digunakan untuk mengawal kemasukan air ke dalam tangki. Tugas injap ini adalah sebagai kunci bagi paip tersebut. Apabila *sensor* mengesan tahap sukatan air, maka injap yang berfungsi sebagai kunci akan mula memainkan peranan. Segala kerja-kerja ini akan dikawal oleh satu sistem yang dinamakan sebagai pengawal. Pengawal yang digunakan ialah PLC (*programmable Logic Control*). PLC ini akan menentukan bilakah masa yang sesuai untuk air keluar dari tangki, bila masa injap perlu ditutup atau dibuka, apa yang perlu dilakukan oleh *sensor* apabila dapat mengesan air dan berapa lama masa akan diambil untuk memenuhkan atau mengurangkan air.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

CHAPTER I

INTRODUCTION

1.1 Project Overview

Automatic Level Control system can be used to produce an on/off signal for level control. The most common method of level control is simply to start the water pump at a low level and allow it to run until a higher water level. This project will be used in houses, factories and complexes. The high of level water in the tank is to keep in fix level, so if the water in tank is going out then the pipe will come in until the surface back to the setting level.

Automatic level control system is used to monitor a point or a set of points to start or stop a pump or valve. A group of single point switches are coordinated with the use of a controller to provide relays for the control points.

In this project, the types of system involve components such as process water holding tanks, actuators as valves and pumps and measured values as level, flow and composition. The flow of water into the tank is controlled by a valve and motor. The control input signal to the valve is a current signal in mA which is converted into a pressure signal. This pressure is applied to a valve and changes the valve stem position in mm. the valve position dictates the amount of flow passing through the valve into the tank. The height of water in the tank is measured by a transducer (gauge pressure) which produces an output in mA.

1.2 Project Objective

In order for the project to success and to be implemented, the following objectives have to be achieved:-

- To solve a problem using a previous water level system
- To build automatic level control which can be use for learning tools in control.
- To maintains the water in the certain level.
- To design the programming using PLC.
- This system has variable setting in input and display the level.

1.3 Problem Statement

Previously when using the current system like, pumps, limit switch, timer, and manual control and etc. this system usually accouter the following problem.

1) Malfunction of the limit switch can cause the overflowing of the water.

2) When used timer, the volume of water in the tank won't always be the same because of sometimes the flow of the water from outside source is not consistent.

3) The problem of manual control is sometimes people forget to turn off or turn on the valve.

4) Manual float system is an old technology which now that system have many problem.

1.4 Scope of Work

To achieve the project objectives there are certain scope that must been done. The scope can be divided into several parts. The scopes are:-

1) This project includes the study of control system, which is going to be used to control water flow. The project also includes the study of float switch technology which is going to be used as sensors in tank.

2) To make this project successful the CX programming need also to be studied to developed program process to predetermined the result of the project.

3) After the simulation is done this project will continue with development of the hardware which process need to be plan and the component characteristic need also to be study, such as PLC, sensor, LCD or display and etc.

4) The side effect of using float switch as a sensor in a tank need also to be studied.

1.5 Methodology

These projects have been start with research the automatic level control. After that will continue with calculation for find value of water, level, flow and pressure. If use the wrong formula research will star again until find the correct formula. Then find the suitable component. Before do the hardware developments must do the simulation. If simulation not achieved target, go back to research and find again. If done, make the hardware development and troubleshooting. After finish troubleshooting prepares a final report and then submits to supervisor.

1.6 Thesis Outline

This thesis will be divided into 5 chapters to provide the understanding of the whole project.

Chapter 1 is introduction to the overview of this project and its objectives. It also explains the scopes of the project.

Chapter 2 describe about the literature review that has been studied to get information to complete the project. This study is focused especially on automatic level control

Chapter 3 it will cover up all the project methodology and a process this project implementation to achieve goal. Also hardware and software technical details are explained in this part.

Chapter 4 explains the result of this project and the operation of the circuit. In this chapter the analysis of the project also has been discussed.

Chapter 5 explains on the future recommendation for the project to for improvement matters.

CHAPTER II

LITERATURE REVIEW

2.1 Background Study

Automatic level control system is used to monitor a point or a set of points to start or stop a pump or valve. A group of single point switches are coordinated with the use of a controller to provide relays for the control points. In this project, the types of system involve components such as process water holding tanks, actuators as valves and pumps and measured values as level, flow and composition. The flow of water into the tank is controlled by a valve. The control input signal to the valve is a current signal in mA which is converted into a pressure signal. This pressure is applied to a valve and changes the valve stem position in mm. the valve position dictates the amount of flow passing through the valve into the tank. The height of water in the tank is measured by a transducer (gauge pressure) which produces an output in mA.

Reynold Number

The type of flow that occurs depends on 4 parameter:

- The density of fluid, ρ
- The inside diameter of the pipe, d
- The obsolute viscosity of the fluid, μ
- The average velocity of the flowing fluid, v

$$\text{Reynold number} = \rho v d / \mu$$

$$V = Q/a = 4Q / \pi d2$$

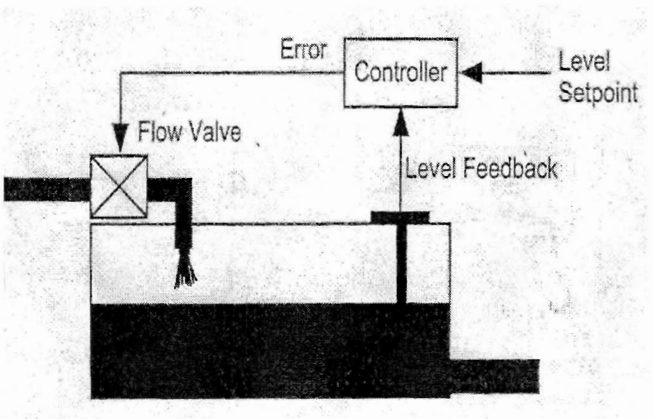

Figure 2.1: Automatic Level Control

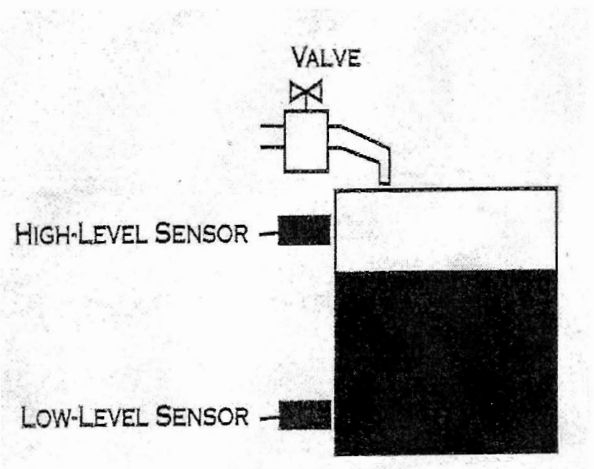

Figure 2.2: Level Sensor

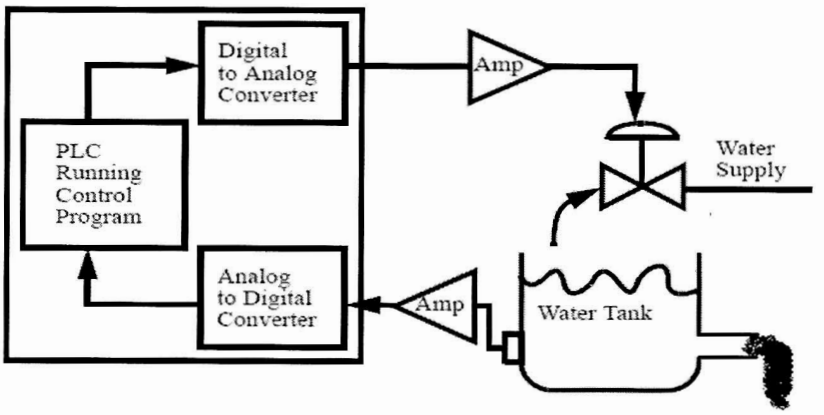

Figure 2.3: Controller Block Diagram

Laminar Flow (Value less than 2000)

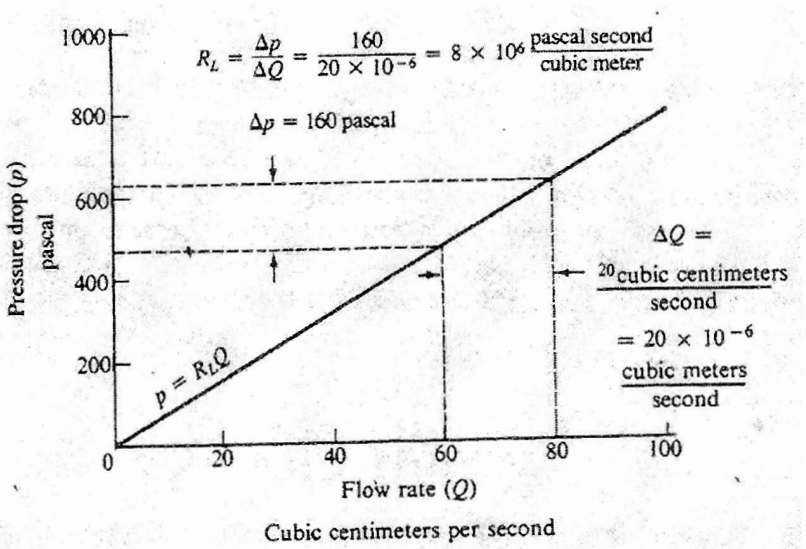

Figure 2.4: Linear Graph

Laminar Flow (Hagen-Poisenille Law)

$$P = RLQ, \text{ Pa}$$

$$RL = 128\mu L/ \pi d4, \text{ Pa.s/m3}$$

Water Flow Capacitance

$$CL = \Delta V / \Delta P$$

$$\Delta P = Pg\ \Delta H$$

$$\Delta H = \Delta V / A$$

$$\Delta P = Pg\ \Delta V / A$$

$$CL = \Delta V / \Delta P = \Delta VA / Pg\ \Delta V$$

$$= A / Pg,\ m3/Pa$$

Water Flow Inertance

$$IL = P / \Delta Q / \Delta t$$

2.2 A Circuit Water Level Detection and Control

For the residents who live in high buildings, low water pressure is a very common problem, especially when many people use the water at the same time. Therefore, many people install a water tower on the roof of the building. The water is stored at a water tank at the basement first. Then it is pumped into the water tower on the roof using a pumping motor. In this manner, the low water-pressure problem can be improved and the water can be used in a more efficient way.

Traditional water level controller can control the water between two levels. However, since the controller is usually placed at the top of the water tower, corrosion and mal-function may occur due to the effect of humidity to the controller. Meanwhile, if the water level of the basement tank is too low, the pumping motor may be burned because there is no water to pump.

2.2.1 Traditional Water Level Controller

Traditional water level controller uses floating balls as the sensors for level detection, which is depicted in Figure 1. As shown in the figure, the controller has two floating balls (will be called ball A and ball B hereafter) placed at two levels (will be called level H and level L hereafter). According to the positions of the two

balls, the switch of the pumping motor is set to be on or off. The operation theory is as shown in the following table:

Table 2.1: Table of Operation

Step	Description
1	When the water level of the water tank is lower than level L, due to the effect of gravity, the weights of ball A and ball B will be heavy enough to make the switch be closed. This will turn on the pumping water to pump water into the water tower.
2	When the water level reaches level L, due to the effect of floating force, ball B will float on the water. However, the weight of ball A is still enough to make the switch be on. Therefore, the pumping motor keeps on pumping water.
3	When the water reaches level H, due to effect of floating force, ball A and ball B have no weight on the switch. Therefore, the motor stops pumping water.
4	When the residents use the water, the water will be lower than level H first. In this case, though the weight of ball A is on the switch, it is not heavy enough to turn on the motor. If the water is lower then level L, the weights of ball A and ball B will make the switch be closed and turn on the pumping motor.
5	Repeating the above procedure, the water in the water tower can be controlled between level H and level L.