

WATER LEVEL IN TANK USING LEVEL SENSOR AND PID CONTROLLER

MUHD ASRAN BIN ABDULLAH

This thesis is submitted as partial fulfillment of the requirements for the award of the  
Bachelor of Electrical Engineering (Hons) (Control & Instrumentation)

Faculty of Electrical & Electronics Engineering  
Universiti Malaysia Pahang

NOVEMBER 2008

“ All the trademark and copyrights use herein are property of their respective owner.  
References of information from other sources are quoted accordingly otherwise the  
information presented in this report is solely work of the author.

Signature : \_\_\_\_\_

Author : MUHD ASRAN BIN ABDULLAH

Date : \_\_\_\_\_

## **DEDICATION**

To my beloved parents,

Dato' Haji Abdullah Bin Ahmad and my mother, Hjh Nik Noorul Aini Binti Nik Mohd Salleh for their full support, love, patience, and encouragement during my degree study.

## ACKNOWLEDGEMENT

Assalamualaikum warahmatullahi wabarakatu,

Thank you Allah for giving me this opportunity to finish my undergraduate project. It is a very great pleasure for me to acknowledge the contributions of a large number of individuals that has been supportive throughout this year. First of all, I would like to thank my supervisor, En Ahmad Nor Kasruddin Bin Nasir for providing me precious helps, supports, motivation especially the tolerance from him throughout the development of this project.

I would like to also further my appreciation to my friends and course mates. especially Marleena Akmal Ahmad Ariff and Hairul Nizam Bin Hasan for all the supports and helps i needed throughout the living time in Universiti Malaysia Pahang (UMP) We have gone through thick and thin together. All the courage and valuable memories you have given me will never be forgotten. Thank you for always being there by my side.

I would also like to acknowledge my parents and siblings. Thank you for your support and motivation. I am gratefully acknowledged the support, encouragement, and patience of my families. I am very happy to have such family that always loves me and care about me. Without them, I will not be able to finish this project. Last but not least to all other peoples who are not able to be mentioned here. Your contributions are very much appreciated.

Thank you very much.

## **ABSTRACT**

Water level in tank control using level sensor and PID controller system is an implementation of PID controller application into designing an intelligent and automatic level control of water/liquids/solids. While people especially in engineering fields have difficulties to measure and control the desired level in smooth transitions, this system provides the features which allow people to control and maintain water level in tanks as accurately and as steady with smooth transition process. This system is able to continuously maintain and doing necessary processes non stop day and night. The design will be implemented into a model built for a FKEE process laboratory in UMP (University Malaysia Pahang).

## **ABSTRAK**

Sistem Kawalan paras air dalam tangki menggunakan pengesan paras dan pengawal PID adalah penggunaan pengawal PID di dalam sebuah kawalan paras air/cecair/pepejal secara automatic dan pintar. Sementara manusia khususnya di dalam bidang kejuruteraan menghadapi kesukaran untuk mengawal dan mengukur paras yang dikehendaki secara perubahan yang lancar, system ini mampu memberikan manusia kuasa untuk mengawal dan menjaga paras air dalam tangki secara tepatnya dan stabil. Sistem ini mampu berfungsi berulang-ulang tanpa henti siang dan malam. Rekabentuk ini akan dilaksanakan ke satu model yang dibina makmal FKEE di dalam UMP (Universiti Malaysia Pahang).

## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	<b>TITLE OF PAGE</b>	.....i
	<b>DECLARATION</b>	..... ii
	<b>DEDICATION</b>	.....iii
	<b>ACKNOWLEDGEMENT</b>	.....iv
	<b>ABSTRACT</b>	.....v
	<b>ABSTRAK</b>	.....vi
	<b>TABLE OF CONTENT</b>	...vii-viii
	<b>LIST OF FIGURES</b>	.....ix- x
	<b>LIST OF TABLES</b>	.....xi
	<b>LIST OF ABBREVIATIONS</b>	.....xii
<b>1</b>	<b>INTRODUCTION</b>	
	1.1 Overview	1
	1.2 System Overview	1-2
	1.3 Problem statement	2-3
	1.4 Objectives	3
	1.5 Scope of project	4
<b>2</b>	<b>LITERATURE REVIEW</b>	
	2.1 Level Measurement	5-6
	2.1.1 Types of level measurement sensor	6-8
	2.1.2 Selection of level sensor in this project	8-9
	2.2 P.I.D controller	9-15

2.3	Valve	16-18
	2.3.1 Selection of valve in this project	19-20
<b>3</b>	<b>METHODOLOGY</b>	
3.1	Project flow and block diagram	21-23
3.2	Project Procedure	24-25
3.3	Plant model building process	26
3.4	Plant Design	26-28
	3.4.1 Tank Cover	28-29
	3.4.2 Platform Structure for valve	29-30
	3.4.3 Plumbing	30-31
	3.4.4 Wiring	31-33
	3.4.5 Plant Commissioning	33-35
	3.4.6 Tuning of YS1700 PID Controller	35-37
<b>4</b>	<b>RESULT &amp; ANALYSIS</b>	
4.1	Introduction	38
4.2	Results analysis	38
4.3	Steps of tuning to get the final result.	39-46
<b>5</b>	<b>CONCLUSION</b>	
5.1	Conclusion	47
5.2	Recommendations	48
5.3	Costing and commercialization	48

## REFERENCES

## APPENDIX



## LIST OF FIGURES

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Prosonic M FMU40 ultrasonic level sensor	8
2.2	Graph response due to P value alterations	11
2.3	Graph response due to I value alterations	13
2.4	Graph response due to D value alterations	14
2.5	Flowserve 3200IQ control valve	19
3.1	Flow diagram of PID controller on water level	22
3.2	Closed single loop block diagram	23
3.3	Placement of drainage valve type open/close	23
3.4	Ideal process response	23
3.5	YS1700 operating procedure	25
3.6	Initial plant sketch	27
3.7	Project plant	28
3.8	Tank cover 1	28
3.9	Tank cover 2	28
3.10	Tank cover placing FMU40	29
3.11	Initial valve's structure sketch	29
3.12	Valve mounting	30
3.13	Plumbing of the plant	31
3.14	Connection FMU40 $\leftarrow \rightarrow$ YS1700	31
3.15	Connection YS1700 $\leftarrow \rightarrow$ 3200IQ	32
3.16	Air compressor	33
3.17	DC water pump	33
3.18	YS1700 main window	34
3.19	Function block programming	36

3.20	YS1700 tuning window	37
4.1	Graph response for P=100, I=1, D=0	40
4.2	Graph response for P=750, I=1, D=0	41
4.3	Graph response for P=57.8, I=16, D=4	42
4.4	Graph response for P=60, I=90, D=4	43
4.5	Graph response for P=100, I=42, D=10	45

**LIST OF TABLES**

<b>TABLE NO</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	Effects of P.I and D	10

**LIST OF ABBREVIATIONS**

P	Proportional
I	Integration
D	Derivative
FKEE	Fakulti Kejuruteraan Elektrik & Elektronik
Kp	Proportional constant
Ki	Integral constant
Kd	Derivative constant
STC_ON	Self tuning on
Pu	Interval time
PBu	Proportional band value