

CERTIFICATION OF APPROVAL

Silo Management System

by

Nuraishah binti Zakaria

A project dissertation submitted to the
Electrical and Electronics Engineering Programme
Universiti Teknologi PETRONAS
in partial fulfilment of the requirement for the
BACHELOR OF ENGINEERING (Hons)
(ELECTRICAL AND ELECTRONICS ENGINEERING)

Approved by,

(Assoc Prof Dr Irraivan Elamvazuthi)
Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

December 2009

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

NURASHAH BINTI ZAKARIA

ABSTRACT

Grain storage is very important in paddy industry. The grain is stored inside a tank called a silo. Although the grain is safely stored in the silo, the changing of temperature and humidity inside the silo will affect the grain. So, in order to control them, aeration system is implemented. Aeration is the process of moving air through a medium (grain storage) in order to control the temperature and moisture of the grain. Aeration system can prevent condensation from happening. It can also reduce microbial growth and remove bad odours caused by the microbial activity. Therefore, this project is designed to monitor and control the aeration process in the silo. This aeration system consists of a fan, vent, transition duct, perforated floor, sensors and a motor. When the temperature is higher than the set point, the fan will blow the air up through the silo. The heat from the warm grain will transfer to the air while the air is moving to the top. The air will flow out from the silo to the atmosphere through a vent. This report will discuss on the literature review, methodology, results and also discussion of this project. Literature review is more on the research of the aeration process. The methodology discusses the requirements needed to design an aeration system. The discussion consists of calculations of parameters such as the airflow rate and also the Labview programming.

ACKNOWLEDGEMENTS

First of all, I would like to express my gratitude to my final year project supervisor, Assoc Prof. Dr Irraivan Elamvazuthi for giving me advices and support for this one year project. His encouragement has given me the strength to overcome the problems that I have encountered when the project is in progress.

Thanks to all the people that have helped me in achieving the objectives of the project especially the lecturers. The lecturers whom I consult have explained to me the basic theory to make this project works. I would like to thank to the mechanical and electrical technician for assisting me in finishing the prototype. Not forgetting Mrs Siti Hawa for helping me preparing the necessary document in order to make sure the project is running smoothly.

Most importantly, I would like to express my gratitude to my parent and sibling who had supported me in finishing the project. Their sacrifices and support has helped me a lot in this project.

Last but not least, I would like to extend my appreciation to my friends in University Technology PETRONAS (UTP) who has helped me and gave me some advices so that my project works and has successfully achieved the objectives.

TABLE OF CONTENTS

CERTIFICATION OF APPROVAL	.	.	.	.	.	.	.	.	i
CERTIFICATION OF ORIGINALITY	.	.	.	.	.	.	.	.	ii
ABSTRACT	.	.	.	.	.	.	.	.	iii
ACKNOWLEDGEMENT	.	.	.	.	.	.	.	.	iv
LIST OF FIGURES	.	.	.	.	.	.	.	.	viii
LIST OF TABLES	.	.	.	.	.	.	.	.	ix
CHAPTER 1:	INTRODUCTION	.	.	.	.	.	.	.	1
	1.1	Background of study	.	.	.	.	.	.	1
	1.2	Problem statement	.	.	.	.	.	.	1
	1.3	Objectives	.	.	.	.	.	.	2
	1.4	Scope of Study	.	.	.	.	.	.	2
	1.5	Feasibility of Project	.	.	.	.	.	.	2
CHAPTER 2:	LITERATURE REVIEW AND THEORY	.	.	.	.	.	.	.	3
	2.1	Current System	.	.	.	.	.	.	3
	2.2	Aeration process flow	.	.	.	.	.	.	4
	2.3	Aeration system design	.	.	.	.	.	.	6
		2.3.1	<i>Airflow rate</i>	.	.	.	.	.	7
		2.3.2	<i>Fan Selection</i>	.	.	.	.	.	9
		2.3.3	<i>Air distribution.</i>	.	.	.	.	.	10
			2.3.3.1	<i>Transition duct</i>	.	.	.	.	11
			2.3.3.2	<i>Perforated Floor</i>	.	.	.	.	12
		2.3.4	<i>Ventilation system</i>	.	.	.	.	.	13

CHAPTER 3:	METHODOLOGY	. . . . .	14
	3.1. Procedure Identification.	. . . . .	14
	3.2 Gantt Chart	. . . . .	14
“	3.3 Tools and Equipments	. . . . .	15
	3.3.1 <i>Hardware Material</i>	. . . . .	15
	3.3.2 <i>Software</i>	. . . . .	15
	3.4 Requirement of an Aeration System	. . . . .	16
	3.5 Conceptual Design	. . . . .	17
	3.5.1 <i>SCADA System</i>	. . . . .	17
	3.5.1.1 <i>Hardware</i>	. . . . .	17
	3.5.1.2 <i>Software</i>	. . . . .	18
	3.5.2 <i>Plant</i>	. . . . .	19
	3.6 Calculation for Designing Aeration System	. . . . .	21
	3.6.1 <i>Calculate the Storage Volume.</i>	. . . . .	21
	3.6.2 <i>Airflow Required</i>	. . . . .	21
	3.6.3 <i>Duct Location</i>	. . . . .	21
	3.6.4 <i>Calculate the Perforated Area</i>	. . . . .	21
	3.6.5 <i>Sizing of the Perforated Duct</i>	. . . . .	22
	3.6.6 <i>Sizing of non Perforated Duct Supply.</i>	. . . . .	22
	3.6.7 <i>Sizing of the Roof Vent</i>	. . . . .	22
	3.7 Motor Control Circuit	. . . . .	23
	3.8 Procedure connecting DAQ Card with software	. . . . .	24
CHAPTER 4:	RESULTS AND DISCUSSION	. . . . .	25
	4.1 Overall System Connection	. . . . .	25
	4.2 DAQ connection to CPU	. . . . .	28
	4.3 Simulation Coding and Results.	. . . . .	33

CHAPTER 5:	CONCLUSION AND RECOMMENDATION	37
5.1	Conclusion	37
5.2	Recommendation	37
REFERENCES		38
APPENDIX		39
APPENDIX I	GANTT CHART FOR FYP 1	40
APPENDIX II	GANTT CHART FOR FYP II	41
APPENDIX III	DETAILED DRAWING	42
APPENDIX IV	PCI 6024E DATASHEET	45
APPENDIX V	CB68LP DATASHEET	48
APPENDIX VI	TIP 127 DATASHEET	49
APPENDIX VII	TIP 122 DATASHEET	54
APPENDIX VIII	1N4148 DATASHEET	59
APPENDIX IX	WIRING DIAGRAM	63

LIST OF FIGURES

Figure 1	Aeration Process Flow.	4
Figure 2	Three zones in a bed of aerated grain	5
Figure 3	The process of cooling grain temperature	6
Figure 4	Components of an aeration system	6
Figure 5	(a) Axial fan and (b) Centrifugal fan components	9
Figure 6	Types of transition duct shapes.	12
Figure 7	Types of perforated floors for flat bottom bins	12
Figure 8	Gooseneck vent	13
Figure 9	Project Procedure Identification	14
Figure 10	The outline diagram of SCADA system	17
Figure 11	Flow Chart for coding in Labview	18
Figure 12	Front View of the Silo	19
Figure 13	Perforated Duct	22
Figure 14	Non Perforated Duct Supply	22
Figure 15	H Bridge Circuit	23
Figure 16	Transistor Base Condition	23
Figure 17	System Testing	25
Figure 18	Overview of System Connection	26
Figure 19	Components on the silo	27
Figure 20	Soldered H Bridge Circuit	27
Figure 21	Test Connection of analog input	28
Figure 22	Test connection of digital output	29
Figure 23	Voltage checking at analog output channel	29
Figure 24	Voltage connection at LED terminal	30
Figure 25	Reading of thermocouple before heating	31
Figure 26	Reading of thermocouple after heating	32
Figure 27	Labview coding.	33
Figure 28	Front Panel of simulation	34

Figure 29	The temperature monitoring from front panel	.	.	35
Figure 30	Data monitoring analysis	.	.	35
Figure 31	The recorded data	.	.	36

LIST OF TABLES

Table 1	Summary of Advantages and Disadvantages of Upward (Pressure System)	7
Table 2	Summary of Advantages and Disadvantages of Downward (Suction System) Airflow	8
Table 3	The equipment and tools being used	15
Table 4	Software and related material being used	15