

**DESIGNING A PACKAGING SYSTEM FOR AN AUTOMATED LIGHTER  
PACKAGE**

By

Indra Jaya

ID Number: 1-1105-021

A Bachelor's Thesis

Submitted to the Faculty of Engineering

DEPARTMENT of MECHATRONICS

in partial fulfillment of the  
requirements for the Degree of

BACHELOR OF SCIENCES

WITH A MAJOR IN MECHATRONICS

**SWISS GERMAN UNIVERSITY**

SWISS GERMAN UNIVERSITY

Campus German Centre

BSD City – 15321

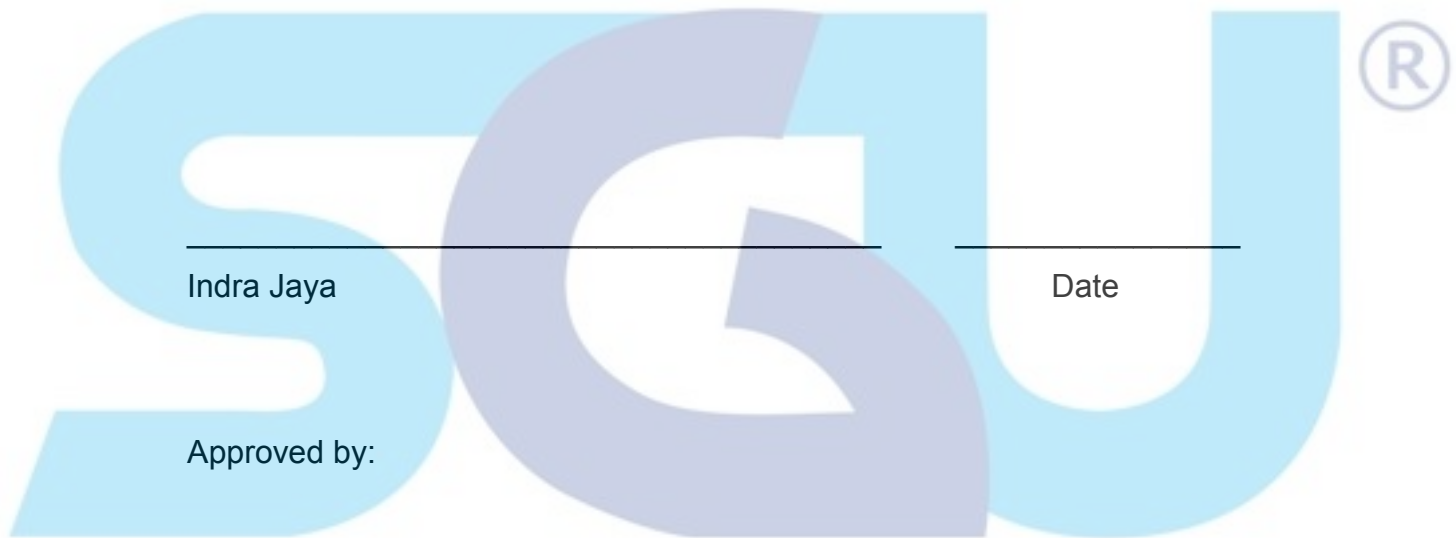
Island of Java, Indonesia

[www.sgu.ac.id](http://www.sgu.ac.id)

January 2010

### STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.



**SWISS GERMAN UNIVERSITY**

---

Dr. Ir. Tutuko Prajogo, MSMfgE

---

Date

---

Indra Jaya

---

Chairman of the Examination Steering Committee

---

Date

## ABSTRACT

### DESIGNING A PACKAGING SYSTEM FOR AN AUTOMATED LIGHTER PACKAGE

By

Indra Jaya

SWISS GERMAN UNIVERSITY

Bumi Serpong Damai

Dr. Ir. Tutuko Prajogo, MSMfgE, Major Lecturer and Advisor

This thesis project is about to design, develop and analyze a machine that will be able to package a lighter box. This packaging machine consists of several processes, from measuring process to palletizing process. The purpose of this packaging system is to package several lighter boxes to the packaging box. In the packaging system the system has to be able to detect the packaging box with several sizes and to detect how many lighter boxes can be put inside the box. There are three example types of packaging boxes that will be demonstrated. To make this machine into full packaging system, palletizing process is also considered for making this product easy to transport in a large scale

## DEDICATION

I dedicate this thesis especially to God, Father and Mother. Despite all of my family, I would like to dedicate this thesis to all my friends and lecturers which also supported me to finish it.



## ACKNOWLEDGMENTS

- The author wishes to thank God for his bless and grace to finish this thesis.
- To Dr. Ir. Tutuko Prajogo, MSMfgE for the entire concept on doing thesis and being great advisor.
- To Dipl. Ing. Maralo Sinaga for being the most supportive lecture
- To Cegi Muhamad Hanafi, SST for all of the helpful advice and support on mechanical construction.
- To my entire friend which gave me support and courage to finish this thesis. (Diana Putri, Randyka Aprindi Komala, William Lauw, Irwan Gunawan, Elvin Chandra, Armand, Jonathan Ligawan and Deni).
- To (Diana Putri, Jonathan Ligawan, Elvin Chandra, and Armand) for all unforgettable moments together.
- To all Mechatronics '05 friends for all unforgettable moments together
- To Mr Robet, Mr Hendi, and Mr Dhany for all of the advise and providing mechanical workshop and tools for the past 2 months.
- To all of the SGU lectures for all of the knowledge they passed down to the author during 4 years of lessons.
- Finally, to all of the people that help the author to finish the thesis.

## TABLE OF CONTENTS

<a href="#">STATEMENT BY THE AUTHOR.....</a>	<a href="#">2</a>
<a href="#">ABSTRACT.....</a>	<a href="#">3</a>
<a href="#">DEDICATION.....</a>	<a href="#">4</a>
<a href="#">ACKNOWLEDGMENTS.....</a>	<a href="#">5</a>
<a href="#">TABLE OF CONTENTS.....</a>	<a href="#">6</a>
<a href="#">LIST OF TABLES.....</a>	<a href="#">9</a>
<a href="#">LIST OF FIGURES.....</a>	<a href="#">9</a>
<a href="#">CHAPTER 1 – INTRODUCTION.....</a>	<a href="#">12</a>
<a href="#">1.1 Overview.....</a>	<a href="#">12</a>
<a href="#">1.2 Background.....</a>	<a href="#">12</a>
<a href="#">1.3 Thesis objective.....</a>	<a href="#">12</a>
<a href="#">1.4 Thesis Scope.....</a>	<a href="#">13</a>
<a href="#">1.5 Thesis Limitation.....</a>	<a href="#">13</a>
<a href="#">1.6 Chapter’s Overview.....</a>	<a href="#">14</a>
<a href="#">CHAPTER 2 – LITERATURE REVIEW.....</a>	<a href="#">15</a>
<a href="#">2.1 Automation System.....</a>	<a href="#">15</a>
<a href="#">2.2 Controller in Automation system.....</a>	<a href="#">16</a>
<a href="#">2.2.1 Programmable Logic Controller (PLC).....</a>	<a href="#">16</a>
<a href="#">2.2.2 Microcontroller.....</a>	<a href="#">17</a>
<a href="#">2.3 Packaging Box Detector System.....</a>	<a href="#">18</a>
<a href="#">2.3.1 Infrared Sensor.....</a>	<a href="#">19</a>
<a href="#">2.3.2 Photoelectric Sensor.....</a>	<a href="#">20</a>
<a href="#">2.3.3 Reed switch sensor.....</a>	<a href="#">21</a>
<a href="#">2.4 Pneumatic system.....</a>	<a href="#">21</a>
<a href="#">2.4.1 Components of a Pneumatic System.....</a>	<a href="#">24</a>
<a href="#">2.4.1.1 Power Component.....</a>	<a href="#">24</a>
<a href="#">2.4.1.2 Air Compressor.....</a>	<a href="#">26</a>
<a href="#">2.4.1.3 Air Pressure Regulator and Filter.....</a>	<a href="#">26</a>
<a href="#">2.4.1.4 Directional Control Valve.....</a>	<a href="#">27</a>
<a href="#">2.4.1.5 Logic Valve.....</a>	<a href="#">28</a>
<a href="#">2.4.1.6 Relay.....</a>	<a href="#">29</a>
<a href="#">2.4.1.7 Solenoid Valve.....</a>	<a href="#">29</a>
<a href="#">2.5 Looking at Different Packaging System.....</a>	<a href="#">30</a>
<a href="#">2.5.1 Overall System Process.....</a>	<a href="#">31</a>
<a href="#">2.5.2 Case magazine.....</a>	<a href="#">31</a>
<a href="#">2.5.3 Pick and Place system.....</a>	<a href="#">32</a>
<a href="#">2.5.4 Weight checking.....</a>	<a href="#">33</a>
<a href="#">2.5.5 Case taping unit.....</a>	<a href="#">34</a>
<a href="#">2.5.6 Palletizing.....</a>	<a href="#">34</a>
<a href="#">2.5.7 Conveyor Belt.....</a>	<a href="#">35</a>
<a href="#">CHAPTER 3 – METHODOLOGY.....</a>	<a href="#">36</a>

3.1 Packaging Explanation.....	36
3.2 Recognizing the Need for Packaging System .....	37
3.3 Packaging System Process.....	37
3.4 Packaging system process explanation .....	38
3.4.1 Measuring process.....	38
3.4.1.1 Original idea.....	39
3.4.1.2 Problem with the Original Idea.....	40
3.4.1.3 Measuring Process solution.....	40
3.4.1.4 Measuring process requirement .....	41
3.4.1.5 Electrical Components in Measuring Process.....	41
3.4.2 Filling Process.....	42
3.4.2.1 Filling Process Requirements.....	43
3.4.2.2 Filing Process Solution.....	43
3.4.2.4 Electrical Components in Filling Process.....	45
3.4.3 Closing Process.....	45
3.4.3.1 Closing Process Requirements .....	46
3.4.3.2 Closing Process Solution .....	46
3.4.4 Palletizing process.....	47
3.4.4.1 Palletizing Process Requirements .....	48
3.4.4.2 Electrical Components in Palletizing Process.....	48
3.4.4.3 Palletizing Process Solution.....	49
3.5 Mechanical Component .....	50
3.5.1 Operation of Transport system.....	50
3.5.2 Measuring process.....	51
3.5.3 Packaging Box Lid Magazine.....	52
3.5.4 Lighter Box Magazine.....	53
3.5.5 Pallet box .....	54
3.6 Electrical Cabinet.....	55
3.7 MITSUBISHI RV-M1 Robot.....	56
3.7.1 System Description of MITSUBISHI Robot.....	57
3.8 Control Panel.....	60
3.9 Electrical Cabinet.....	62
3.9 Symbol and pseudo code.....	63
3.10 Control System .....	66
CHAPTER 4 – RESULT & DISCUSSION.....	69
4.1 Measuring Process test and result .....	69
4.1.1 Function Test.....	70
4.1.2 Result.....	70
4.2 Filling Process Test and Result.....	71
4.2.1 Filling Process Function Test.....	72
4.2.2 Result.....	72
4.3 Closing Process Test and Result.....	73
4.3.1 Closing Process Function Test.....	74
4.3.2 Closing process Result.....	74
4.4 Palletizing Process Test and Result.....	74
4.4.1 Palletizing Function Test .....	76
4.4.2 Result.....	76
4.5 The result of complete system .....	77

4.6 The Result of Control Panel .....	78
4.7 Result of Electrical Cabinet.....	79
CHAPTER 5 CONCLUSION AND RECOMENDATION.....	80
GLOSSARY.....	81
REFERENCES.....	84
APPENDICES.....	87
A – MECHANICAL DESIGN (Technical Drawing).....	87
B – DATASHEET.....	98
C – BILL OF MATERIAL.....	111
D – WIRING DIAGRAM.....	112
E – PNEUMATIC DIAGRAM.....	122
F – FLOW CHART.....	125
G– MITSUBISHI ROBOT.....	126
H – PROGRAMMING.....	134
CURRICULUM VITAE.....	146

