

**REDESIGN OF
REVERSE VENDING MACHINE**

By

Jonathan Putra Rasendriya
11901003



SWISS GERMAN UNIVERSITY
The Prominence Tower
Jalan Jalur Sutera Barat No. 15, Alam Sutera
Tangerang, Banten 15143 – Indonesia

Revision after Thesis Defense on 10 July 2023

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 acknowledgement is made in the thesis.



Jonathan Putra Rasendriya
Student

13th April 2023
Date

Approved by:



Erikson Ferry Sinaga ST. M.Kom
Thesis Advisor

Date

Dr. Maulahikmah Galinium, S. Kom., M. Sc.

Dean

Date

Jonathan Putra Rasendriya

ABSTRACT

REDESIGN OF REVERSE VENDING MACHINE

By

Jonathan Putra Rasendriya
Erikson Sinaga, S.T, M.kom, Advisor

SWISS GERMAN UNIVERSITY

Plastic waste is a pressing global environmental issue, with rapid production growth and long decomposition periods. In Indonesia, bottled drinking water waste contributes significantly to the overall plastic waste problem. Reverse Vending Machines (RVMs) have proven effective in reducing plastic waste in European countries but are still uncommon in Indonesia. SGU is developing RVMs with an integrated application, but improvements are needed, such as addressing the issue of crushing bottles with lids. By removing bottle caps before crushing and enhancing RVM design, SGU aims to reduce plastic waste, contributing to a cleaner and more sustainable environment in Indonesia.

Keywords: RVM, Reverse Vending Machine, Crusher, Loadcell, Barcode Scanner



© Copyright 2023
by Jonathan Putra Rasendriya
All rights reserved

DEDICATION

I dedicate this work towards myself and towards the company in which this product will be used for the better and growth of the company.



ACKNOWLEDGEMENTS

I would like to express my gratitude first and foremost to the Lord Jesus Christ, who has always showered me with boundless love and guidance and bestowed His grace upon my life. I am also thankful to my family for their unwavering faith and constant support, which has been a source of encouragement for me.

I extend my heartfelt appreciation to Mr. Erikson Sinaga, ST M.Kom, who has served as my advisor. I am truly grateful for his patience and invaluable assistance throughout the completion of this thesis project.

I would also like to thank Mr. Y. Fredhi S for his support and valuable suggestions in this thesis, as well as his assistance with the 3D printing. Lastly, I express my gratitude to my dear friends in the Complex Discord group, who have remained supportive and encouraging throughout the journey.

Thank you all for your contributions and encouragement, which have played a significant role in the successful completion of this project.

TABLE OF CONTENTS

	Page
STATEMENT BY THE AUTHOR.....	2
ABSTRACT.....	3
DEDICATION	5
TABLE OF CONTENTS.....	7
LIST OF FIGURES	9
LIST OF TABLES	11
CHAPTER 1 - INTRODUCTION.....	12
1.1 Background.....	12
1.2 Research Problem	13
1.3 Objective.....	13
1.4 Hypothesis	14
CHAPTER 2 - LITERATURE REVIEW	15
2.1 Theoretical Perspectives	15
2.1.1 Reverse Vending Machine.....	15
2.1.2 RVM Crusher.....	16
2.1.3 PHPMyAdmin	17
2.2 Previous Studies	17
2.3 Refundable Beverage.....	19
CHAPTER 3 – RESEARCH METHODS	20
3.1 Design Justification	20
3.1.1 Breakdown System Structure.....	20
3.2 Mechanical Calculation	22
3.3 Mecahnical Design	26
3.3.1 Slider and Bottle Cap container	26
3.3.2 Bracket For IR sensor	27
3.3.3 Bracket for Conveyor.....	28
3.4 Electrical Design.....	29
3.4.1 Laser Sensor.....	30
3.4.2 Load Cells	31

3.4.2	HX711.....	32
3.4.3	Raspberry Pi.....	33
3.4.4	Inductive Proximity Sensor	34
3.4.5	Thermal Printer	35
3.4.6	IBT-2.....	36
3.4.7	DC Motor.....	37
3.4.8	7-inch Capacitive LCD Touchscreen.....	38
3.5	Control and Program.....	39
CHAPTER 4 – RESULTS AND DISCUSSIONS.....		43
4.1	Pre Thesis Condition	43
4.2	Mechanical Result	44
4.3	Electrical Testing and Result.....	46
4.3.1	Load Cells Testing	46
4.3.2	Barcode Scanner Testing	49
4.4	New User Interface	52
4.5	Full System Testing	56
CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS		58
5.1	Conclusions	58
5.2	Recommendations	59
GLOSSARY		60
REFERENCES		61
APPENDIX A-Datasheet.....		63
APPENDIX B – PROGRAM CODES		71
CURRICULUM VITAE.....		75

LIST OF FIGURES

	Page
Figure 2.1 TOMRA RVM.....	16
Figure 2.2 Previous RVM UML	18
Figure 2.3 Standardized Barcode Location and Container Dimension.....	19
Figure 3.1 Breakdown System Structure	21
Figure 3.2 Bottle Cap Slider	26
Figure 3.3 Bottle Cap Container	26
Figure 3.4 Assembly of Bottle Cap Slider	27
Figure 3.5 Bracket Laser Module	27
Figure 3.6 Bracket Receiver Laser.....	28
Figure 3.7 Bracket Conveyor	28
Figure 3.8 Wiring Diagram of RVM	29
Figure 3.9 Laser Sensor	30
Figure 3.10 Load Cells.....	32
Figure 3.11 HX711	33
Figure 3.12 Raspberry Pi	34
Figure 3.13 Inductive Proximity Sensor	35
Figure 3.14 How Inductive Sensor Works.....	35
Figure 3.15 Thermal Printer.....	36
Figure 3.16 IBT-2	37
Figure 3.17 Worm Geared DC Motor.....	38
Figure 3.18 Geared DC Motor	38
Figure 3.19 Flow Chart Part 1.....	Error! Bookmark not defined.
Figure 3.20 Flow Chart Part 2.....	42
Figure 4.1 Bracket for Laser Sensor	44
Figure 4.2 Bracket for Receiver	44
Figure 4.3 Conveyor Braket.....	45
Figure 4.4 Load Cells Callibration.....	46
Figure 4.5 Graph Ideal Mass vs Load Cells telsting	47
Figure 4.6 Initial Condition for UI.....	52
Figure 4.7 Waiting UI	53

Figure 4.8 List of Objects	54
Figure 4.9 Rejected UI	54



LIST OF TABLES

	Page
Table 4.1 Load Cells Testing with 5 weight	47
Table 4.2 Load Cells vs Real Weight	49
Table 4.3 Width to Height Barcode Ratio	50
Table 4.4 Distance Reading Barcode.....	51
Table 4.5 Full System Testing	56

