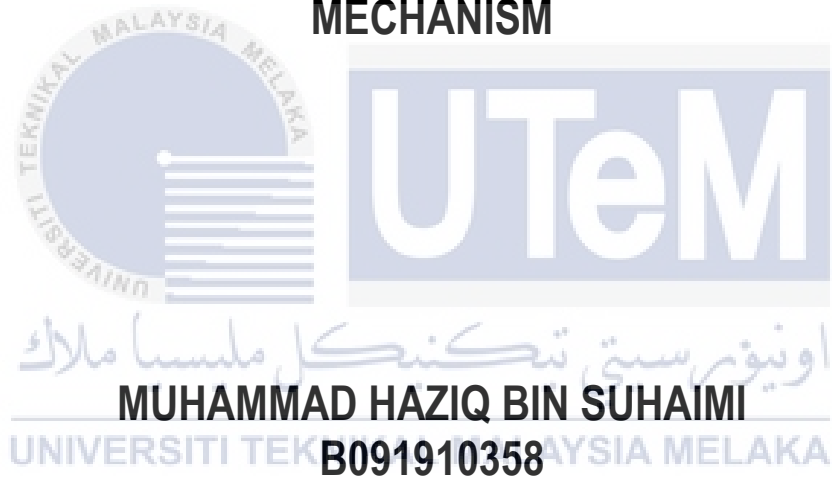




THE DESIGN AND DEVELOPMENT OF PINEAPPLE PLANTING MECHANISM



**BACHELOR OF MANUFACTURING ENGINEERING
TECHNOLOGY (PRODUCT DESIGN) WITH HONOURS**

2023



**Faculty of Mechanical and Manufacturing Engineering
Technology**



**THE DESIGN AND DEVELOPMENT OF PINEAPPLE PLANTING
MECHANISM**

Muhammad Haziq Bin Suhaimi

Bachelor of Manufacturing Engineering Technology (Product Design) with Honours

2023

THE DESIGN AND DEVELOPMENT OF PINEAPPLE PLANTING MECHANISM

MUHAMMAD HAZIQ BIN SUHAIMI

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology (Product Design) with Honours



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

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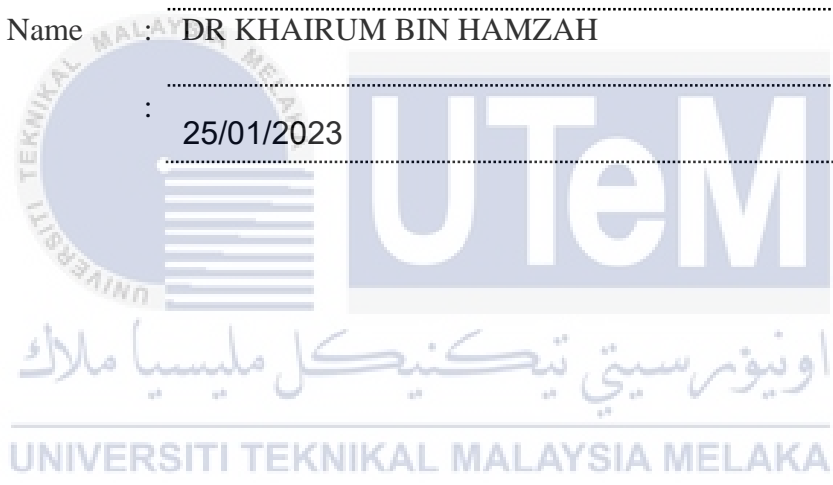
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DEDICATION

I dedicate this project to the Almighty God, Allah SWT, the Creator of all entire beings in the universe. He has been the main source, the strength and inspiration for this project. “He has given everything from Him as the pay for what the people has done their work”. I also dedicate this project to my family, especially my parents. My father, Mr Suhaimi bin Ali @ Ahmad. Thank you for the great support you have given me for this entire life. My mother, Mrs Zunika binti Mohamed. Thank you for being the best mother i have ever had. Thank you for being the greatest parent, raising me from when i am child until was how big I am right now like it is nothing. Not to forget, I dedicate this project to my supervisor, Dr Khairum bin Hamzah, Dr Hambali bin Boejang, my siblings, friends, and also to my partner Nur Hidayatul Ashikin. Thank you for all the words, motivation, inspiration, advice, support, patience, confidence and everything. Without their support and prayers, I may not be able to do this as far as i could.

ABSTRACT

The purpose of this research work is to design and develop mechanism for pineapple-planting. This is because currently, pineapple planting is done by hand which is time-consuming and takes a lot of work to since it takes 10 days to finish one hectare of farm with 1,800 sucker every day, therefore this study is carry out to overcome this problem. The design activities are carried out according to engineering design phases introduced by Rudolph J. Eggert. In order to conduct this research work, the information and data are gained by site visiting, interviews, and observations from Hj Norman's pineapple plantation farm in Segamat, Johor. This research work is using 3D CAD software for engineering design activities. Once the CAD data is available, the data is saved as STL file and produce an alpha prototype category. Based on this research study, this project is expected help pineapple farmers reduce some of their burdens by addressing the present problem of boosting pineapple planting productivity while also introducing a new degree of mechanization for the pineapple production system. Furthermore, the body structure design analysis result is expected to deliver the functions smoothly without any problem. Finally, this pineapple planting mechanism, in conjunction with the system mechanism, passed the analytical testing and was approved for production.

ABSTRAK

Tujuan kerja penyelidikan ini adalah untuk mereka bentuk dan membangunkan mekanisme penanaman nanas. Ini kerana pada masa ini, penanaman nanas dilakukan secara manual yang memakan masa yang lama dan memerlukan banyak kerja kerana mengambil masa 10 hari untuk menyiapkan satu hektar ladang dengan 1,800 sulur setiap hari, justeru kajian ini dijalankan bagi mengatasi masalah ini. . Aktiviti reka bentuk dijalankan mengikut fasa reka bentuk kejuruteraan yang diperkenalkan oleh Rudolph J. Eggert. Bagi menjalankan kerja penyelidikan ini, maklumat dan data diperoleh melalui lawatan tapak, temu bual dan pemerhatian dari ladang ladang nanas Hj Norman di Segamat, Johor. Kerja penyelidikan ini menggunakan perisian CAD 3D untuk aktiviti reka bentuk kejuruteraan. Setelah data CAD tersedia, data disimpan sebagai fail STL dan menghasilkan kategori prototaip alfa. Berdasarkan kajian penyelidikan ini, projek ini diharapkan dapat membantu petani nanas mengurangkan sedikit beban mereka dengan menangani masalah semasa meningkatkan produktiviti penanaman nanas sambil juga memperkenalkan tahap mekanisasi baharu untuk sistem pengeluaran nanas. Tambahan pula, hasil analisis reka bentuk struktur badan dijangka dapat menyampaikan fungsi dengan lancar tanpa sebarang masalah. Akhirnya, mekanisme penanaman nanas ini, bersama-sama dengan mekanisme sistem, lulus ujian analisis dan telah diluluskan untuk pengeluaran.

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TABLE OF CONTENTS

	PAGE
DECLARATION	
APPROVAL	
DEDICATION	
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vii
LIST OF FIGURES	ix
LIST OF SYMBOLS AND ABBREVIATIONS	xii
LIST OF APPENDICES	xiv
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Background of Pineapple Industry	1
1.3 Problem Statement	3
1.4 Research Objective	3
1.5 Scope of Research	3
1.6 Summary	4
CHAPTER 2 LITERATURE REVIEW	5
2.1 Introduction	5
2.2 Fruits production in Malaysia	5
2.2.1 Durian	7
2.2.2 Mangosteen	8
2.3 Pineapple Plant	9
2.3.1 Pineapple Cultivation	12
2.3.2 Sucker	14
2.3.3 Mechanization and Automation of Pineapple Cultivation	16
2.3.4 Type of Agriculture Machinery	22
2.3.5 Design for Structure	23
2.3.6 Type of chassis Frames Structure	24
2.4 Introduction to Product Design and Development	28
2.4.1 Design and Development Product Team	30
2.4.2 The Product Development Process	33

2.5	Engineering Design Phases (EDP)	37
2.5.1	Engineering Design Process	40
2.6	Design Phase	42
2.6.1	Formulation	44
2.6.2	Concept Design	57
2.6.3	Configuration design	67
2.6.4	Design for Manufacturing Assembly (DFMA)	69
2.6.5	Parametric Design	71
2.6.6	Prototype Fabrication	79
2.6.7	Detail Design	82
2.7	Computer Aided Design (CAD)	83
2.7.1	SOLIDWORKS Software	85
2.8	Summary	87
CHAPTER 3 METHODOLOGY		88
3.1	Introduction	88
3.2	Process Flow Chart of Pineapple Planter Mechanism	88
3.3	Research Design	90
3.4	Literature Review	90
3.5	Establishing Target Specification	91
3.5.1	House of Quality (HOQ)	91
3.5.2	Engineering Design Specification (EDS)	92
3.6	Concept Design	93
3.6.1	Concept Generation	94
3.6.2	Concept Selection	95
3.6.3	Final Specification	96
3.7	Custom and Standard Part List	97
3.8	Prototype Fabrication Process	97
3.9	Summary	101
CHAPTER 4 RESULTS AND DISCUSSION		102
4.1	Introduction	102
4.2	Target Specification	102
4.2.1	House of Quality (HoQ)	104
4.2.2	Engineering Design Specification (EDS)	106
4.3	Concept Design	106
4.3.1	Concept Generation	106
4.3.2	Concept Selection	109
4.3.3	Final Specification	110
4.4	Custom and Standard Part List	111
4.5	Detail Design	113
4.6	Prototype Fabrication Model	113
4.7	Summary	114
CHAPTER 5 CONCLUSION AND PROJECT POTENTIAL		115
5.1	Conclusion	115
5.2	Project Potential	115

REFERENCES

117

APPENDICES

124



LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Field capacity and total field time-based operation (Muazu et al., 2014)	18
Table 2.2	Mechanization and automation level at every crop production stage (Badril Abu Bakar et al., 2021)	22
Table 2.3	Engineering Design Specification Template (Eggert, 2005)	56
Table 2.4	Configuration Decisions for Different Product Elements	68
Table 2.5	Solution Evaluation Parameters for Belt-Pulley System (Eggert, 2005)	75
Table 2.6	Design variables for Belt-Pulley Systems	75
Table 2.7	Problem Definition Parameters for Belt-Pulley System	76
Table 3.1	House of quality for pineapple planter machine	92
Table 3.2	The engineering design specification for pineapple planting machine	93
Table 3.3	The combination table of concept	94
Table 3.4	Total number of combinations	95
Table 3.5	Construction of Weighted Rating Method	96
Table 3.6	The engineering design specification for pineapple planting machine	97
Table 3.7	Parameter setting in Ultimaker Cura 4.9.1	98
Table 3.8	Features setting in Ultimaker Cura 4.9.1	98
Table 4.1	Customer's background	103
Table 4.2	Customer Requirement	103
Table 4.3	Customer Importance weight by subfunction	104
Table 4.4	House of Quality for the Pineapple Planting Mechanism	105
Table 4.5	Pineapple Planting Mechanism concept combination table	107

Table 4.6	Total number of combinations	107
Table 4.7	Total number of combination (continued)	108
Table 4.8	Total number of combination (continued)	109
Table 4.9	Final specification of pineapple planter mechanism	110
Table 4.10	Final specification of pineapple planter mechanism (continued)	111

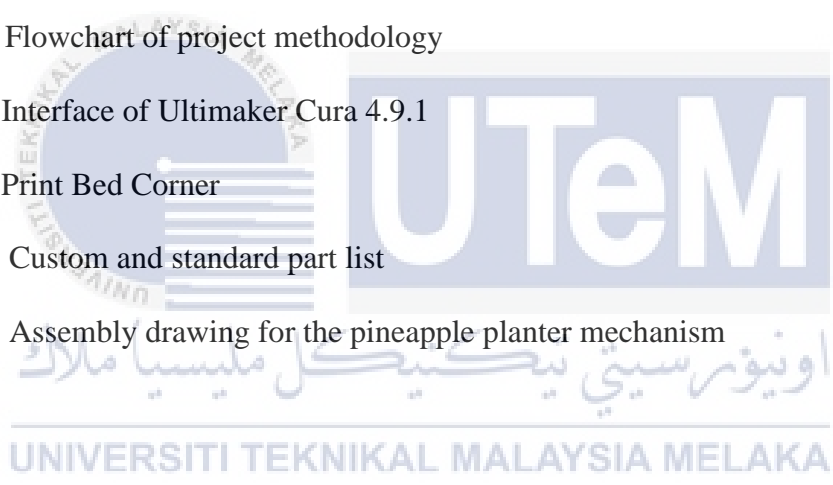


LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1	One of the pineapple plantations farms in Johor (Anonymous, n.d.)	2
Figure 2.1	Shows the variety of fruit that sell in Malaysia (Residence style.com, 2019)	7
Figure 2.2	A bucket full of durian (anonymous, n.d.)	8
Figure 2.3	The purple mangosteen “Garcinia mangostana” (anonymous, n.d.)	9
Figure 2.4	Shows the type of pineapple that cultivars grown in Malaysia (animgro, 2019)	10
Figure 2.5	Shows the type of pineapple that cultivars grown in Malaysia (animgro, 2019)	11
Figure 2.6	Shows the production, export, and area trends of pineapple industry in Malaysia, 1975-2015 (MOA,2016)	12
Figure 2.7	Shows the pineapple farm that use the same of using silver shine plastic	14
Figure 2.8	Show the morphology of pineapple plant (LPNM, 2019)	15
Figure 2.9	Show the type of sucker pineapple	15
Figure 2.10	Shows the stages of pineapple production	19
Figure 2.11	Shows the bed of pineapple plantation cover with silver shine plastic for weed control	20
Figure 2.12	A semi-mechanized planter (Ahmad <i>et al.</i> , 2013)	21
Figure 2.13	Monocoque Chassis type (Anonymous, 2011)	24
Figure 2.14	Ladder Type Chassis (Anonymous, 2014)	25
Figure 2.15	Tabular Frame Chassis (Anonymous, 2021)	26

Figure 2.16 Example of engineered, discrete, physical product (clockwise from top left); WS 7.0 PLUS Combine Harvester, Drone 3WWDZ-10 Agriculture Drone, 2ZS (6 row) Hand Type Transplanter, and WD385D Rubber Track Tractor (anonymous, n.d.)	29
Figure 2.17 The composition of product development team for an electromechanical product of modest complexity (Ulrich <i>et al.</i> ,2012)	30
Figure 2.18 Applicable generic product development (Ulrich <i>et al.</i> , 2004)	34
Figure 2.19 The essential stages of the design process include formulating generating, analysing, and evaluating (Eggert, 2005)	38
Figure 2.20 Formulation initiates all solution strategies (Eggert., 2005)	39
Figure 2.21 Five phase of design, emphasizing the crucial mature of design problem formulation (Hambali Boejang, 2021)	42
Figure 2.22 The process of formulating a design problem (Eggert, 2005)	45
Figure 2.23 Rooms of the product planning house of quality (Eggert, 2005)	52
Figure 2.24 The house of quality for an electric sharpener (Eggert, 2005)	55
Figure 2.25 Concept design decision-making activities (Boejang, 2021)	58
Figure 2.26 Concept generation is an integral part of the concept development phase (Eggert, 2005)	59
Figure 2.27 Example of concept alternatives table (Ulrich & Eppinger, 2012)	62
Figure 2.28 Example of concept combination table (Ulrich & Eppinger, 2012)	62
Figure 2.29 Show an example of outpatient syringe concept sketch generated by the product development team in order to describe the basic concepts consideration (Ulrich <i>et al.</i> , 2016).	65
Figure 2.30 Pugh's method	67

Figure 2.31 Configuration design, from product to part (Boejang, 2021)	69
Figure 2.32 show an example of DFA summary before DFMA analysis (Naiju, 2021)	70
Figure 2.33 Show an example of DFA summary after DFMA analysis (Naiju,2021)	71
Figure 2.34 Parametric design decision-making process (Eggert, 2005)	74
Figure 2.35 Sample of soft tooling made of silicon (anonymous.n.d.)	81
Figure 2.36 Sample of hard tooling product (anonymous. n.d.)	82
Figure 2.37 Flow process in design phase (Eggert, 2005)	83
Figure 3.1 Flowchart of project methodology	89
Figure 3.2 Interface of Ultimaker Cura 4.9.1	99
Figure 3.3 Print Bed Corner	100
Figure 4.1 Custom and standard part list	112
Figure 4.2 Assembly drawing for the pineapple planter mechanism	113



LIST OF SYMBOLS AND ABBREVIATIONS

1D	-	1 Dimension
2D	-	2 Dimension
3D	-	3 Dimension
BOM	-	Build of Material
c	-	Center distance
CAD	-	Computer Aided Design
CAE	-	Computer Aided Engineering
CFD	-	Contract for Differences
CNC	-	Computer Numerical Control
CSG	-	Computational Fluid Dynamics
d_1	-	Driven-pulley diameter
DFA	-	Design for Assembly
DFMA	-	Design for Manufacturing Assembly
DOA	-	Department of Agriculture
DOF	-	Degree of Freedom
ED	-	Engineering Desgin
EDM	-	Engineering Data Management
EDS	-	Engineering Design Specifications
F_1	-	Belt Tension
FAMA	-	Federal Agriculture Marketing Authority
FEA	-	Finite Element Analysis
FEM	-	Finite Element Method
F_{max}		Belt strength
GCS	-	Global Coordinate System
GDP	-	Gross Domestic Product
HoQ	-	House of Quality
LPP	-	'Lembaga Pertubuhan Peladang'
MAFI	-	Minitstry of Agriculture and Food Industries

MARDI	-	Malaysia Agriculture Research and Development Institute
MBD	-	Multibody Dynamics
MOA	-	Ministry of Agriculture
MPIB	-	Malaysia Pineapple Industry
NA	-	Non-Available
PDD	-	Product Design Development
PDM	-	Product Data Management
PDS	-	Product Design Specification
QFD	-	Quality Function Deployment
R&D	-	Research & Development
RP	-	Rapid Prototyping
T_b	-	Torque Belt
UAE	-	United Arab Emirates
USA	-	United State of America
\dot{W}		Motor power
WCS	-	Works Coordinate Systems
$\dot{W}f$		Friction coefficient

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LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX A	Gant Chart of PSM1 activity.	124
APPENDIX B	Bachelor's degree project 2 Gantt chart	125
APPENDIX C	Engineering Design Specification of Pineapple Planting Mechanism	126
APPENDIX D	Construction of weighed Rating Method	127
APPENDIX E:	Perimeter of Pineapple Crop	130
APPENDIX F:	The engineering design specification part list	131
APPENDIX G:	Sucker Feeder Part List	132
APPENDIX H:	Sucker puncher part list	134
APPENDIX I:	Engineering drawing for pineapple planter structure custom parts	138
APPENDIX J	Prototype fabrication model	142

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter presents the background of the pineapple industry in Malaysia including a statement of the problems of manual cultivation methods today. Furthermore, the issue description specifies a number of objectives that must be met. In addition, this chapter also includes the scope of project research.

1.2 Background of Pineapple Industry

Pineapple is extensively consumed in both fresh and canned form because of its appealing sweet flavour. The pineapple flavour is a complex combination of volatile and non-volatile chemicals that are present in minute levels. The fragrance component composition can be utilized for quality control, authentication, and categorization of pineapple types. Pineapple (*Ananas cosmoses*) also is one of the popular fruit crops grown in Malaysia. The Spanish first introduced pineapple to Malaysia in the sixteenth century. The pineapple industry in Malaysia is the oldest agro-based export-oriented industry dating back to 1888(Animagro.blogspot,2014). Despite its tiny size in comparison to palm oil and rubber, the industry is critical to the country's socio-economic development.

According to (animagro.blogspot, 2014), Malaysia's pineapple business is unique in that approximately 90% of the crop is grown on peat soil, which is considered poor for most other crops. Malaysia was one of the world's top three pineapple growers in 1960s and early 1070s, now has a small industry that has been supported by the Malaysian Pineapple Industry

Board (MPIB) since 1957 which is responsible for controlling and developing the Malaysian pineapple industry (Chan,2000). In the tropical fruit category, canned pineapple was the second most exported item behind watermelon. Based on the long-term planning that has been accumulated by the MPIB, there are several methods has been devised on to expand into new areas, increase the productivity, and address the problem of fruit supply shortages in factories. This figure depicts the example of pineapple farm in johor (refer Figure 1.1).



Figure 1.1 One of the pineapple plantations farms in Johor (Anonymous, n.d.)

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Haji Norman Bin Sharom, a pineapple farm operator in Johor who also sells and distributes fresh pineapples, will be interviewed for this study. He is the Johor Pineapple Industry Board's chairman.

1.3 Problem Statement

The planting of pineapple sucker is discovered to be done manually based on observation. For this, a one-acre plot of land takes 10 days to complete. Thus, this study is conducted in order to improve the planting process by designing new mechanism machine.

1.4 Research Objective

The primary goal of this study is to design and develop a mechanism for pineapple transplanting machine. Specifically, the objectives that need to be achieved in this case study are as follows:

1. To design and develop a planting mechanism for pineapple
2. To fabricate the pineapple planting mechanism

1.5 Scope of Research

The scope of this project is as follow:

- i. To perform literature review on topic-related journals, articles, and books.
- ii. To study and develop the engineering design phase based on the design & development
- iii. The utilization of 3D CAD software to design the mechanical system to deliver the function of the pineapple planting machine
- iv. To fabricate the prototype version of the mechanism.