UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE DESIGN AND DEVELOPMENT OF PINEAPPLE PLANTING MECHANISM

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Faculty of Mechanical and Manufacturing Engineering Technology

THE DESIGN AND DEVELOPMENT OF PINEAPPLE PLANTING MECHANISM

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A thesis submitted
in fulfillment of the requirements for the degree of
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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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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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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.blogsport, 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.)

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.