DESIGN AND DEVELOPMENT OF MOTORCYCLE ROTATED STAND

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**A project report submitted
in fulfillment of the requirements for the degree of
Bachelor Manufacturing Engineering Technology with Honours**

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2023

DECLARATION

I declare that this thesis entitled “Design and Development of Motorcycle Rotated Stand ” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 11 January 2023

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology with Honours.

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DEDICATION

This report is dedicated to my parents in particular, for their endless love, support, and encouragement. And to my lecturer Ts. Dr. Kamarul Bin Amir Mohamed has guided me along the way to finish this project. Thank you for all your support, and give me strength until this project is finished.

ABSTRACT

This project describes a motorcycle stand to design a space-saving and multifunctional product based on basic service to maintenance the motorcycle for users. Every motorcycle has its own way to handle and how to stand if the user wants to place and park. However, there must be the exertion of force and energy when handling motorcycles, especially for types of motorcycles with mass of 300kg and above. Besides that, the characteristics of the motorcycle are very big and it is utilized more space to park in a certain place. Due to that, the main purpose of this thesis is to study the characteristics of motorcycle stands and maintenance for motorcycles. Then, the thesis is also about to analyze the level strength of the structure motorcycle stand using Solidworks software. In addition, to design a functional stand for lifting and rotating a motorcycle with a maximum weight of 300kg. In this study to produce a new motorcycle rotated stand, at least three phases must be completed in the development of this project. The three phases are the study, design, and development phases. This project was started with a questionnaire survey that involved 123 respondents. This questionnaire survey is carried out to figure out the customers' requirements. Furthermore, the data collected will be utilized to improve or develop a new motorcycle stand design that would meet the expectations of customers and a morphological chart has been used to complete this project. Thus, the motorcycle rotated stand will be created based on customer requirements and stability to use for lifting and rotating. Concept designs have been created and the most appropriate concept is chosen using the Pugh matrix, House of Quality (HOQ) and Solidworks software was used to design the 3D CAD drawing of the selected concept. The Design for the motocycle rotated stand is sketching 4. It is because sketching 4 is more safety, efficiency, stability and it is easy to store. The rotated motorcycle stand must have these criteria according to the objective of this project. The material selection has been selected by analysis in Solidworks simulation to assess the motorcycle stand's safety, durability, and structural integrity, to optimize the satisfaction of users with their everyday usage, to determine the material behaviour and deformation in a few aspects. The main concerns in this project were the displacements, factor of safety, strains, and stresses of motorcycle stand designs subject to internal and external loads. A project feature was developed to perform weakness point of the product, in order to confirm that the designed product is stable enough to use. The results showed that the designed motorcycle stand is stable to use.

ABSTRAK

Projek ini adalah mengenai pendirian motosikal yang direka bentuk untuk produk yang menjimatkan ruang dan pelbagai fungsi berdasarkan perkhidmatan asas untuk penyelenggaraan motosikal kepada pengguna. Setiap motosikal mempunyai keistimewaan tersendiri untuk dikendalikan dan cara berdiri sekiranya pengguna ingin meletakkan kenderaan. Namun, pengguna mesti menggunakan tenaga yang banyak untuk mengendalikan motosikal terutamanya bagi motosikal yang berjisim sebanyak 300kg dan ke atas. Selain itu, ciri-ciri motosikal tersebut sangat besar dan menggunakan lebuh banyak ruang untuk disimpan. Oleh itu, tujuan utama tesis ini adalah untuk mengkaji ciri-ciri pendirian motosikal dan penyelenggaraan motosikal. Di samping itu, tesis ini juga menganalisiskan tahap kekuatan struktur pada pendirian motosikal dengan menggunakan Solidworks. Selain itu, tujuan thesis ini untuk mereka bentuk pendirian berfungsi untuk mengangkat dan mengalihkan motosikal yang mempunyai berat maksimumnya 300kg. Pelaksanaan pendirian motosikal dalam kajian ini, mempunyai tiga fasa yang perlu dilaksankan. Tiga fasa tersebut ialah fasa kajian, reka bentuk dan pembangunan. Projek ini dimulakan dengan tinjauan soal selidik yang melibatkan 123 orang responden. Tinjauan soal selidik ini dijalankan untuk mengetahui keperluan pengguna yang memggunakan motorsikal. Justera, data yang dikumpulkan akan digunakan untuk menambahbaik dan mereka bentuk "Motorcycle Rotated Stand" yang akan memenuhi jangkaan pelanggan dan carta morfologi dalam projek ini. Oleh itu, "Motorcycle Rotated Stand" akan dibuat berdasarkan keperluan pelanggan dan kestabilan untuk digunakan untuk mengangkat dan dialihkan. Reka bentuk konsep telah dibuat dan konsep yang paling sesuai dipilih dengan menggunakan "Pugh matrix", "House of Quality (HOQ)" dan Solidworks yang digunakan untuk mereka bentuk lukisan CAD 3D bagi konsep yang dipilih. Reka bentuk yang telah dipilih untuk "Motorcycle Rotated Stand" ini ialah lakaran 4. Dalam kajian "House of Quality (HOQ)", lakaran 4 lebih selamat, cekap, stabil dan mudah disimpan. "Motorcycle Rotated Stand" mestilah mempunyai kriteria ini untuk memenuhi objektif projek ini. Pemilihan bahan telah dipilih melalui analisis dalam simulasi Solidworks untuk menilai keselamatan, ketahanan, dan integriti struktur pendirian motosikal, untuk mengoptimumkan kepuasan pengguna dengan penggunaan harian mereka. Kebimbangan utama dalam projek ini ialah sesaran, faktor keselamatan, strain, dan tegasan reka bentuk pendirian motosikal tertakluk kepada beban dalaman dan luaran. Projek yang telah dibangunkan untuk melaksanakan titik kelemahan produk, untuk mengesahkan bahawa produk yang direka bentuk adalah stabil untuk digunakan. Hasil kajian menunjukkan bahawa pendirian motosikal yang direka adalah stabil untuk digunakan.

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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		**viii**
LIST OF SYMBOLS AND ABBREVIATIONS		**xii**
LIST OF APPENDICES		**xiii**
CHAPTER 1	**INTRODUCTION**	**1**
1.1	Background Research	1
1.2	Problem Statement	3
1.3	Research Objective	4
1.4	Scope of Research	4
1.5	Report Outline	5
1.6	Summary	6
CHAPTER 2	**LITERATURE REVIEW**	**7**
2.1	Introduction	7
2.2	History of Motorcycles	7
2.3	Type of Motorcycles	14
	2.3.1 Standard	15
	2.3.2 Naked Bike	15
	2.3.3 Touring Motorcycle	17
	2.3.4 Dirt Bike	18
	2.3.5 Café Racer	19
	2.3.6 Motocross	20
	2.3.7 Chopper	21
2.4	Services of Motorcycles	22
2.5	Type of High Jack Lifter	25
2.6	Material of Product	28
	2.6.1 Mechanical Properties of Materials	28

2.6.2 Material Selection 36
2.6.3 Material Analysis 37
2.7 Structural Analysis 40
2.7.1 Finite Element Model and Analysis 42
2.8 Summary 47

CHAPTER 3 METHODOLOGY 52
3.1 Introduction 52
3.2 Planning of The Study 52
3.3 Phase I: Study and Research 54
3.3.1 Existing Product 54
3.3.2 Project Limitation 55
3.3.3 Propose Design 55
3.3.4 Construct Qustionnaire 55
3.4 Phase II: Design 56
3.4.1 Distribute Questionnaire 56
3.4.2 Data Analysis 57
3.4.3 Design Sketching 58
3.4.4 Material Selection 58
3.4.5 3D Modelling 59
3.4.6 Analysis and Simulation 59
3.5 Phase III: Develop Phase 59
3.5.1 Cutting 60
3.5.2 Welding 60
3.5.3 Assembly 60
3.5.4 Finishing 60
3.6 Summary 61

CHAPTER 4 RESULTS AND ANALYSIS 62
4.1 Introduction 62
4.2 User Requirement Preliminary Survey 62
4.3 Analysis of Questionnaire 62
4.3.1 Part A: Respondent Background 63
4.3.2 Part B: Design Part by Part of Motorcycle Rotated Stand 65
4.4 Design and Development of Motorcycle Rotated Stand 69
4.4.1 Morphological Chart 69
4.4.2 Concept Sketches 71
4.4.3 Pugh Matrix 75
4.4.4 House Of Quality (HOQ) 76
4.4.5 Engineering Drawing 77
4.5 Analysis and Simulation for Structure 79
4.6 Weakness Point / Critical Point 83
4.7 Project Features 87
4.8 Project Costing 90
4.9 Summary 92

CHAPTER 5	**CONCLUSION AND RECOMMENDATIONS**	**93**
5.1	Conclusion	93
5.2	Recommendation	94
REFERENCES		**95**
APPENDICES		**99**

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Timeline History of Motorcycle	10
Table 2.2	Range Weight of Motorcycle	14
Table 2.3	The maintenance for the Ducati 999 Superbike	24
Table 2.4	Type of High Jack Lifter in the market	25
Table 2.5	Table of strength, hardness, and the ratio of hardness to strength in Cu and Cu-Zn alloys with different pretreatment	35
Table 2.6	Type of Material for Frame	38
Table 2.7	Summary of Chapter 2	47
Table 4.1	Morphological Chart	70
Table 4.2	Pugh Matrix	75
Table 4.3	Summarizes result analysis for Frame with 9 middle rods.	80
Table 4.4	Summarizes result analysis for Frame with 13 middle rods.	82
Table 4.5	Project Costing for Design 4	90

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1 Steam engines and bicycles in the 19th century		8
Figure 2.2 The first motorcycle by Louis Guillaume Perreaux		8
Figure 2.3 Internal combustion engine motorcycle by Daimler		9
Figure 2.4 First motorcycle in 1894		9
Figure 2.5 The motorcycle Yamaha SR400		15
Figure 2.6 Example of Naked Bike		16
Figure 2.7 Example of touring and grand touring motorcycle (KTM 1290 Super Duke GT)		17
Figure 2.8 Dirt Bike		18
Figure 2.9 Café Racers		19
Figure 2.10 Example of Motorcross		20
Figure 2.11 Chopper Bike		21
Figure 2.12 Example Service for Superbikes Need to Support.		23
Figure 2.13 Example Service for Superbikes Do Not Need to Support.		23
Figure 2.14 Tensile Test		30
Figure 2.15 Relationship Stress and Strain Curve		30
Figure 2.16 Necking in a tensile specimen		31
Figure 2.17: TEM microstructures of the 1100 aluminum annealed for 1.8 ks at (a) 373 K, (b) 423 K, (c) 473 K, (d) 498 K, (e) 523 K, and (f) 573 K after 6 cycles of ARB (e ¼ 4:8) at 473 K. Observed from TD		33

Figure 2.18 TEM microstructures of the IF steel annealed for 1.8 ks at (a) 673 K, (b) 773 K, (c) 873 K, (d) 898 K, (e) 923 K, and (f) 973 K after 5 cycles of ARB (e ¼ 4:0) at 773 K. Observed from TD 33
Figure 2.19 Schematic figure of a Brinell-hardness tester 34
Figure 2.20 Charpy test 36
Figure 2.21 Free body diagram of critical position during operation of RhiNO v2.0 41
Figure 2.22 Structural and Design Detail on RhiNO v2.0 42
Figure 2.23 Boundary condition and an acting load of the finite element model 43
Figure 2.24 Result in FEA in CATIA V5R20 (a) Deformation of the RhiNO v2.0, (b) von Mises stress acting on the RhiNO v2.0, and (c) Translational displacement on the RhiNO v2.0 44
Figure 2.25 The Maximum Deflection of the Wheel is 0.97mm 45
Figure 2.26 The Maximum Von Mises Stress Detected On The Axle Shaft 45
Figure 3.1 Framework of Study 53
Figure 3.2 Framework of Product Development in Phase I 54
Figure 3.3 Framework of Product Development in Phase II 56
Figure 3.4 Survey Design 57
Figure 3.5 Example of Morphological Chart 58
Figure 3.6 Framework of Product Development in Phase III 59
Figure 4.1 The analysis of the gender of the respondent in percentage. 63
Figure 4.2 The analysis of the age of respondents in percentage. 64
Figure 4.3 The analysis of the ownership of motorcycles in percentage. 65
Figure 4.4 The analysis of body frame design. 66
Figure 4.5 The analysis of wheel feature. 67

Figure 4.6 The analysis of stand holder design. 67
Figure 4.7 The analysis of clamping single arm on motorcycle feature. 68
Figure 4.8 Sketching 1 71
Figure 4.9 Sketching 2 72
Figure 4.10 Sketching 3 73
Figure 4.11 Sketching 4 74
Figure 4.12 House of Quality 76
Figure 4.13 Assembly Sketching 4 77
Figure 4.14 Frame of Sketching 4 78
Figure 4.15 Frame with 9 Rod 79
Figure 4.16 Frame with 13 Rod 79
Figure 4.17 Stress Analysis 80
Figure 4.18 Displacement Analysis 81
Figure 4.19 Strain Analysis 81
Figure 4.20 Factor of Safety Analysis 82
Figure 4.21 Base Wheel of Frame 83
Figure 4.22 Stress Analysis for Base Design 4 84
Figure 4.23 Displacement Analysis for Base Design 4 84
Figure 4.24 Strain Analysis for Base Design 4 85
Figure 4.25 Factor of Safety Analysis for Base Design 4 85
Figure 4.26 Wheel for Frame 86
Figure 4.27 Feature of Design 4 by Isometric View 87
Figure 4.28 Feature of Design 4 by Side View 87
Figure 4.29 Close up of Design 4 by Front View 88

Figure 4.30 Platform to Place High Jack Lifter 88

Figure 4.31 Roller to Rotate The Rear Wheel 89

LIST OF SYMBOLS AND ABBREVIATIONS

D,d	-	Diameter
Etc	-	Editable text configurations
CC	-	Cubid Capacity
ACU	-	Auto-Cycle Union
Kg	-	Kilogram
HP	-	Horsepower
KTM	-	Kronreif, Trunkenpolz, Mattighofen
HSS	-	High strength steel
UFG	-	Ultrafine grained
ARB	-	Accumulative roll-bonding
FEA	-	Finite element analysis
F	-	Force
N	-	Newton
Lb	-	Pounds (in weight)

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX A	Gannt Chart PSM 1	99
APPENDIX B	Gannt Chart PSM 2	100
APPENDIX C	Google Form Survey	101
APPENDIX D	Detail Design for Assembly Sketching 4	109
APPENDIX E	Detail Design for Frame of Sketching 4	110
APPENDIX F	BDP Thesis Status Verification	111
APPENDIX H	Turnitin Result	112

CHAPTER 1

INTRODUCTION

1.1 Background Research

Motorcycles are the fastest-growing segment of the global automobile industry, representing the majority of fleets in many low and middle nations and motorcycles are the fastest-growing trends in the global automobile industry, accounting for the majority of fleets in many low- and middle-income nations (Dimitrios, 2017). There are many different sorts of motorcycles, depending on how they are used, the designer's purpose, or a mix of the two. Cruiser, sport, touring, standard, dual-purpose, and dirt bikes are the six primary categories. Sport touring motorcycles are often classified as a seventh category.

Every motorcycle has its own special to handle and how to stand if the user wants to place and park. Every motorcycle must have one stand. The one stand is always used as a temporary park. The side-stand on superbikes positions the bike in a slanting position, limiting users' capability to do maintenance. The kickstand should be retracted by kicking it up with the left foot and allowing it to tuck behind the motorcycle's underbody. Besides, the motorcycle also has a double stand or known as a center stand. Besides that, double-stand which is common on considerably lighter lower CC motorcycles is rarely encountered on superbikes with a dry weight of moreover 100 kg. This double-stand serves as a temporary stand that elevates the motorcycle to a vertical standing position, allowing for easy maintenance work on a regular or ad-hoc basis (Rashid et al., 2012).

Motorcycle studies have recently sparked a lot of interest in the scientific community (Syahmi et al., 2022). A paddock stand is used on superbike motorbikes to support the motorcycle in an upright and stable posture, which can be used for a variety of tasks such as washing, tire change, and general maintenance (Pratik Patole, 2015). So, the paddock stand serves an important purpose and can be found in most garages. It's not difficult to use a paddock stand. All that is required is to align the paddock stand's holding mounts with the extension bolts on the rear wheel and support the wheel on it. Then simply push the handle frame lower, wedging the bike upwards until the frame contacts the ground and supports it. It's a lock mode in which the bike will be supported on the stand and will not move till you pull the frame upwards again. As a result, they are extremely safe to use.

While using a paddock for a superbikes motorcycle, the motorcycle will be stable and can use to maintain the motorcycle. It also provides solid stability to the motorcycle. However, if the user motorcycle does not use the paddock stand, it has limitations that can occur motorcycle damage and fall. Moreover, the paddock stand has a lot of space to store. It can occupy space for the user to store such as in the garage. Next, one stand motorcycle can also easy to fall upside down the motorcycle which is parking for a long period. This is because, factors of environment, maintenance, and the placement of motorcycles are affected the stability of the motorcycles.

1.2 Problem Statement

People nowadays prefers riding a motorcycle to driving a car. This is because motorcycles also have lower operational costs and fuel consumption than passenger cars, contribute less to traffic congestion and provide the personal freedom that public transportation does not (Cox & Mutel, 2018). However, users must use a lot of force and energy for handling motorcycles, especially for types of motorcycles with 100 kg and above. Besides that, the characteristics of the motorcycle are very big and it is use more space to store. If the motorcycle has to park and handle, the space also should be big and have a lot of space to use. Besides that, motorcycles like 100kg and above do not have a double stand. So, it is difficult to park and maintenance. So, paddock stands are commonly used by superbike owners to temporarily hold their motorcycle in an upright posture, allowing them to do either daily or ad-hoc maintenance (Syahmi et al., 2022). Unfortunately, usage of the paddock in the current market is not effective and the rear wheel of the motorcycle and front are not orderly. In addition, the paddock can lifting at rear wheel of the motorcycle only.

1.3 Research Objective

The main aim of this research is to propose a systematic and effective methodology to design and develop a motorcycle rotated stand with reasonable accuracy. Specifically, the objectives are as follows:

i) To study the characteristics of the motorcycle stands and services to maintenance for motorcycles.

ii) To analyze the level strength of the motorcycle stand using Solidworks software.

iii) To design a functional stand for lifting and rotating a motorcycle with a maximum weight of 300kg.

1.4 Scope of Research

The scope of this research are as follows:

i) This project focuses on the motorcycle which does not have a double stand and type of service the motorcycle.

ii) The main focus of this project is to design and create functional tools for lifting and can rotate the motorcycle.

iii) Handling motorcycle which is weight of moreover 100 kg to 400 kg in the small space.

1.5 Report Outline

This study proposal has been divided into 5 main chapters. Each chapter consists of the project background, literature review, methodology, result, and project summary. Chapter 1 introduces the project background, problem statement, research objective, research scope, report outline, and summary. This chapter is very important to tell the background and direction of this project.

Chapter 2 cover the literature study on about type of motorcycle, the history of the motorcycle, the space that the motorcycle use, and the service or maintenance for the motorcycle. This chapter describes the history, and analysis of the structure of the material, basics, principles, and existing products that have to handle the motorcycle.

Chapter 3 explain the flow chart of a detailed project implementation process that is carried out for the whole process of the methodology and project scheme (Gantt Chart). This chapter describes from the beginning until the end. There has three-phase for this project which are Phase I (Study), Phase II (Design of Product), and Phase III (Development and Fabrication).

Chapter 4 presents the results and analysis of the development of the motorcycle rotated stand, along with the results step by step. The data the result collected from the survey by questionnaire and analyzed in Solidwork.

Chapter 5 concludes the improvement of the final result collected from the survey. The improvement is based on the customer requirement. This chapter also will conclude with the study objective and suggestions for the future studies.