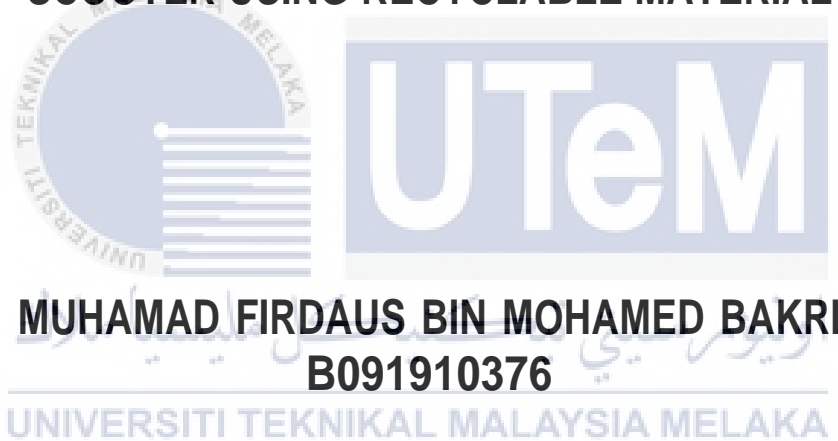




**DEVELOPMENT AND STRUCTURE ANALYSIS FOR TRENDY  
SCOOTER USING RECYCLABLE MATERIAL**



**BACHELOR OF MANUFACTURING ENGINEERING  
TECHNOLOGY WITH HONOURS**

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**Faculty of Mechanical and Manufacturing Engineering  
Technology**



**Muhamad Firdaus Bin Mohamed Bakri**

**Bachelor of Manufacturing Engineering Technology with Honours**

**2023**

**DEVELOPMENT AND STRUCTURE ANALYSIS FOR TRENDY SCOOTER  
USING RECYCLABLE MATERIAL**

**MUHAMAD FIRDAUS BIN MOHAMED BAKRI**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2023**

## DECLARATION

I declare that this Choose an item. entitled “Development and Structure Analysis For Trendy Scooter Using Recyclable Material” is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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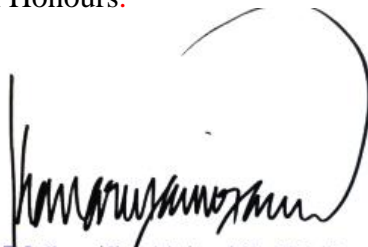
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## APPROVAL

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 (BMMW) with Honours.

Signature

:



Supervisor Name

:

Ts. Dr. Kamarul Bin Amir Mohamed, CEng MIMechE  
TS. DR. KAMARUL BIN AMIR MOHAMED  
Faculty of Mechanical and Manufacturing Engineering Technology  
Universiti Teknikal Malaysia Melaka

Date

:



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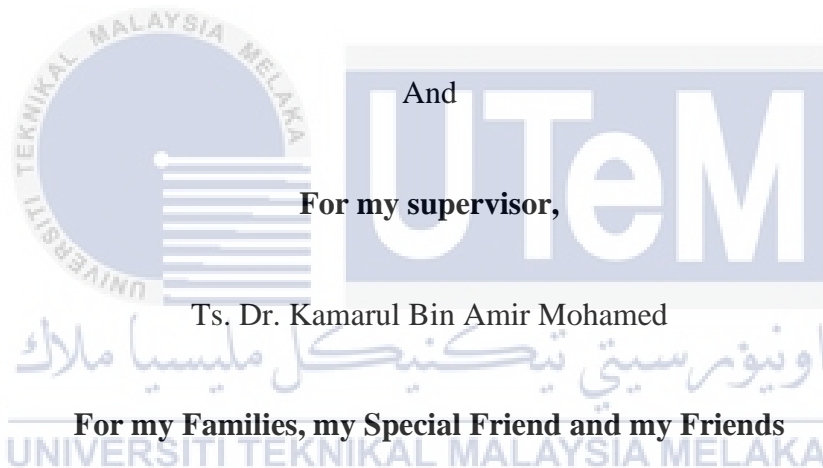
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## DEDICATION

**To my beloved parents who are always supported me:**

Mohamed Bakri Bin Sulaiman

Rahimah Binti Ahmad



Who give a warm, caring, encouraging, and verificatory atmosphere. There are characteristics that contribute to the setting that is invariably required to realize the goals a heads.

## ABSTRACT

Electric vehicles, such as electric bicycles and electric scooters, are becoming popular among individuals of every age group. This is due to the fact that electric vehicles are more cost effective than gasoline and diesel engines. Furthermore, because electric vehicles are more eco-friendly, they can help to minimise pollution. As a result, the idea developed to revive an abandoned electric scooter by modifying its original form to make it more appealing by employing the Café Racer concept and optimising the usage of existing components. Tires, motors, handlebars, and other components, on the other hand, can still be reused. Cafe Racer is the idea used for this project. This is due to Cafe Racer's distinct design, which is confirmed by the findings of a literature review and a poll of 101 respondents. Furthermore, the structure chosen for this project is the fourth. This is because, after analysing the chosen construction using FEA analysis, it was discovered that it had strong strength and an appealing design. However, morphological charts will be used in the choosing process of the exterior idea for the café racer that will be created.



## ***ABSTRAK***

Pada masa kini, penggunaan kenderaan elektrik seperti basikal elektrik dan skuter elektrik menjadi satu pilihan masyarakat tanpa mengira lapisan umur. Hal ini kerana, penggunaan kenderaan elektrik lebih menjimatkan berbanding kenderaan yang menggunakan bahan bakar seperti petrol dan diesel. Selain itu, kenderaan elektrik juga dapat mengurangkan pencemaran pada alam sekitar oleh kerana ianya lebih mesra alam. Oleh hal yang demikian, tercetusnya sebuah idea bagi membangunkan semula sebuah skuter elektrik yang terbiar dengan membuat beberapa modifikasi kepada struktur asalnya supaya ianya kelihatan lebih menarik dengan menggunakan konsep Café Racer serta memaksimumkan penggunaan komponen-komponen yang sedia ada. Namun begitu, komponen-komponen yang masih boleh digunakan semula terdiri daripada tayar, motor, pemegang, dan banyak lagi. Konsep yang menjadi pilihan bagi projek ini adalah Cafe Racer. Hal ini kerana, Cafe Racer mempunyai reka bentuk yang unik dan kenyataan ini disokong oleh hasil kajian literatur serta kaji selidik yang dijalankan terhadap 101 orang responden. Selain itu, reka bentuk struktur yang dipilih bagi projek ini adalah reka bentuk yang keempat. Hal ini kerana, setelah menjalankan analisis terhadap struktur yang dipilih, mendapati bahawa struktur ini mempunyai kekuatan yang baik serta reka bentuk yang menarik. Namun begitu, bagi proses pemilihan konsep luaran bagi Café Racer yang bakal dihasilkan adalah melalui penggunaan carta morphologi.

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## LIST OF SYMBOLS AND ABBREVIATIONS

GHG	-	Greenhouse Gases
CO <sub>2</sub>	-	Carbon Dioxide
SLA	-	Seal Lead Acid
NiCd	-	Nickel-Cadmium
NiMh	-	Nickel-metal Hydride
Li-ion	-	Lithium-Ion
LiPo	-	Lithium-ion Polymer
DC	-	Direct Current
REE	-	Rare Earth Element
NMC	-	Nickel Manganese Cobalt
LCO	-	Lithium Cobalt Oxide
LFP	-	Lithium Iron Phosphate
HEV	-	Hybrid Electric Vehicle
EV	-	Electric Vehicle
FEA	-	Fenite Element Analysis
FEM	-	Fenite Element Method
GMAW	-	Gas Metal Arc Welding
SMAW	-	Shielded Metal Arc Welding

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Today, EVs can provide a more ecologically responsible mode of transportation while also lowering reliance on oil. Emissions, such as CO<sub>2</sub>, NO<sub>x</sub>, or particulate matter, can be decreased locally and globally if power generation plant efficiency is increased. Furthermore, as compared to typical automobiles, the usage of EVs may result in less noise exposure as stated by Aasness & Odeck, (2015). Also, due to this, Electric vehicles are becoming more popular in every part of the world. In the United States, for example, there are millions of electric vehicles on the road, with the amount predicted to rise to 18 million by 2030. as mentioned by (Farkas, 2015).

However, every electric vehicle has its own lifespan, this is because electric vehicle only depends entirely on the battery that functions as its heart. Also, battery ageing affects not only the performance of the battery itself, but also the performance of the vehicle, such as diminishing maximum power, driving range, energy economy, and so on as mentioned by Chen et al., (2020). In addition, according to Biggins, (2022) the lifespan of an electric vehicle can reach the age of 10 years to 20 years according to the quality of the battery used. Also, when it reaches its limit, it will become waste. Inside the waste are damaged batteries and electrical components.

Other than that, there are several methods that can be used to turn recycled items into more attractive and well -functioning ones. Therefore, this is the main purpose of this study conducted to transform a used electric scooter into a trendy scooter with café racer concept. In this process, there are some important things such as making the frame design of the café racer model by maximizing the use of existing materials. Next, analysis and development of the frame structure and finally is to fabricate the selected design. This study is very important to cultivate a culture of creative and critical thinking in problem solving. Moreover, this study is also able to provide awareness to the community about the importance of reusing used items to reduce the amount of waste in the environment

## **1.2 Problem Statement**

In this project there are two problem statements. First is related to the outdated design of existing electric vehicles and less attractive. This is because, the original design of this electric scooter was found to be less popular among youngsters and more focused on the older group. In order to overcome this problem, the design of the electric scooter must be upgraded to be more stylish, so that youngsters can use it without hesitation in the future. Second, Electric scooters left in storage for a long time will become waste if not reused. However, there are some parts of the electric scooter that can still work well.

## **1.3 Research Objective**

- To study about the existing parts, suitable material, café racer design and method that will be used to fabricate the model.
- To modify an old electric scooter into a trendy electric scooter using new structure.
- To fabricate a café racer based on the design that has been selected

## **1.4 Research Scope**

The goal of this project is to use recyclable parts to turn an outdated electric scooter into a café racer. This research was carried out on an electric scooter that had been abandoned at a workshop at Universiti Teknologi Malaysia Melaka (UTeM). However, the primary goal of this project is to create a robust structure of the café racer. At the completion of this project, a café racer powered by batteries will be created utilising available materials with some changes to compliment the cafe racer.

## **1.5 Report Outline**

This study proposal has been divided into 5 main chapters. Each chapter consist 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 covers literature review on structure, batteries and the other detail that related to thisproject. In this chapter all the selected topics will be described in more detail based on the existing research references and it will be a strong evidence of the project underway.

Chapter 3 describes the project journey process of modifying an old electric scooter into a cafe racer from start to finish in detail. There are 3 important phases in the implementation of this project, namely Phase I (Study), Phase II (Design) and Phase III (Fabrication).

Chapter 4 presents the results and analysis on the development of cafe riders using recyclable materials. In this chapter there are some analysis results that can be obtained from various aspects. Among them are the analysis of the frame structure, how to select the design concept through the method of morphological chart and the results of circuit connection to enable the motor to move.

Chapter 5 concludes the improvement the final result of the café racer. The improvement is based on the observation and analysis that has been carried out. This chapter also will conclude the study objectives and suggestion in the future.

## **1.6 Summary**

This chapter provides an overview of the project's history and goals. In addition, the issue statement and research scope are being specified in order to limit the scope of this planning procedure. The next chapters address the literature review and the material needed to complete the overall analysis.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

In this chapter contains literature review related to the study conducted. At the same time, there are several sources that can be used as reference for this chapter. Among them are, journals, review articles, research articles, encyclopedias and electronic media sources. However, all sources obtained are reliable sources and at the same time must be consistent with the study conducted.

#### 2.2 Electric Vehicles

Several patents for electric bicycle motors were granted in the 1890s. In 1895, Ogden Bolton was given a patent (US Patent 552,271, 1895) in the United States for a bicycle battery having six brush poles, a DC collector, and a hub motor installed on the back wheel. Hosea W. Libbey of Boston invented an electric bicycle (US Patent 547,441, 1895) powered by a dual electric motor in 1897. Heinzmann, a German manufacturer, began mass producing electric motors for bicycles in 1920. In the 1930s, Minneapolis-based Lejay Manufacturing registers patents that form the basis of the GoBike, an electric bicycle powered by a Ford T generator attached to the back wheel. Moulton Consultants Ltd. later developed a double chain transmission, one from the bottom bracket and the other from the electric motor.

Electric bicycles saw a growth in the 1940s due to a shortage of large motorised vehicles as a result of the Second World War's war operations. However, it was not until the first oil crisis in 1973 that the use of electric bicycles was advocated, despite their lack of appeal. Sinclair Research Ltd. released the Zike, a bicycle with nickel-cadmium batteries, in 1992. It was an 11-kg portable bicycle with a small electric motor driving the back wheel and batteries incorporated into the frame. There were only 2000 copies sold. With the term "Power assist," the Japanese business Yamaha helped disseminate the model of "bicilec" or "pedelec" (pedal electric cycle) in Japan in 1993. All these historical information are provided by Salmeron-Manzano & Manzano-Agugliaro, (2018) based on the research that has been conducted.

Electric vehicles (EVs) are one viable answer to the major environmental issues produced by petroleum-fueled automobiles in recent decades. First and foremost, Cherry et al. (2016) describes that electric bikes (e-bikes) are two-wheeled bicycles driven by an electric motor and battery, with peak speeds of approximately 30 km/h and weights ranging from 30 to 80 kg. Also an electric bike is a bicycle equipped with an electric motor that can give up to 25 km/h of power assistance as stated by Johnson & Rose, (2015). In addition, according to Bloom et al., (2021) since it was introduced in 2017, standing electric scooters have become an important mode of transportation for urban inhabitants, accounting for a considerable percentage of the micro-mobility market in cities throughout the world. Their simplicity of use, low cost, and absence of parking constraints all contribute to their appeal and offer an instant answer to urban transportation difficulties. Also, e-scooters are among the most energyefficient and emit less greenhouse gases (GHG) ways of motorised transportation available dueto their low weight and efficient drive train as stated by Ji et al., (2014).