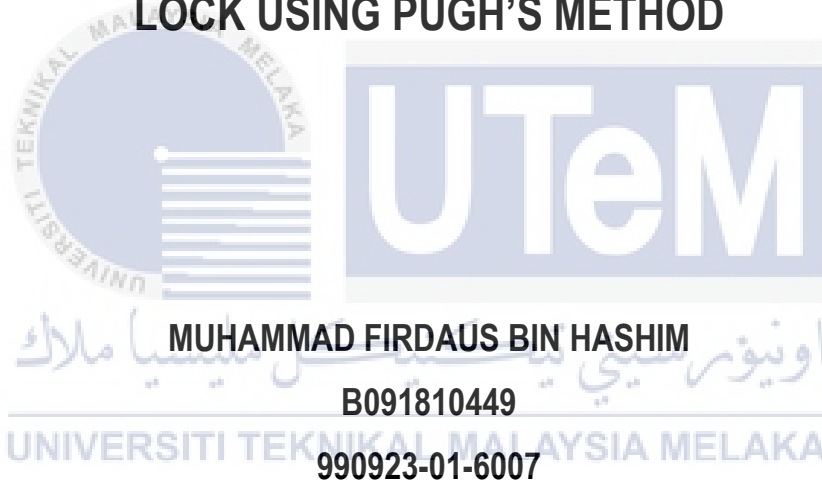




**DESIGN SMART ANTI-THEFT MOTORCYCLE MECHANICAL
LOCK USING PUGH'S METHOD**



**BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY
(AUTOMOTIVE TECHNOLOGY) WITH HONOURS**

2022



Faculty of Mechanical and Manufacturing Engineering Technology



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Muhammad Firdaus Bin Hashim

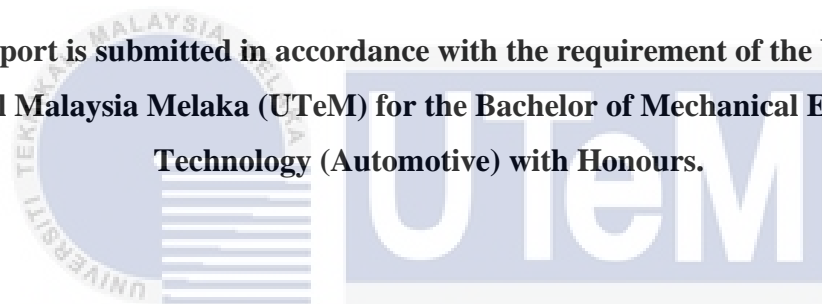
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**DESIGN SMART ANTI-THEFT MOTORCYCLE MECHANICAL LOCK USING
PUGH'S METHOD**

MUHAMMAD FIRDAUS BIN HASHIM

**This report is submitted in accordance with the requirement of the Universiti
Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering
Technology (Automotive) with Honours.**



اونيورسيتي تيكنيكل مليسيا ملاك

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA


2022

DECLARATION

I declare that this thesis entitled “Design Smart Anti-theft Motorcycle Mechanical Lock Using Pugh’s Method” 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.

Signature

:



Name

:

Muhammad Firdaus Bin Hashim

Date

:

17/01/2022

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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 Mechanical Engineering Technology (Automotive Technology) with Honours.

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17/01/2022

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DEDICATION

On this occasion, I dedicated this to my beloved parents Hashim Mohamed, and Faridah
Yahya, my family, and my fellow friends whose unyielding love, support, and
encouragement have enhanced my soul.



ABSTRACT

Based on the stolen motorcycle issue and the lack of more lock security for motorcycles that truly provide high safety, a high-security security lock for motorcycles was designed and built. This product was developed after researching other locks on the market to ensure that it is truly high protection security anti-theft lock. This project aims to design and develop an anti-theft locking system (ATLS) using a Autodesk solidwork software to analyze the strength of prototype CAD and may proceed with developing 3-D prototype by using 3-D printing to guarantee high safety for motorcycle. This product has two-part locking systems. The first is to use the rod as the primary locking mechanism for this product that connector with the frame lock. This connection will be secured to the rim of both the rear and front tires to ensure that it cannot move. In this case, to ensure that this product has exceptional strength, finite element analysis FEA is performed on it to obtain the test strength of the design concept This device can genuinely provide a second option for customers who want to secure their motorcycles from being stolen. Despite the fact that it is difficult to transport, this product is effective in achieving its goal. Last but not least, Pugh's Method was applied and found that it is an effective way to evaluate multiple concept designs and to come out with a new prototype. The development process of the prototype in this project had produced a 3-D prototype that shows the concept of ATLS using 3-D printing.

ABSTRAK

Berdasarkan isu motosikal dicuri dan kekurangan keselamatan kunci untuk motosikal yang benar-benar menyediakan keselamatan tinggi, kunci keselamatan tinggi untuk motosikal telah dirancang dan dibina. Produk ini dikembangkan selepas menyelidiki kunci lain di pasar untuk memastikan ia benar-benar kunci keselamatan yang tinggi anti-pencurian. Projek ini bertujuan untuk merancang dan mengembangkan sistem kunci anti-pencurian (ATLS) menggunakan perisian kerja kuat Autodesk untuk menganalisis kekuatan prototip CAD dan mungkin melanjutkan mengembangkan prototip 3-D dengan menggunakan cetakan 3-D untuk menjamin keselamatan tinggi untuk motosikal. This product has two-part locking systems. Pertama adalah menggunakan tongkat sebagai mekanisme kunci utama untuk produk ini yang menyambung dengan kunci bingkai. Sambungan ini akan dilindungi ke pinggir ban belakang dan depan untuk memastikan ia tidak boleh bergerak. Dalam kes ini, untuk memastikan bahawa produk ini mempunyai ketegangan luar biasa, analisis unsur terbatas FEA dilakukan padanya untuk mendapatkan ketegangan ujian konsep desain. Peranti ini benar-benar boleh menyediakan pilihan kedua untuk pelanggan yang mahu memastikan motosikal mereka daripada dicuri. Walaupun ia sukar untuk dipindahkan, produk ini berkesan untuk mencapai tujuannya. Akhirnya, Kaedah Pugh telah dilaksanakan dan ditemukan bahawa ia adalah cara yang efektif untuk menilai reka konsep berbilang dan untuk keluar dengan prototip baru. Proses pembangunan prototip dalam projek ini telah menghasilkan prototip 3-D yang menunjukkan konsep ATLS menggunakan cetakan 3-D.

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To my classmates and my housemates, thank you for the beautiful memories you all have given me. Thank you for sticking with me through the good, bad, and in-between days of our degree journey. Nothing could ever replace our times together, and best wishes for the future.

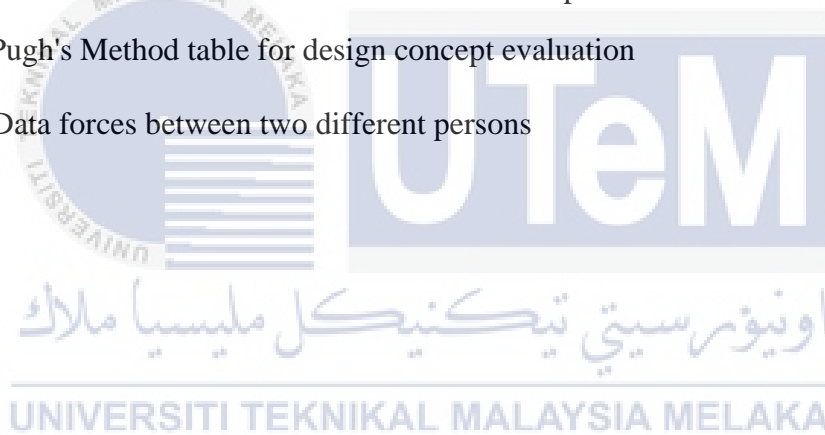
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LIST OF SYMBOLS AND ABBREVIATIONS

D,d	-	Diameter
FEA	-	Finite Element Analysis
FEM	-	Finite Element Method
ATLS	-	Anti-Theft Lock System
CAD	-	Computer-Aided Design
MM	-	Milimeter
IN	-	Inche
PSM	-	Projek Sarjana Muda
N	-	Newton
M	-	Meter
OD	-	Outer Diameter
CM	-	Centimeter
Mpa	-	Mega Pascal
Pa	-	Pascal
F	-	Force



LIST OF APPENDICES

APPENDIX PAGE	TITLE
A	Isometric view of prototype's full assembly
B	Isometric view of ATLS body rod
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CHAPTER 1

INTRODUCTION

1.1 Background

The vast majority of our everyday activities take place outside of our homes. As a result, transportation has an impact on every element of our life, particularly when it comes to performing our daily routines such as going to work, school, the mall, the bank, and so on, as well as returning home. There are numerous things that we would be unable to participate in if we did not have access to transportation. Transportation has made significant contributions to the growth of the economic, social, political, and cultural areas through improving their overall state. Motorcycles as shown in **Figure 1.1** are becoming more popular as a mode of transportation in the Philippines, and they are becoming one of the most convenient modes of transportation in the country (Pachica *et al.*, 2017). Thus, motorcycles are one of the least cost and handiest modes of transportation; but they are also one of the most easily stolen, disassembled, and sent as spare parts (McDono, 2011).

Motorcycles contribute significantly to the industry. Then there are motorcycles, which are also widely used as a mode of transportation. Vehicles are used for both the lengthier travel between the house and short trips to run errands around town. As people's reliance on bikes grows, it's more crucial than ever to guarantee that they're of good quality and safe. As the motorcycle industry grew in popularity, motorcycle theft in the nation became more prevalent over time, with a plethora of different methods of theft being documented through time (Liu *et al.*, 2018). In fact, motorcycle theft has without a doubt become a significant

issue in the community. Even though the police are believed to be doing all they can to deter these thieves, it continues to rank high on the list of crimes perpetrated on the streets on a daily basis in the United States. This is because motorcycle robberies are growing more regular and more aggressive in recent years.



Figure 1.1: Motorcycle is one of the most important transportation

(Source: Motorcycle.com, 2016)

Furthermore, while violent crime and to a lesser extent, property crime has decreased over the last few decades in most countries, those who are not cautious are still at serious risk of losing their property (FanGuider, 2019). Hence, motorcycles are a popular target for thieves. Despite declines in overall crime, motorcycle robberies are on the rise in some countries. Stealing a car is more difficult, and a bicycle isn't nearly as valuable. With the right strategies, one may reduce the likelihood of anyone stealing their motorcycle.

Other than that, statistics about the stolen motorcycle problem in Malaysia was in under control. For example, statistic motorcycle stolen case was recoding 37 % for 7 months this year (Utusan Online, 2008). From January until July 2008, 2,648 cases were recorded but on

other hand, 2,632 cases were recorded in statistic criminal journey at the same time last year as described in **Figure 1.2**. According to police statistics, a total of 127 motorcycles reported stolen during the first 80 days of this year and motorcycle theft cases accounted for nearly 40% of Sibū’s crime index. He appealed to motorcycle owners to be more careful with their machines until he said “They should lock them properly (TheStar, 2013).



Figure 1.2: One of the big issue for motorcycle theft in Malaysia

(Source: The Star, 2019)

By such a thing, that is why my project is to come up with a solution to this problem. To assure people or customers that their motorcycle is not easily stolen, the antitheft locks system must be of high performance and security.

1.2 Problem Statement

The theft of motorcycles is becoming more common these days. According to The Star, 2019, police received 31,577 reports of stolen motorbikes, with an average of 87 bikes stolen every day in Malaysia. Motorcycle theft is common because there aren't enough security locks for motorcycles that provide adequate protection (**Figure 1.3**). A high-security security lock for motorcycles was designed. As a result, it's tough to locate the finest lock motorbike on the market with great security, which is one of the main reasons why motorcycles are still simple to steal.

The first step in this process was to interview motorcycle owners or users about their problems and needs. The main issue is that no amount of security can keep thieves away from their motorcycles (Cruiser, 2019). Even if they used a multi-point lock, many motorcycles were stolen. What motorcycle owners need is a system that can prevent their motorcycle from being stolen while also alerting them to the violation. Furthermore, its cost should be low.



Figure 1.3: Motorcycle thief using cutter (Source: Motorcyclenews.com, 2018)

1.3 Aim

The smart anti-theft motorcycle lock system's goal is to provide the best of locking system and improve safety when drivers are not around, where much attention and consideration are required to prevent the theft of the motorcycle increased. This study will benefit peoples to find and protect their motorcycles safely from being stolen and open the ATLS in a short time using an app. The problem of people commonly faced if the motorcycle has been stolen attempting lock with low safety of locking system in can be solved with the smart anti-theft lock system.

1.4 Objective

Below are the objectives that set for this study:

- 1) By the end of this project, a smart anti-theft motorcycle lock system will be design using Pugh's method.
- 2) By the end of this project, a strength analysis will be done on the prototype CAD model using Finite Element Analysis (FEA) in SimSolid software.
- 3) By the end of this project, a 3-D prototype of a smart anti-theft motorcycle lock system will be develop using 3-D printing.

1.5 Project Scopes

This project will cover the following scopes:

- 1) CAD development of the prototype only evolves around the first prototype before making some modifications. The CAD model of ATLS is based on the tire for every type of motorcycle.
- 2) FEA is only carried out on the CAD model of the antitheft lock for motorcycles.
- 3) Develop a 3-D prototype of a smart anti-theft motorcycle lock system using a 3-D printer.

1.6 Organization of Thesis

The remainder of this thesis is compromised of four further chapters as summarised below.

Chapter 2: A review of literature review relevant to the present study comprising types of lock system in market to conduct the development of the best locking system that connects the front and rear tires.

Chapter 3: The new methodology, proposed through the approach for discussing the processes involved in this project will be explained. The process for this project began with the specification of the issue and a study of the literature to gather information on 3-D prototype and concept design as documented in the ATLS literature.

Chapter 4: Three-dimensional prototype was created via the use of 3-D printing, and the strength of the design was evaluated via the use of finite element analysis (FEA).

Chapter 5: Conclusion are drawn from the overall findings of the research along with recommendations for future work.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The number of motorcycle robberies reported today is more than at any other time in recent history, it has become essential to equip a motorbike with the most effective anti-burglary device available. The motorcycle focal locking framework provides the finest assurance for protecting your motorbike against a wide range of burglary scenarios and theft attempts. Essentially, it is a motorbike security device that provides excellent insurance for your motorbike. However, in the case of a burglary, this framework was unable to establish that it provided total protection and openness to the motorbike in question.

As a result, a more developed framework makes use of an inserted framework centered on an anti-theft lock system (ATLS) between two tire innovations, which is more developed. The motorbike tire incorporates the structure that has been sketched out and constructed. A lot of advancements have been made in the field of anti-theft systems for automobiles, with some of the more significant of them being as follows (Sethi *et al.*, 2015). Then, the overview flow for this chapter is shown in **Figure 2.1**.

