

THE HUMAN ANALYSIS AND ERGONOMICS FOR THE
SEAT DESIGN OF ELECTRIC SCOOTER

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DESIGN OF ELECTRIC SCOOTER**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Design)(Hons.)

by

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DECLARATION

I hereby, declared this report entitled “The Human Analysis and Ergonomics for the Seat Design of Electric Scooter” is the result of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) with Honours. The member of the supervisory committee is as follow :-

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ABSTRACT

The development of ergonomic is developed and recognized during the Second World War. This is because, for the first time, human technology and science are applied together systematically. Word ergonomic comes from the Greek Word meaning work law. Some countries used the terms human factors. The ergonomics purpose to design appliances, technical system and tasks in such way as to improve the safety of human, health, comfort and performances.

The project is based on the human analysis and ergonomics for the seat design of the electric scooter. The scooter seat is a seat placed in a limited space, which when in motion, undergoes dynamic forces, among which the centrifugal force, plays an important role to cause discomfort to the driver. Engineers may design the electric scooter to be ergonomically friendly, it doesn't mean that one design will work for all users, especially if the electric scooter is designed for a person of certain proportions. The finding is expected to explain and give better understanding about the ergonomic seat design for electric scooter. Based on the anthropometric measurement data and the ergonomics principles, the electric scooter seat can be improved by using RULA analysis method. The results and discussion is analyzing the electric scooter seat and design the ergonomic electric scooter seat in order to prevent musculoskeletal.

The data that has been collected such as the dimension of the electric scooter and the correct posture used by the rider has been used to complete the design and analysis. The primary focus will be on the redesign the electric scooter seat for improving the body

posture of the rider and validate the redesign electric scooter seat based on the RULA analysis.

Based on the RULA analysis and the results shown, it proved that the modified design of the electric scooter seat design is better than the existing design. The most crucial part is the distance between the handle and the seat, which give big effect to the comfort of the rider. Besides, the height of the seat also gives an impact to the posture of the rider during riding the electric scooter.

ABSTRAK

Pembangunan ergonomik dibangunkan dan diiktiraf semasa Perang Dunia Kedua. Ini kerana, buat kali pertama, teknologi manusia dan sains digunakan bersama-sama secara sistematik. Ergonomik perkataan berasal dari bahasa Yunani yang bermaksud undang-undang kerja. Sesetengah negara menggunakan istilah faktor manusia. Tujuan ergonomik adalah untuk mereka bentuk alat, sistem teknikal dan tugas-tugas untuk meningkatkan keselamatan manusia, kesihatan, keselesaan dan persembahan.

Projek ini adalah berdasarkan kepada analisis manusia dan ergonomik untuk reka bentuk tempat duduk skuter elektrik. Kerusi skuter adalah kerusi yang diletakkan di dalam ruang yang terhad, yang apabila bergerak, mengalami daya dinamik, antara yang daya empar, memainkan peranan yang penting untuk menyebabkan ketidakselesaan kepada pemandu. Jurutera boleh mereka bentuk skuter elektrik menjadi mesra secara ergonomik, ia tidak bermakna bahawa satu reka bentuk sesuai untuk semua pengguna, terutamanya jika skuter elektrik direka untuk seseorang dengan ukuran badan yang tertentu. Penemuan itu dijangka menjelaskan dan memberi kefahaman yang lebih baik tentang reka bentuk kerusi ergonomik untuk skuter elektrik. Berdasarkan data pengukuran antropometri dan prinsip-prinsip ergonomik, kerusi skuter elektrik boleh diperbaiki dengan menggunakan kaedah analisis Rula. Keputusan dan perbincangan adalah menganalisis kerusi skuter elektrik dan reka bentuk tempat duduk skuter elektrik yang ergonomik untuk mengelakkan otot.

Data yang telah dikumpulkan seperti dimensi skuter elektrik dan postur yang betul yang digunakan oleh penunggang telah digunakan untuk melengkapkan reka bentuk dan analisis. Tumpuan utama akan diberikan kepada reka bentuk semula kerusi skuter elektrik untuk memperbaiki postur badan penunggang dan mengesahkan reka bentuk semula kerusi skuter elektrik yang berdasarkan analisis Rula.

Berdasarkan analisis Rula dan keputusan menunjukkan, ia membuktikan bahawa reka bentuk yang diubahsuai daripada elektrik reka bentuk tempat duduk skuter adalah lebih baik daripada reka bentuk yang sedia ada. Bahagian yang paling penting ialah jarak antara pemegang dan tempat duduk, yang memberi kesan besar kepada keselesaan penunggang. Selain itu, ketinggian kerusi itu juga memberi kesan kepada postur penunggang semasa menunggang skuter elektrik.

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LIST OF ABBREVIATIONS

MSD	-	Musculoskeletal Disorder
RULA	-	Rapid Upper Limb Assessment
MSF	-	The Motorcycle Safety Foundation
WHO	-	World Health Organization
CTDs	-	Cumulative Trauma Disorders
RSIs	-	Repetitive Strain Injuries
WMSDs	-	Work-related Musculoskeletal Disorders
WCB	-	The Workers Compensation Board
UTeM	-	Universiti Teknikal Malaysia Melaka
NASA	-	The United States National Aeronautics and Space Administration
US	-	The United States
CATIA	-	Computer Aided Three-dimensional Interactive Application
CAD	-	Computer Aided Design

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter clarify about the background of study, the problem statement, objective of the study, and the scope as well as limitation in completing this study. From the background of the study, the problem statement will attain to identify the objective of the study. The basic fundamental of the human analysis and ergonomics will be discussed in the background study. Then, from the objective, the limitation and the scope will be identified. This study is mainly about the human analysis and ergonomics of seat design for the Electric Scooter that manufactured by G-Wheel Revolution Manufacturing.

1.1 Background of Study

The development of ergonomics is developed and recognized during the Second World War. This is because, for the first time, human technology and science are applied together systematically. Word ergonomics comes from the Greek Word meaning work law. Some countries used the terms human factors. The ergonomics purpose to design appliances, technical system and tasks in such way as to improve the safety of human, health, comfort and performances. The main focus of this study is to study and analyze

the ergonomics seat for the Electric Scooter. Hence, this study takes place at G-Wheel Revolution Manufacturing.



Figure 1.1: Official Logo
(Source: <<http://www.gwheel.com.my>>)



Figure 1.2 : Factory
(Source: <<http://www.gwheel.com.my>>)

The electric vehicles that the G-Wheel Revolution Manufacturing produced are Electric Bicycles, Electric Buggies, Electric Trams, Electric Wheelchairs and Electric Surrey Bikes, and Electric Scooter. Electric Bicycles consist of eight models which are Lasak, Iris, Musytari, Neutron, Nucleas, Revo-X and Revo-Z. All the models have their own specialization. There are three types of Electric Buggies. There are two seaters, four seaters, and six seaters Electric Buggies. The Electric Trams has 14 seaters, single unit and double units. The Electric Wheelchairs can be categorized into two types which are Power Wheelchair GW003 and Power Wheelchair GW003. The Electric Surrey Bikes consist of Multi-rider vehicles (2, 4, 6, and 8 seaters). There are only one type of Electric Scooter which is GW 800ES model. This study is to focus on the Electric Scooter, which needed to conduct some analysis on its front seat. This analysis is needed to be done because the company needs to be considering the ergonomics aspects for the product before it can enter to the market. This is important to make sure the seat is safe and comfortable enough for the user. There are several factors that needed to be considered to prove the seat is ergonomically enough, that will be analyzed throughout this study.

1.1.1 Product Description

This is the Electric Scooter that manufactured by G-Wheel Manufacturing.



Figure 1.3: GW 800ES Electric (Source: <<http://www.gwheel.com.my>>)

Motor Type	: 800w brushless
Battery Type	: 48V20AH PbCu (Free Maintenance Battery)
Maximum Speed	: ≤ 40 km/h
Continuous Distance	: 50km
Consumption Per 100 km	: < 1.0 kw/h
Minimum Slope Ability	: $> 12^\circ$
Brake Quality	: < 4 m(speed at 30km/h)
Brand	: Schneider Electric

1.2 Problems Statement

Based on literature review and previous studies, there are several aspects that need to be considered to design an ergonomics scooter seat. The design concept of the scooter seat is quite similar to the motorcycles seat or any other 2-wheels vehicles. The motorcycle or scooter seat is a seat placed in a limited space, which when in motion, experiences dynamic forces, in the middle of centrifugal force, plays an important role to cause discomfort to the motorcyclist. While engineers may design motorcycles to be ergonomically friendly, it doesn't mean that one design will work for all users, especially if the motorcycles are designed for a person of certain balances.

The ergonomics design involving motorcycles is a complicated process as it involves a very oblige space between the rider and the motorcycle. In any adjustment of the design of the motorcycle, the different needs of the motorcyclist must be considered. Generally, the most important aspect of a motorcycle design is to provide the safety and comfort for the rider by reducing or eliminating fatigue during the riding process.

1.3 Objectives of the Study

Based on the problem issue, the objectives of the study were defined are:

- i. To study the existing design of the seat for the Electric Scooter.
- ii. To test and analyze the ergonomics design of the existing Electric Scooter's seat by using 3 type of measurement percentile of human modelling (5th, 50th, 95th).
- iii. To suggest, recommend and propose the improvement design for the seat of the Electric Scooter.

1.4 Scope and Limitation of the Study

This study focused on the human analysis and ergonomics for the seat of the Electric Scooter that manufactured by G-Wheel Revolution Manufacturing. In this study, the aspects that will be look are ergonomics requirement, ergonomics principle and ergonomics problem faced by the user. Besides, other aspects such as anthropometric measurement, riding posture, muscle fatigue, musculoskeletal disorder (MSD), RULA analysis and also covered in this study. However, there has some limitation in this study because the simulation focus only on the Electric Scooter that produced by G-Wheel Manufacturing.

1.5 Benefits of the Study

This study bring many benefits to all especially among the G-Wheel Revolution Manufacturing customer. Benefits of this study are identifying how the scooter seat can helps the rider feel more comfortable during riding the scooter. Besides, based on the anthropometric measurement data and the ergonomics principles, the scooter seat can be improved by using RULA analysis method. The overall study benefit is to analyze the Electric Scooter seat that produce by G-Wheel Revolution Manufacturing and design the ergonomics seat for the Electric Scooter.