

THE HUMAN ANALYSIS AND ERGONOMICS FOR THE
DRIVER'S SEAT DESIGN OF ELECTRIC BUGGY

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**THE HUMAN ANALYSIS AND ERGONOMICS FOR THE SEAT DESIGN
OF ELECTRIC BUGGY (DRIVER SEAT)**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia
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(Manufacturing Design)(Hons.)

by

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DECLARATION

I hereby, declared this report entitled “The Human Analysis and Ergonomics for the Driver Seat Design of Electric Buggy” 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

Automotive ergonomics is the study of how automotive can be designed better for human use. Improper design and uncomfortable seats imposes a lot of stress upon different body parts of driver. It is the driver who gets more fatigue than the passengers. If the driver seat is not comfortable the comfort or discomfort factors can lead to various injuries related to car seat design.

The project is based on the human analysis and ergonomics for the seat design of the electric buggy. The buggy 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 cars to be ergonomically friendly, it doesn't mean that one design will work for all users, especially if the car is designed for a person of certain proportions. The finding is expected to explain and give better understanding about the ergonomic driver seat design for electric buggy. Based on the anthropometric measurement data and the ergonomics principles, the buggy driver seat can be improved by using RULA analysis method. The results and discussion is analyzing the electric buggy seat and design the ergonomic buggy driver seat in order to prevent musculoskeletal.

The data that has been collected such as the dimension of the electric buggy and the correct posture used by the driver has been used to complete the design and analysis. The primary focus for this chapter will be on the redesign the electric buggy driver seat for improving the body posture of the driver and validate the redesign electric buggy driver 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 buggy roof 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 driver during driving the electric buggy.

ABSTRAK

Ergonomik automotif ialah kajian bagaimana automotif boleh direka lebih baik untuk kegunaan manusia. Reka bentuk yang tidak sesuai dan tempat duduk tidak selesa menghasilkan banyak tekanan ke atas bahagian-bahagian badan yang berbeza kepada pemandu. Hal ini menyebabkan pemandu mendapat keletihan lebih daripada penumpang. Jika tempat duduk pemandu yang tidak selesa, maka factor ketidakselesaan boleh membawa kepada pelbagai kecederaan yang disebabkan oleh reka bentuk tempat duduk kereta.

Projek ini adalah berdasarkan kepada analisis manusia dan ergonomik untuk reka bentuk kerusi itu daripada kereta elektrik. Tempat duduk *buggy* adalah dalam ruang yang terhad, dan akan mengalami daya dinamik apabila bergerak, antara yang daya empar, memainkan peranan yang penting untuk menyebabkan ketidakselesaan kepada pemandu. Jurutera boleh mereka bentuk *buggy* untuk menjadi mesra secara ergonomik, ia tidak bermakna bahawa salah satu reka bentuk adalah sesuai untuk semua pengguna, terutamanya jika *buggy* yang direka untuk seseorang saiz tertentu. Dapatan kajian akan menerangkan dan memberikan pemahaman yang lebih baik tentang reka bentuk tempat duduk pemandu yang ergonomik untuk *buggy* elektrik. Berdasarkan data antropometri dan prinsip-prinsip ergonomik, kerusi pemandu *buggy* boleh diperbaiki dengan menggunakan kaedah analisis RULA. Keputusan dan perbincangan adalah menganalisis kerusi kereta elektrik dan bentuk tempat duduk pemandu kereta yang ergonomik untuk mengelakkan otot.

Data yang telah dikumpulkan seperti ukuran *buggy* elektrik dan postur tunggangan yang betul yang digunakan oleh pemandu telah digunakan untuk melengkapkan reka bentuk dan analisis.

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 bumbung kereta dan tempat duduk, yang memberi kesan besar kepada keselesaan penunggang. Selain itu, ketinggian kerusi itu juga memberi kesan kepada postur pemandu semasa memandu kereta elektrik.

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LIST OF ABBREVIATIONS

ISO - International Organization for Standardization

MCD - Musculoskeletal Disorder

RULA - Rapid Upper Limb Assessment

SC - Subcommittee

SPSS - Statistical Package for the Social Sciences

TC - Technical Committee

WCB - Workers' Compensation Board

WHO - World Health Organization

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

This chapter explain the background of project, the problem statement, objectives of the study, the scope and findings of the project. From the background of the study, the problem statement will obtain to identify the objective of the study, the basic fundamental of the human analysis and ergonomics will be discussed in the background. Then, from the objectives, the scope and findings will be about the human analysis and ergonomic of driver seat design for the electric buggy.

1.1 Background of the research

The development of ergonomic are developed and recognized during the Second World War, human technology, ergonomics and science are together applied systematically. The word ergonomic comes from the Greek Word meaning human and work law. Some countries used the terms human factors. The ergonomics aims 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 diver seat for the Electric Buggy.



Figure 1.1: Official Logo



Figure 1.2 : Factory

The electric vehicles that the G-Wheel Revolution Manufacturing Sdn. Bhd. produced are Electric Bicycles, Electric Buggies, Electric Trams, Electric Wheelchairs and Electric Surrey Bikes. 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). This project is focus on the 4-seaters Electric Buggy, which needed to make some analysis on its driver 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.



Figure 1.3: Electric Buggy (Golf Cart)

1.2 Problem Statements

Based on literature review and previous studies, there are several aspects that need to be considered to design an ergonomic buggy seat. The design concept of buggy seat is quite similar to the car seat or any other 4-wheels vehicles. The buggy seat is a seat placed in a restricted space, which when in motion, undergoes dynamic forces, among which the centrifugal force, plays a significant role that lead to discomfort of the driver. While engineers may design cars to be ergonomically friendly, it doesn't mean that one design will work for all users, particularly if the car is designed for a person of certain proportions.

It's also up to passengers and drivers to make them comfortable. For instance, the driver and position driver seat and driver feet barely reach the pedals; the driver may induce nonessential strain on his or her arms in case just as sitting too close can lead to leg or back pain. Seat position, posture and time spent in the car all can impact a person's health. Loughborough University's researchers have come up with certain principles for ensuring driver's health. An ideal "starting position," from which the drivers adjust

various controls has been created by the researcher to ensure maximum comfort, control and a good view of the road and the car's interior system (Jacob Silverman, 2012). Furthermore, when performing the jobs tasks such as press the pedal, hold the steering and change the gear, the driver might feel the discomfort and pain in their arms and wrist. This study is expected to explain and give better understanding about the ergonomic driver seat design for electric buggy.

1.3 Objectives of the study

The objectives of the study are:

- a) To study and investigate the existing design of the driver seat for the electric buggy.
- b) To test and analyze the ergonomics design of the existing electric buggy's driver seat by using RULA methods in 3 type of measurement percentile of human modelling (5th , 50th ,95th)
- c) To suggest and purposes the improvement design for the driver's seat for the Electric Buggy.

1.4 Scope and finding of the study

This study focused on the human analysis and ergonomics for the driver seat of the 4-seaters electric buggy that manufactured by G-Wheel Manufacturing. In this study, the aspects that will be look are ergonomic requirement, ergonomic principle and ergonomic problem faced by the user. Besides, other aspects such as anthropometric measurement, working posture, time study, muscle fatigue, musculoskeletal disorder (MSD), RULA analysis and productivity also covered in this study. However, there has some limitation

in this study because the simulation focus only on the electric buggy that produced by G-Wheel Manufacturing Sdn. Bhd.

1.5 Benefits of the research

This study bring many benefits to all especially among the G-Wheel Manufacturing Sdn. Bhd's customer. Benefits of this study are identifying how the buggy seat can helps the driver feel more comfortable during drive the buggy. Besides, based on the anthropometric measurement data and the ergonomics principles, the buggy driver seat can be improved by using RULA analysis method. The overall study benefit is to analyze the electric buggy seat that produce by G-Wheel Manufacturing Sdn. Bhd and design the ergonomic buggy driver seat in order to prevent musculoskeletal .

1.6 Structure of the thesis

This report will be contains in five chapters. The first chapter will enclose the introduction of project. The chapter will discuss about the background of project and includes the problem statement, objective, scope of the project and benefits of project.

Chapter two will focus on the literature review. It consists of the previous studies regarding the ergonomics for the driver seat, anthropometric measurement, working posture for driving the buggy, musculoskeletal disorder (MSD) and RULA analysis.

Meanwhile in chapter three, it describes about the methodology for this study. In methodology, the setup of the experiment and data collection will be discussed. The anthropometric measurement and electrical buggy driver seat design are use in order to collect data from the industry.

The data collected will be analyzed in chapter four. The result and discussion will be discussed thoroughly in chapter four. In chapter four, the result and analysis will determine whether the project achieve the objective of the study. The existing electrical buggy driver seat will redesign if needed in order to improve and reduce the musculoskeletal disorder among the drive. Moreover, any new findings based on the experiment will also be discussed on this chapter.

Chapter five, conclusion which is final chapter will review the whole content of this project progress to achieved the objective. Moreover, this chapter will discuss about the conclusion of the project. The future recommendation also been discussed in this chapter.