



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN OF TWO SEATED THREE WHEEL VEHICLE

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

by

MOHD FARIDH BIN SAMIAN @ MIAAN

FACULTY OF MANUFACTURING ENGINEERING

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JUDUL: Design of Two Seated Three Wheel Vehicle

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Saya MOHD FARIDH BIN SAMIAN @ MIAAN

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This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Design Engineering) with Honors'. The members of the supervisory committee is as follow

.....
Mr. Abdul Halim Hakim B. Abdul Aziz

(Main Supervisor)

ABSTRACT

This final year project is focusing on the design of two seated three wheel vehicle. This research on design two seated three wheel vehicle have made since a long time ago according to the journals has been published. Based on the title design of two seated three wheel vehicle, this design will be concentrated on body vehicle, interior vehicle such as seat, dashboard and steering, and analysis the interior design vehicle. The design concept idea has blended the advantages of motorcycle and car to produce a mini vehicle that provides the comfort of personal transportation. The concept design has one tyre at the front and two tyres at the rear with two seated occupants. This project uses the CATIA software to design and analysis the concept vehicle. Based on the data collection from a several resources, final year project begin with design the concept of three wheel vehicle. Using the several tools in CATIA software to completed the design vehicle. By using the 1988 Anthropometry Data of US Army, anthropometry analysis was started to found the suitable dimensions for design the interior vehicle. The data was important to make sure the design is more ergonomic and safety to the user. The ergonomic of the interior design is very important because it is related to driver performance measures such as comfort, efficiency, risk of injury and others. The anthropometry analysis focused on the seat dimension. According the data get from the analysis, the interior design was started. Interior design included seat, dashboard and steering. Then, run the Posture analysis by Human posture analysis. Other analysis is a vision by using the CATIA software. The data that get that from the analysis is useful to improvement the design for the future.

ABSTRAK

Projek tahun akhir ini fokus kepada rekabentuk kenderaan tayar tiga dengan dua tempat duduk. Penyelidikan mengenai kenderaan tayar tiga dengan dua tempat duduk in telah lama dijalankan sejak dahulu lagi berdasarkan kepada jurnal yang telah diterbitkan. Berdasarkan kepada tajuk rekabentuk kenderaan tayar tiga dengan dua tempat duduk, rekabentuk tertumpu kepada bahagian badan kenderaan, bahagian dalaman seperti tempat duduk, papan pembuka dan kemudi, dan analisis bahagian dalaman kereta. Idea konsep kenderaan adalah gabungan kelebihan motosikal dan kereta bagi menghasilkan kenderaan kecil yang mana menyediakan keselesaan untuk pengangkutan persendirian. Konsep rekabentuk kenderaan tersebut mempunyai satu tayar di hadapan dan dua tayar di belakang dengan dua tempat duduk. Projek ini menggunakan perisian CATIA untuk merekabentuk and analisa konsep kenderaan tersebut. Berdasarkan kepada data yang dikumpul daripada beberapa sumber, projek tahun akhir bermula dengan merekabentuk konsep kenderaan tayar tiga. Merekabentuk kenderaan telah siap dengan menggunakan beberapa perkakas di dalam perisian CATIA. Dengan menggunakan 1988 Anthropometry DATA of US Army, analisa anthropometry telah dijalankan untuk mencari data ukuran yang sesuai untuk merekabentuk kenderaan dalaman. Data tersebut adalah penting bagi memastikan rekabentuk tersebut lebih ergonomik dan selamat untuk digunakan untuk semua orang. Anthropometry analisis fokus kepada ukuran kerusi kenderaan. Rekabentuk dalaman melibatkan kerusi, Berdasarkan kepada data yang diambil setelah selesai analisa, rekabentuk kenderaan dalaman dimulakan. Rekabentuk dalaman melibatkan 'seat, dashboard dan Steering'. Kemudian jalankan analisis bagi 'Human Posture Analysis'. Analisis lain adalah jarak penglihatan. Data-data yang diperolehi amat berguna untuk penambahbaikan rekabentuk tersebut pada masa akan datang.

DEDICATION

For my beloved family and friends

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

| | |
|-------|--|
| CATIA | Computer Aided Tri dimensional Interactive Application |
| PSM 1 | Projek Sarjana Muda 1 |
| PSM 2 | Projek Sarjana Muda 2 |

CHAPTER 1

INTRODUCTION

This chapter presents the background of the project, problem statement, objectives of the project, scope and project outlines. Background of the project describes about the project overview. Problem statement states the reason for doing the project. The objectives of the project are aim of the project and the scopes of the project are the limitation of the project. This final year project described a project on design of two seated three wheel vehicle.

1.1 Background

Design could be viewed as an activity that translates an idea into a blueprint for something useful, whether it is a car, a building, a graphic, a service or a process. The important part is the translation of the idea, though design's ability to spark the idea in the first place should not be overlooked.

Chris Adams (2008) state ergonomics (human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. Ergonomics is employed to fulfil the two goals of health and productivity.

Ergonomic in design would be important in produce a products. Ergonomics features in a product could give a satisfaction and comfortable to the users.

Ergonomic in design could be achieved through enhance a performance of the product, increase safety of the product and increase user satisfaction of the product.

Research on design of two seated three wheel vehicle has made since a long time ago. According inside journal has been published, Robert Q. Riley (1999) development of two seated three wheel vehicle can be divided into four sections which is section one is the steam age, section two is the first petrol engines, section three is between the word wars and section four in 1945 until 2001. The history about the section will be explained in the literature review.

Currently, also found a programme development of three wheel vehicle such as CLEVER programme. The alternative vehicle called CLEVER (Compact Low Emission Vehicle for Urban Transport) is conceived as a small, three-wheel vehicle with minimal demands on urban space, both in terms of traffic and parking. Furthermore, energy consumption, exhaust and noise emissions are low. CLEVER is funded by the European Commission with the Growth Programme of the Fifth Framework Programme. The main characteristic of the project is to design and development three wheels vehicle for two occupants with a tilting and an enclosed body using a natural gas engine as a fuel of the vehicle.

Designing ergonomics of two seated three wheel vehicle based on the same concept by combining the advantages of motorcycle and car to produce a mini vehicle that provides the comfort of personal transportation. Advantages such as small size, low cost and protection against bad weather would be found in this new breed of automobile. Designing two seated three wheel vehicle has two tyre at the rear and one tyre at the front of vehicle, but were also has two tyre in a front and one tyre in a rear of vehicle. For this project is design new concept of three wheel vehicle with two tyres at the front and one tyre at the rear with two seated occupants. Other that, design an interior vehicle such as seat for occupant and steering.

Ergonomic in designing two seated three wheel vehicle give the users satisfaction. In big cities with high density population, there is always a similar problem is traffic jam. With the increase of numbers of vehicles within the developing cities, traffic jam has become a major problem in daily life. Just to make

the case worst, according to some studies, most of drivers preferred travelling alone in their daily trip to the working places which refers to Single Occupancy Vehicle (SOV) that contribute the most to traffic congestion. The Malaysian government once launched a campaign to educate the public on this matter but to no avail. Therefore, the concept of a new vehicle that is small in size has emerged.

Vehicle interior design directly relates to driver performance measures such as comfort, efficiency, risk of injury, and vehicle safety. Although the design of two seated three wheels vehicle is a small size than a conventional vehicle, comfort, efficiency, risk of injury and vehicle safety aspect not neglected. Interior design especially designs a comfort seat for occupant preferred highly because comfort seat design is more than ever one of the major factors of car performance. Comfort is much more than a soft handle. Comfort is one of the greatest aspects of a design's effectiveness. Comfort in the human-machine interface and the mental aspects of the product or service is a primary ergonomic design concern. As a seat is one of the main interfaces between the car and the body, comfort cannot be forgotten during seat design. Human posture analysis by CATIA software one of the method use to analyze the design seat comfort with an occupant or not.

The software use for design an ergonomic two seated three wheel vehicle is CATIA software. CATIA plays a major role in the design process. CATIA was one of the first CAD programs to provide 3D solid modelling. Many advantages using the CATIA such as increase design productivity enhances technological results usage in tooling design and reduces programming machining time.

1.2 Problem Statement

Today, vehicle is a major transportation in undergo daily routine whether car or motorcycle, people use facilities that go work or to wherever. With the increase of numbers of vehicles on the road within the developing cities, traffic jam has become a major problem in daily life. The design an ergonomic two seated three wheel vehicle give alternative to the users to reduce traffic jam with the size of the vehicle is smaller than conventional car. Other than that, not all people have a competence in

driving a vehicle. Furthermore, driving large vehicle will become difficulty to driver have a fewer efficiency. Three wheels vehicle is ease to drive because the size is smaller than conventional car and much greater cornering power often exceeding that of a four wheel vehicle. With one tyre in the front, three wheel vehicles need a small space when cornering and therefore could overcome the problem for the less competent driver making a corner. In the world, has many small car produced but the problem is not all the small car give the satisfaction, comfort and efficiency to the users. Designing an ergonomic two seated three wheel vehicle can overcome the problem and give more advantages to the users.

1.3 Objectives

The objectives of project are:

- (a) To design new concept of two seated three wheels vehicle by using CAD software (CATIA)
- (b) To design an ergonomic vehicle interior by using CAD software (CATIA).
- (c) To analysis the vehicle interior design by using Human Posture Analysis (CATIA)

1.4 Scope

This project was creating in two parts. First, research on three wheel vehicle design including interior design vehicle earlier and second is design two seated three wheel vehicles. This design will be concentrate on design of body and interior vehicle such as seat, dashboard and steering. Then analyze the vehicle interior (seat) by using Human Posture Analysis (CATIA). The design of suspension, engine and transmission not include in this project.

1.5 Project Outlines

Based on the thesis for Projek Sarjana Muda (PSM), I have been constructed for the process flow of completion in order to fulfill course of Degree in Universiti Teknikal Malaysia Melaka (UTeM). Below shows the format of the organization:

- (a) Chapter 1 represents the introduction of the design two seated three wheel vehicle conducted which is background, problem statement, objectives, scope and project outlines. In this chapter, it explains clearly how the subtopics influence each other in this project.
- (b) Chapter 2 represents the literature review on the background and basic information about the design two seated three wheel vehicle. By understand the basic concept of three wheels vehicle and research method early; it may enhance the progress of this project.
- (c) Chapter 3 represents the methodology used for conduct this project. This chapter included the planning of the research, flowchart, and the sources of data.
- (d) Chapter 4 shows the result of the design an ergonomic two seated three wheel vehicle and presentation the data that received from the analysis of human posture.
- (e) Chapter 5 represents the discussion on the result of the study. It is stressing the significance and implementations of the findings of this project.
- (f) Chapter 6 presents the conclusion of the whole study and recommendation for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to Automotive Design

Automotive design is the profession involved in the development of the appearance, and to some extent the ergonomics, of motor vehicles or more specifically road vehicles. This most commonly refers to automobiles but also refers to motorcycles, cars, trucks, buses, coaches, and vans. The functional design and development of a modern motor vehicle is typically done by a large team from many different disciplines included in automotive engineers. Automotive design in this context is primarily concerned with developing the visual appearance or aesthetics of the vehicle, though it is also involved in the creation of the product concept.

Chris Clements and Dr Samantha Porter (2007) illustrate automotive design is the consideration of aesthetics during the product development of an automobile. It encompasses almost every aspect of a vehicle's design that is readily visible to the customer - from the seats and steering wheel through to the door trims and the dashboard.

2.1.1 Design Elements

Chris Clements and Dr Samantha Porter (2007) explained the task of the design team is usually split into two main aspects: exterior design and interior design. Graphic design is

also an aspect of automotive design; this is generally shared amongst the design team as the lead designer sees fit. Design focuses not only on the isolated outer shape of automobile parts, but concentrates on the combination of form and function, starting from the vehicle package. Exterior design of the vehicle develops the proportion, shape, and surface of vehicle. Interior design of the vehicle also develops the proportions, shape, placement, and surfaces for the instrument panel, seats, door trim panels, headliner, pillar trims, etc. Here the emphasis is on ergonomics and the comfort of the passengers.

2.1.2 The Automotive Design Process

Chris Clements and Dr Samantha Porter (2007) state typical stages of the automotive design process include:

(a) Establishment of vehicle specification

The multi-disciplinary team establish parameters and decision points, ensuring the project runs to schedule

(b) Discussion of first concept sketches

Designs are presented on theme boards and mood boards

(c) Informal selection of concept sketches

The design team pick out their favorite sketches

(d) Management review of concept sketches

CAD models are produced for marketing research purposes

(e) 2D market research

Concepts are shown to members of the public for their comments

(f) Presentation of reworked concepts

Reworked concepts are presented again, taking into account market research feedback

(g) Approval for detailed engineering

Full - size clay models are produced. These are often made using CAD data and hand-finished

(h) 3D market research

Full-size exterior and interior concept models are shown to members of the public. One concept is selected, informed by public opinion

(i) Final approval of 3D model

The management team gives final approval to one model which is then fully resolved as a three-dimensional clay model

(j) Final feasibility development of chosen concept

The full - size clay model is scanned and a new 3D digital model produced. Other engineering disciplines are then responsible for the feasibility of the final design in terms of operation and manufacture

(k) Final approval of the design

2.2 Introduction to Three Wheel Vehicle

Study on three wheel vehicle has long held. Many company involved in that study among that BMW, Jaguar, Volkswagen and others. Robert Q. Riley (1999) cited the idea of smaller, energy-efficient vehicles for personal transportation seems to naturally introduce the three wheel platform. Opinions normally run either strongly against or