DESIGN AND ERGONOMICS ANALYSIS OF UTeM BUS COCKPIT ARRANGEMENT

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fulfilment of the requirements for the award of
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SUPERVISOR DECLARATION

"I hereby declare that I have read this project and in my opinion this project is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design & Innovation)"

Signature: .....

Name: Mr Shafizal bin Mat

Date: 2 July 2012

Dedication

For father and mother loved ones

DECLARATION

"I hereby declare that the work in this project is my own except for summaries and quotations which have been duly acknowledged."

Signature: .....

Name: Mohd Nashrol bin Mohd Nawi

Date: 2 July 2012

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Greatest thanks to ALLAH S.W.T for blessing and giving me the ability to finish this project, which hopefully can contribute in further research

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Thanks.

ABSTRACT

This project is about design and ergonomics analysis of UTeM bus cockpit arrangement. Ergonomics analysis will be applied within this project to investigate why UTeM bus driver having some problems when they are driving. There are some problems happen to driver bus like lower back pain, bus cockpit space area limited and etc. This study is focusing on UTeM bus cockpit arrangement and the target user is UTeM bus driver. There are some compartments included in the bus cockpit such as steering, pedal, seat, gear lever, parking brake and instrument panel. Engineering design concept was used in this project to get the information and data that related like Pugh method and House of Quality (HOQ). Five concept of conceptual design must come out before selection design done. Each concept has been designed with various designs where the position of the gear lever and parking brake is modified while the driver's seat adjusted in various ways. The best design has been selected using the Pugh method. Concept 1 was chosen as the best concept design of cockpit arrangement. The existing and new design of bus cockpit had been drawn using CATIA and ergonomics analysis is applied to get ergonomics result from the design. Comparison is made on the design of new and existing to see if the new design more ergonomic or not. The final result for existing design is 5 over 8 and the comparison shows that the new design is more ergonomics compare with the existing design with overall final score of 3 over 8. The new design can be used in the future to build a real cockpit bus arrangement and it will minimize and prevent any injury to bus driver when driving.

ABSTRAK

Projek ini adalah mengenai reka bentuk dan analisis ergonomik terhadap susunan kokpit bas UTeM. Analisis ergonomik akan digunakan dalam projek ini untuk mengenalpasti masalah yang dihadapi oleh pemandu bas UTeM apabila mereka memandu. Terdapat beberapa masalah berlaku kepada pemandu bas seperti sakit bahagian belakang badan, kawasan ruang kokpit bas terhad dan sebagainya. Kajian ini memberi tumpuan kepada susunan kokpit bas UTeM dan pemandu bas UTeM sebagai sasaran pengguna. Terdapat beberapa bahagian di dalam kokpit bas seperti stereng, pedal, tempat duduk, tuil gear, brek tangan dan panel instrumen. Konsep rekaan kejuruteraan telah digunakan dalam projek ini untuk mendapatkan maklumat dan data yang berkaitan seperti kaedah Pugh dan Rumah Kualiti (HOQ). Lima konsep reka bentuk mesti direka sebelum pemilihan reka bentuk dilakukan. Setiap konsep telah direkabentuk dengan pelbagai rekaan di mana kedudukan tuil gear dan brek tangan diubahsuai manakala tempat duduk pemandu dipelbagaikan dalam pelbagai cara. Reka bentuk yang terbaik akan dipilih menggunakan kaedah Pugh. Konsep 1 telah dipilih sebagai konsep reka bentuk susunan kokpit yang terbaik. Reka bentuk kokpit bas yang sedia ada dan baru akan dilukis menggunakan CATIA dan analisis ergonomik (RULA analisis) digunakan untuk mendapatkan keputusan ergonomik. Perbandingan dilakukan terhadap reka bentuk baru dan sedia ada untuk melihat sama ada reka bentuk baru lebih banyak ergonomik atau tidak. Keputusan rekabentuk asal adalah 5 daripada 8 dan perbandingan menunjukkan reka bentuk baru adalah lebih ergonomik dibandingkan dengan reka bentuk yang sedia ada dengan skor keseluruhan akhir sebanyak 3 daripada 8. . Reka bentuk baru ini boleh digunakan pada masa hadapan untuk membina susunan kokpit bas yang sebenar. Reka bentuk baru ini boleh meminimumkan dan menghalang apa-apa kecederaan kepada pemandu bas ketika memandu.

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CHAPTER 1

INTRODUCTION

1.0 Project Background

Ergonomics is a combination of the words ergo, a Greek word meaning "work" and nomics, meaning "study" - the study of work. An applied science that co-ordinates the design of devices, systems and physical working conditions with the capacities and requirements of the workers (N. Jaffar et al., 2011).

Nowadays, public transport is one priority to consumer to travel anywhere. Public transport forms the major use of buses, taxi, and train. This public transport designed for the transport of the general public as a public service. A significant problem in the public transport sector is driver distraction (Salmon et al., 2011). There are various methods exist for investigating distraction. However, the majority are difficult to apply within the context of naturalistic bus driving. Thus, this project is proposed to design bus cockpit using ergonomic analysis. In this project, ergonomics was applied to investigate why driver distraction when they driver. This project will be focusing on UTeM bus cockpit.

Cockpit is well known as a compartment in a small aircraft in which the pilot, crews and sometimes passanger sit. However, for bus, cockpit defined as the bus driver compartment to driving that required steering, gear lever, seat, parking brake, pedal and instrument panel that include all button of bus functions like button for

door open and close. These are the basics component that have at cockpit. Each compartments at the bus cockpit have their own functions.

1.1 Problem Statement

The driver should be patience and focus in their driving in order to avoid accident occurs. The driver will face some problems during they drive and it will affect them when they are driving. Same goes to UTeM bus driver, distraction while driving is a major problem to the bus driver.

Besides, they do not feel comfortable with the current bus driver cockpit arrangement. The bus cockpit arrangement not suitable for driver to drive in whole day to pick up student from hostel to campus. It a bit difficult for driver to touch each buttons at the bus instrument panel and it will interfere driver driving.

Driver bus also get some problem when moving around the cockpit especially for fat or big driver bus because the space aroud is too limited. These problems can cause the driver not feel comfortable when sitting and can make them lost their focus to driving. Besides that, driver bus easy to get back pain when they driving especially at the lower back and easy to feel tired.

1.2 Objectives

The main objectives of this project is to design and perform the ergonomics analysis for UTeM bus cockpit arrangement.

1.3 Scope

The scopes that want to achieved for this project to make successfull and fullfill the objectives are re-design the UTeM bus cockpit arrangement that already

made for UTeM's driver bus used. Besides that, the design of cockpit arrangement must perform the new ergonomics design analysis to make a suitable, variable condition and comfortable design for UTeM' driver bus.

The new ergonomics design of UTeM bus cockpit must do a comparison between the existing UTeM bus cockpit design to get the result that can make UTeM bus driver comfortable and can focus without no distraction when driving and not feel so tired to drive on long journey. This ergonomics design must be evaluated by using the CATIA ergonomics analysis to get the result of the new ergonomics design.

1.4 Methodology

Many methods have been used to gain an information about the UTeM bus cockpit arrangement. The method used are doing an interview with UTeM driver bus, and doing article review about the ergonomics function of the bus cockpit arrangement.

The interview done by do talk with UTeM driver bus to know what effect while they driving. The interview gain some information that can be used and doing some research about the problems they face. Besides that, internal sources like journal, article and books have been used to gain information about the bus cockpit arrangement such as ergonomics posture while driving.

For the ergonomic analysis, CATIA software have been used. The software will give result about the ergonomics analysis from the existing UTeM bus cockpit and new concept design of UTeM bus cockpit. The result for existing and new concept design will be used to compare to get the best ergonomics result.

1.5 Project Outline

This research will be divided into six chapters. The first chapter is mainly about the introduction of the project, problem statement, objectives and lastly the project outline.

Chapter two is the literature review. Based on the references gathered (journals, books, websites, article etc.), this chapter will discuss the definition and introduction of ergonomics, bus driver distraction and bus cockpit arrangement. It will also discuss the method on how the research will be done based on the past researches.

Chapter three will be discussing about the review of the research methodology. This will include the design and framework of the study. This chapter will also discussing about the advantage and disadvantage of the methods chosen where ergonomomic analysis method and the drawing of the actual design of cockpit arrangement.

Chapter four is about the conceptual design. The new concept design will be drawn by using CATIA software and it will be analyzed to perfom the ergonomics analysis of the new concept of cockpit arrangement.

Chapter five is discussion of the project analysis. The result get from both actual and new concept design will be compared and discussed. This will include the setup for the data collection, the data collection table and the example of the data which had been taken in this chapter. The data result and the findings during the project research will be compared and discussed in details

In the last chapter, the conclusion and the recommendation will be reviewed. This chapter will concluded the project and give some suggestion will be given for future research. **Figure 1.1** shows the outline of this project.

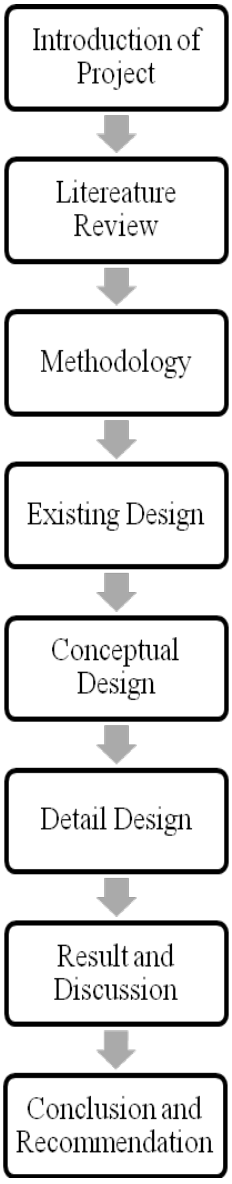

Figure 1.1 Outline of project

Figure 1.2 shows the flow chart of this project. Each chapter of this project will based on the project flow chart. The chapters include in this project are literature review, existing design analysis, conceptual design, detail design, result and discussion and lastly the conclusion and recommendation of this project.

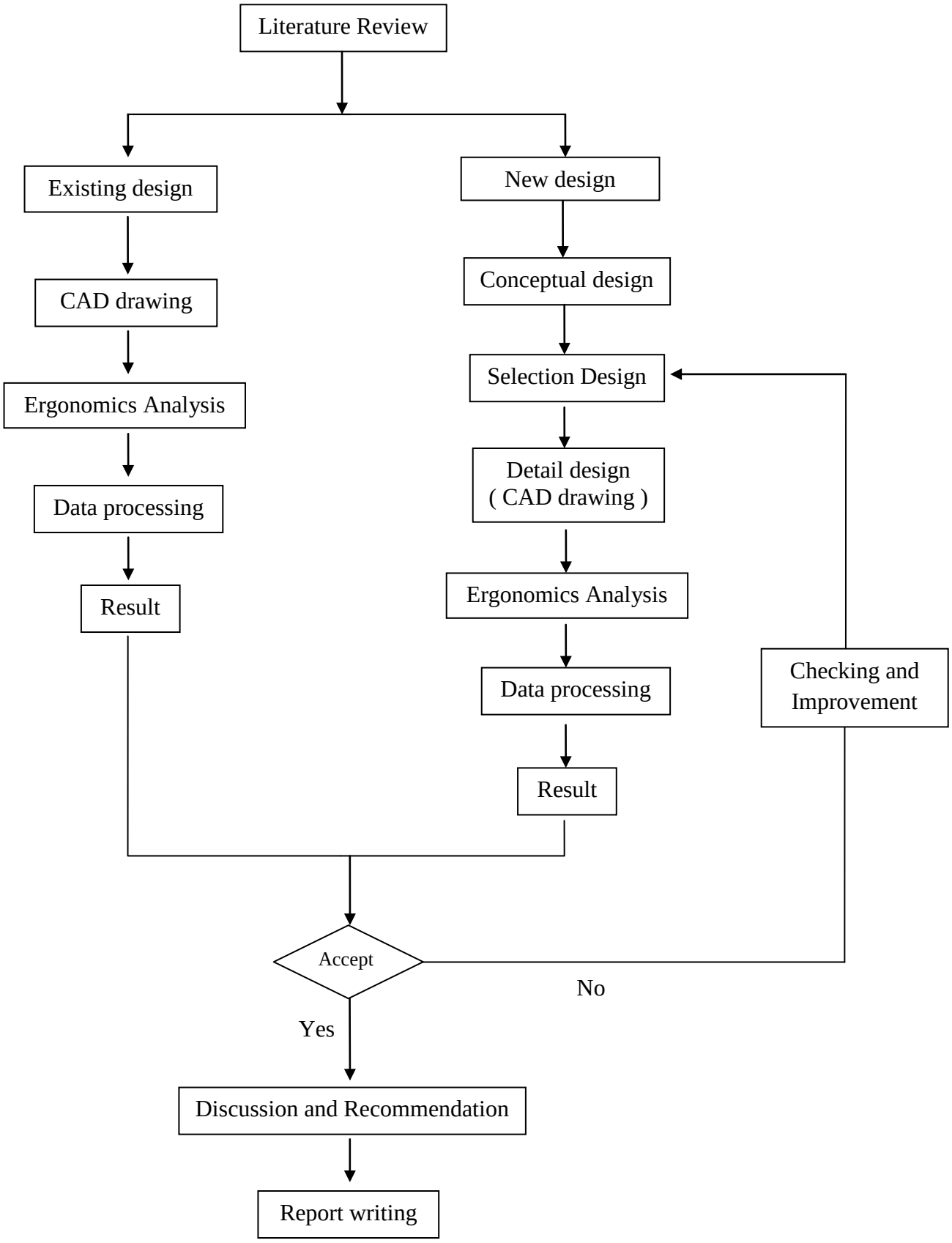

Figure 1.2 Project Flow Chart

Table 1.1 shows the Gantt chart for PSM 1. The tasks needed to complete this project are listed sequently in the vertical axis and the estimated time to accomplish the task are shown along the horizontal axis of this Gantt chart.

Table 1.1 PSM 1 Gantt Chart

PSM 1 Gantt Chart														
Activity	**Week**													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Project Proposal														
• Title Selection														
• Supervisor Verification														
Chapter 1 : Introduction														
• Objective, Scope, Problem Statement & Methodology														
• Correction														
Chapter 2 : Literature Review														
• Journal, Article & Books review														
• Correction														
Seminar 1 (Poster)														
• Preparation														
• Submit														
Chapter 3 : Methodology														
• Flow Chart of Project process														
• Process of Analysis														
• Correction														
Seminar 2 (Presentation)														
• Preparation														
• Presentation														
PSM 1 Report Drafting														
• Preparation														
• Report PSM 1 Submit														

Table 1.2 shows the Gantt chart for PSM 2. The tasks needed to complete this project are listed sequently in the vertical axis and the estimated time to accomplish the task are shown along the horizontal axis of this Gantt chart. To finished this project, the Gantt chart must followed.

Table 1.2 PSM 2 Gantt Chart

Activities	PSM 2 (2012)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Chapter 4 :Conceptual Design & Selection Design															
Sketching															
Concept Evaluation															
Concept Selection															
Detail Design															
Seminar 1 (Poster) - PSM 2															
Preparation															
Submit															
Chapter 5 : Results & Analysis															
Ergonomics Analysis Result															
Comparison															
Chapter 6 : Conclusion and Recommendation															
Conclusion & Recommendation															
Seminar 2 (Presentation) - PSM 2															
Preparation															
PSM 1 & 2 Report Drafting															
Preparation															
Compile PSM 1 & PSM 2															
Report PSM Submit															