

**UNIVERSITY TEKNIKAL MALAYSIA MELAKA**

**ERGONOMICS ANALYSIS DESIGN OF COMPUTER  
TABLE FOR CAD/CAM LABORATORY IN FKP, UTeM**

Thesis submitted in accordance with the requirements of Universiti Teknikal  
Malaysia Melaka for the Bachelor Degree of Manufacturing Engineering in  
Manufacturing Management

By

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MAY 2008



# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS PROJEK\*

JUDUL: Ergonomics Analysis Design of Computer Table for CAD/CAM  
Laboratory in FKP, UTeM

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## APPROVAL

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## **ABSTRACT**

Ergonomics and design have making a greatest relation in producing an artefacts or creating a workplaces. This project was discussed about the development for some artefacts of computer table with comfort while doing the computer job. The project represents the process improvement in the current computer table in CAD/CAM laboratory, FKP, UTeM, after analysis in ergonomics aspects before the development process of designing a new ergonomics computer table that comfortable for student used. Around 66 students from FKP, UTeM, were taken randomly for gathering anthropometric data in this project to create the anthropometric database for these students. The survey through questionnaire also was done for gathering more data to designing process. From the results getting, the problem on the current computer table has been defined in analysis process by using RULA analysis and encountered for solving was taking to development of new computer table with ergonomics condition. The development of new computer table was based on ergonomics view and customer requirements such as size, keyboard level can be adjusted, leg rest, free surface, and etc. In the final of this project, the ergonomics computer table has been developed which all ergonomics specification included in this computer table for future usage.

## ABSTRAK

Ergonomik dan rekabentuk telah membentuk satu gabungan yang terbaik dalam penghasilan sesuatu produk atau rekaan bagi kawasan tempat bekerja. Projek ini telah membincangkan mengenai penghasilan salah satu produk iaitu meja computer di mana ia akan memberikan keselesaan kepada pengguna apabila mereka melakukan kerja menggunakan komputer. Projek ini disediakan untuk membuat penambahbaikan pada meja computer yang digunakan di makmal CAD/CAM, FKP, UTeM, selepas analisis yang dijalankan mengenai aspek-aspek ergonomik sebelum proses penghasilan rekabentuk meja komputer baru yang ergonomik dibuat bagi keselesaan penggunaan oleh pelajar. Seramai 66 orang pelajar dari FKP, UTeM telah dipilih untuk mengumpul bacaan data antropometri bagi membentuk pangkalan data antropometri pelajar. Soal selidik juga telah dijalankan dikalangan pelajar-pelajar ini bagi mengumpul maklumat yang berkaitan dengan proses rekabentuk. Hasil daripada keputusan yang diperolehi, segala masalah yang melibatkan penggunaan meja komputer di dalam makmal telah dikenalpasti melalui analisis dengan menggunakan analisis RULA dan penambahbaikan ke atas masalah ini telah dilakukan untuk penghasilan meja komputer yang baru dengan memasukkan aspek-aspek ergonomik ke atas rekabentuk tersebut. Pembangunan bagi meja komputer yang baru merangkumi aspek ergonomik dan pandangan pengguna seperti saiz, kedudukan papan kekunci yang boleh diubah, tempat letak kaki, tempat untuk meletak barang, dan sebagainya. Di akhir projek ini, satu meja komputer telah berjaya dihasilkan mengikut spesifikasi ergonomik yang ditentukan untuk kebaikan penggunaannya di masa akan datang.

## **DEDICATION**

Especially for my beloved mother and father:

Junainah Binti Tarif

Mohd Shuzaily Bin Mohd Shuzaily

To all my siblings:

Mohd Shafuan Bin Mohd Shuzaily

Nur Shafinas Binti Mohd Shuzaily

Mohd Shafri Bin Mohd Shuzaily

Nur Shahira Binti Mohd Shuzaily

Muhammad Shahrin Bin Mohd Shuzaily

To my supervisor and academic advisor:

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# TABLE OF CONTENTS

Declaration.....	i
Approval.....	ii
Abstract.....	iii
Abstrak.....	iv
Dedication.....	v
Acknowledgements.....	vi
Table Of Contents.....	vii
List Of Figures.....	x
List Of Tables.....	xii
List Of Abbreviations, Symbols, Specialized Nomenclature.....	xiii
<b>1. INTRODUCTION.....</b>	<b>1</b>
1.1 Introduction Background.....	1
1.2 Objective.....	3
1.3 Problem Statement.....	4
1.4 Scope.....	4
1.5 Important of This Project.....	4
1.6 Definition of Terms.....	5
<b>2. LITERATURE REVIEW .....</b>	<b>6</b>
2.1 Introduction.....	6
2.2 Ergonomics.....	6
2.2.1 Introduction.....	6
2.2.2 Purpose.....	8
2.2.3 Fields of Ergonomics.....	9
2.2.4 Compatibility.....	10
2.3 Anthropometric Data.....	12
2.3.1 Human Variability and Statistics.....	12
2.3.2 Estimating the Number of Observation to Make.....	15

2.3.3 Anthropometric Data and its Uses in Ergonomics.....	18
2.3.4 Applications of Anthropometry.....	18
2.4 Design Activities.....	19
2.5 Ergonomics in Design.....	21
2.5.1 Purposes.....	21
2.5.2 Design Requirement and Methods.....	21
2.5.3 System Design Approaches in Ergonomics.....	24
2.5.4 Used-Centered Design.....	24
2.5.5 Application Anthropometric Data in Design.....	26
2.5.6 Kano Model.....	30
<b>3. METHODOLOGY.....</b>	<b>32</b>
3.1 Introduction.....	32
3.2 Research Methodology.....	32
3.3 Methods.....	34
3.4 Materials.....	35
3.5 Procedures.....	37
<b>4. RESULTS AND DISCUSSION.....</b>	<b>41</b>
4.1 Anthropometric Data Analysis.....	41
4.2 Results of Questionnaire.....	43
4.3 Conceptual Design.....	50
4.3.1 Concept Generation.....	51
4.3.2 Concept Evaluation.....	52
4.3.3 Conceptual Design Development.....	54
4.5 Analysis using RULA in CATIA.....	55
<b>5. CONCLUSION AND RECOMMENDATIONS.....</b>	<b>66</b>
5.1 Conclusion.....	66
5.2 Recommendations.....	67
<b>REFERENCES.....</b>	<b>69</b>

## **APPENDICES**

- A Anthropometric Measurement
- B Gantt Chart
- C Questionnaire
- D Current Market Table
- E RULA Employee Assessment Worksheet

## LIST OF FIGURES

1.1	The Flow How Injury Occur	2
2.1	Common Anthropometric Mismatches in Seated Work	11
2.2	A Graphical Representation of The Normal Distribution	13
2.3	The Relative Sizes of Different Percentile Human	14
2.4	Critical User and Furniture Dimension	22
2.5	The Posture Dimension That Need to Consider For Computer Working	23
2.6	Ideal Static Reference Posture	23
2.7	The Diagram of Relation between the Three Areas involves in Ergonomics	25
2.8	The Cycle of User-Centered Design	26
3.1	Flow of The Project	32
3.2	The Measuring Equipment	35
3.3	Computerized Anthropometry	36
3.4	Front View for Computer Table at CAD/CAM Lab	40
3.5	Isometric View for Computer Table at CAD/CAM Lab	40
4.1	Frequency for the Computer Table Usage	45
4.2	Duration Taken to Used the Computer Table	45
4.3	Comfortable while Using the Computer	46
4.4	Injuries in Long Duration Usage	46
4.5	Injuries Body Part	47
4.6	Bodies Comfortable while Using Computer	48
4.7	Capability to Perform Work Effectively	48
4.8	Arm Condition that can Perform Task in Long Duration	49
4.9	The Leg Condition in Good Position	49

4.10	Able to Sit Properly During Working with the Computer	50
4.11	Conceptual Design	52
4.12	The Design Development of Computer Table	54
4.13	Current Table Design Analysis	56
4.14	The Posture of Wrist and Arm	56
4.15	The Side View of Posture Body while Working on the Current Table	57
4.16	The Top View of Posture Body	57
4.17	The RULA Analysis for Left Hand on Current Table	58
4.18	The RULA Analysis for Right Hand on the Current Table	59
4.19	First Step Improvement Design of Computer Table	60
4.20	The RULA Analysis for Left Hand on First Step Improvement Table	61
4.21	The RULA Analysis for Right Hand on First Step Improvement Table	62
4.22	Final Improvement Design of the Computer Table	63
4.23	The RULA Analysis for Left Hand on Final Improvement Design Table	64
4.24	The RULA Analysis for Right Hand on Final Improvement Design Table	64
4.25	The Final Design Development of the Computer Table	65
4.26	The Orthographic View for New Computer Table Development	65

## LIST OF TABLES

2.1	Multiplication Factors for Percentile Calculation	15
2.2	Number of study reading N required for $\pm 5$ % Precision and 95 % Confidence Level	16
2.3	Anthropometric dimension data taken for ten people	17
2.4	Description and example of use of some common anthropometric variables	29
3.1	ISO List of Anthropometric Variables (ISO/DIS 7250)	38
3.3	Productivity Priorities	21
4.1	Percentile for Male Students	41
4.2	Percentile for Female Students	42
4.3	Concept Evaluation	53

# **LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE**

ICT	-	Information and Communication Technology
ULDs	-	Upper Limb Disorder
FKP	-	Faculty of Manufacturing Engineering
UTeM	-	Universiti Teknikal Melaka

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Introduction Background**

Nowadays, computer usage plays an important role in our life where many things can be done using it. The pace of changing in computer technology and Information and Communication Technology (ICT) has been remarkable where the technology was improved rapidly. Even the technology has been improved, the computer especially desktop computer, still need a table as a support for easier to use. Computer usage necessary to use along with the table but there is no specific table that can used as a computer table.

Traditionally, table and computer work are the activities which it usually done in sitting working posture. The ergonomics posture of human body for these activities should consider safety and health to get comfortable position. The comfortable position during these activities is important especially for a long period of time and it can avoid from involves in any injuries.

However, in chase improvement of this technology, people usually disregard about the conformity of table as long as they can used the table to do the computer work. This situation have their effect for the long term, in which they will get involves in injury. The non-conformity of body posture during do the computer work job will occur of work-related musculoskeletal disorders in the neck and upper limb,



such as finger extensor and flexor tendalgias, carpal tunnel syndrome and neck-shoulder myofascial pain. Figure 1.1 below shows the flow how the injury can occur.

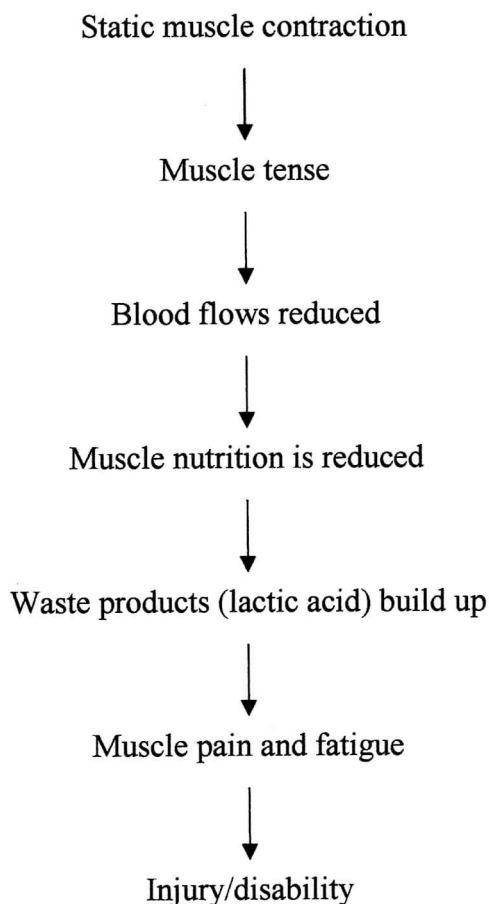


Figure 1.1: The flow how the injury occur

Source: OSHA (2000)

Research on ICT and Upper Limb Disorder (ULDs) has shown that functional impairment, pain and discomfort in the upper limbs, neck and shoulder increases with frequency and duration of exposure to computer use (Bernard, 1997; Punnet and Bergqvist, 1997; Evans and Patterson, 2000). Links between computer usage and a number of symptoms, including pain in the hand, wrist, arm, neck, shoulders and lower back as well as eye strain and headache have been reported (NIOSH, 1997). These associations are evident internationally and across studies in spite of variations in study design, case definition and terminology which pose barriers to

direct comparisons between data sets (Schierhout and Myers, 1996; Silversides, 1997; Harrington et al., 2000)

The ergonomics knowledge has been improved progressively and has been taken into consideration in designing a product. For example, design of an adjustable table based on the anthropometric data collected. From ergonomics knowledge, the injury while using the product or doing the work can be reduced their possibilities from happens. This knowledge is the main focus in completing this project. In this project the analysis of computer table by using anthropometric data taken and then the process of design an ergonomics computer table will be proceed based on the result analysis.

The focus of this project is to design an ergonomics computer table that based on anthropometry database of students FKP, UTeM. This project used student data because it will focus for the improvement of the computer table at FKP CAD/CAM laboratory that usually used by student. All the process to complete this project will be based on the collection data from student.

## **1.2 Objective**

The objectives to achieve in this research and development project are:

- a) To collect anthropometric data.
- b) To study and analyze the common computer table at CAD/CAM laboratory, FKP, UTeM.
- c) To make improvement on the common computer table for good working posture.
- d) To develop a new ergonomics computer table that good for working posture of student population in Malaysia.

### **1.3 Problem Statement**

After the observation and experience in using the computer at CAD/CAM laboratory, it can be defined that an ergonomics design of computer table is very important in finding conformity of workplace while doing the computer job much better in a long period without having any serious pain or injuries.

### **1.4 Scope**

This project is about a development and designing an ergonomics computer table that comfortably used in CAD/CAM laboratory. The following tasks will be covered in this project:

- a. Development of anthropometric database,
- b. Analyze the posture based on anthropometric database for student FKP, UTeM,
- c. Develop an optimized solution of ergonomics computer table according to the posture analyzed by using CATIA software, and
- d. Development of ergonomics computer table using CATIA software.

### **1.5 Importance of This Project**

The project is to develop an ergonomics computer table using the population database of students in Malaysia which it can reduce occupational risk factors for strains, sprains, and cumulative trauma when doing the job. In order to identify the root of this problem, the research study and analyzing process is needed in order to define the solution for that problem.

This project includes the gathering data of student's population in Malaysia with survey and interview to detect the problem and develop a new improvement product. This project finally will reduce work-related musculoskeletal disorders

(WMSDs) by adapting the work to suit the student human body, instead of forcing the student to adapt to the work.

## 1.6 Definition of Terms

*Ergonomics* have been define in many definition which it have same meaning and related to each other. The word ergonomics have taken from greek words 'ergon' mean human work and 'nomos' the scientific study. Ergonomics refers to the interaction between the individual, their work, and work environment so that human capabilities are reinforced without exceeding human limitations. *Ergonomic design* means creating a healthier work area or product for human usage.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter contained the discussion on the definition, concept and history for the ergonomics, anthropometry, engineering design, ergonomics in design and conceptual design. The discussion for those keywords term is important for this project understanding. This chapter also have discussed the past project and researched that related to this project where it can help to gained information about the knowledge.

#### **2.2 Ergonomics**

##### **2.2.1 Introduction**

From the International Ergonomics Association (2005) was states that ergonomics (or 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 the science of work, of the people who do it and the ways it is done, of the tools and equipment they use, the places they work in, and the psychosocial aspects of the working situation (Pheasant and Haslegrave, 2006). It can also be described as the

study of the interaction between people and machines and the factors that affect the interaction (Bridger, 2003).

The word ergonomics was coined by the late Professor Hywell Murell, as a result of a meeting of a working party which was held in Room 1101 of the Admiralty building at Queen Anne's Mansions on 8 July 1949, at which it was resolved to form a society for "the study of human beings in their working environment".

The members of this working party came from backgrounds in engineering, medicine, and the human sciences. During the course of the war, which had just ended, they had all been involved with research of one sort or another into the efficiency of the fighting man, and they took the view that the sort of research they had been doing could have important applications under peacetime conditions. There did not seem to be a name for what they had been doing, however, so they had to invent one and finally settled on ergonomics.

The word work admits a number of meanings. In a narrow sense it is what we do for a living. Used in this way, the activity in question is defined by the context in which it is performed rather than by its content. Unless we have some special reason for being interested in the socioeconomic aspects of work, however, this usage is arbitrary. There is a broader sense, however, in which the term work may be applied to almost any planned or purposeful human activity, particularly if it involves a degree of skill or effort of some sort. In defining ergonomics as a science concerned with human work, we will in general be using the word in this latter and broader sense. Having said this, it would also be true that throughout its 50 years of history, the principal focus of the science of ergonomics has tended to be upon work in the occupational sense of the word.

Work involves the use of tools. Ergonomics is concerned with the design of these, and by extension with the design of artifacts and environments for human use in general. If an object is to be used by human beings, it is presumably to be used in

the performance of some purposeful task or activity. Such a task may be regarded as work in the broader sense. Thus to define ergonomics as a science concerned with work or as a science concerned with design means much the same thing at the end of the day.

The ergonomics approach to design may be summarized in the principle of user-centered design:

*“If an object, a system or an environment is intended for human use, then its design should be based upon the physical and mental characteristics of its human users (insomuch as these may be determined by the investigate methods of the empirical sciences).”*

(Pheasant and Haslegrave, 2006)

The objective is to achieve the best possible match between the product (object, system or environment) being designed and its users, in the context of the (working) task that is to be performed. In other words, ergonomics is the science of fitting the job to the worker and the product to the user.

### **2.2.2 Purpose**

In general, the scope and objective of ergonomics is “designing for human use and optimizing working and living conditions”. Ergonomics considers the physical and mental capabilities and limits of the worker as he or she interacts with tools, equipment, work methods, tasks, and the working environment.

There are two main objective for ergonomics which it related to it purposes. First is to enhance the effectiveness and efficiency with which work and other activities are carried out. The second main objective is to enhance certain desirable human values, including improved safety, reduced fatigue and stress increased

comfort, greater user acceptance, increased job satisfaction and improved quality of life.

Those the main objective related to the purposes of ergonomics. The purposes of ergonomics are to:

- a. Enhance human, that includes workers and users, and their performance:  
By execute ergonomics consideration, workers can increased their performance and also improve productivity by reducing injuries and hazard at workplace and working condition.
- b. Increase human safety and health:  
Ergonomics increased safety and health by providing implementation, design and findings that appropriate and relevant to be implemented by the users or consumers in order for them to do things in safe condition and didn't give harmfulness to them.
- c. Develop human satisfaction:  
Implementing ergonomics in people's activity can increase human satisfaction because human ability and activity are accessed in order to determine suitable condition for them to work and also designing products that suitable to be used by human.

### **2.2.3 Fields of ergonomics**

Field of specialization within discipline of ergonomics:

- a. Physical Ergonomics:  
It is concerned with human anatomical, anthropometric, physiological and biomechanical. Relevant topics include working postures, manual materials handling, repetitive movement, WMSDs, workplace layout, safety and health.