

APPROVAL

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

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Date : 22 April 2011

DECLARATION

“I hereby, declare this thesis is result of my own research except as cited in the
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Date : 22 April 2011

DEDICATION

Highest Special Thanks To My Beloved Parents

Hj. Sutaji Bin Sulaiman

&

Hjh. Masiah Binti Habib

Also

Lovely Siblings and Sweetheart

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ABSTRACT

In the automotive industries, establishment of the car interior design is one of the important phases where the consideration of ergonomics aspect defined in order to give maximum comfortably, performance, and satisfaction for the occupants which fulfil the market requirement. This project basically focuses on the ergonomic car dashboard research by doing an analysis on the dashboard design and its instrument. Base on the previous research, there have difficulties for the driver to reach the instrument panel at dashboard. This situation also tends to give the stresses upon the drivers' body. Realizing the situation, ergonomics was carried out as a practice and disciplines among designers in generating a dedicated product. Three benchmarks were chosen to get its basic information as well as the parameter of the dashboard. Besides that, anthropometric data of the driver were collected base on their percentile. Measuring activities also done to get real data on the existing car dashboard. Yet, the reach capability of the drivers to their car dashboard can be examined. In order to develop a car dashboard design which fulfils the customer requirements, a survey has been conducted as additional information. The data which is collected from the survey and the real time measurement, will be used to construct a digital Computer Aided Design (CAD) data. Then, the CAD data will be used as a reference to generate a new concept design of the car dashboard. An analysis will be run on the new design of car dashboard and instrument panel to evaluate the ergonomics aspect using Computer Aided Three-dimensional Interactive Application software (CATIA V5R16). The output data was compiled, validated and compared among the resource gained. An ergonomic design concept of car dashboard will proposed as a result at the end of this project.

ABSTRAK

Dalam industri automotif, penetapan rekabentuk dalaman sesebuah kereta merupakan salah satu tahap terpenting di mana aspek ergonomi perlu dipertimbangkan agar dapat memberikan keselesaan, prestasi dan kepuasan yang maksimum pada penumpang serta memenuhi keperluan pasaran. Projek ini pada dasarnya mengkaji tentang papan pemuka kereta yang ergonomik dengan melakukan analisis pada rekabentuk dan peralatan yang ada padanya. Berdasarkan kajian sebelum ini, terdapat kesulitan pada pemandu untuk mencapai panel di papan pemuka. Keadaan ini juga cenderung untuk memberikan tekanan pada tubuh pemandu. Menyedari akan situasi tersebut, ergonomik telah dijadikan sebagai amalan dan disiplin dikalangan pereka dalam menghasilkan suatu produk yang eksklusif. Tiga penanda aras dipilih untuk mendapatkan maklumat asas serta ukuran bagi papan pemuka. Selain itu, data antropometrik pemandu dikumpulkan berdasarkan peratusan ketinggian mereka. Aktiviti pengukuran juga dilakukan untuk mendapatkan data yang tepat bagi papan pemuka kereta yang dipilih. Dengan itu, kemampuan capaian pemandu terhadap papan pemuka kereta mereka boleh diperiksa. Dalam rangka untuk membina satu rekabentuk papan pemuka kereta yang memenuhi kehendak pelanggan, survey telah dilakukan sebagai maklumat tambahan. Data yang dikumpul dari tinjauan dan pengukuran akan digunakan untuk membina sebuah data lukisan berbantu berkomputer (CAD). Kemudian, data CAD akan digunakan untuk menghasilkan rekabentuk papan pemuka kereta yang baru. Satu analisa dilakukan pada reka bentuk papan pemuka kereta yang baru bagi menilai aspek ergonomi dengan menggunakan perisian lukisan berbantu berkomputer tiga dimensi (CATIA V5R16). Data output akan dikumpulkan, disah serta dibandingkan daripada sumber yang diperolehi. Cadangan rekabentuk papan pemuka kereta yang ergonomik akan dikemukakan di akhir projek ini.

TABLE OF CONTENTS

	TOPICS	PAGE
	APPROVAL	ii
	DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENTS	v
	ABSTRACT	vi
	TABLE OF CONTENTS	ix
	LIST OF FIGURES	xvi
	LIST OF TABLES	xx
CHAPTER 1	INTRODUCTION	1
	1.1 Background of the Project	1
	1.2 Objective of the Project	2
	1.3 Problem Statement	3
	1.4 Scope of the Project	4
CHAPTER 2	LITERATURE REVIEW	6
	2.1 Automobile	6
	2.1.1 Inside the Automobile	7
	2.1.2 Trend of the Dashboard Design	8
	2.2 Ergonomics	9
	2.2.1 Definition	9
	2.2.2 The Social Value of Ergonomics	11
	2.2.3 Human Factor and Ergonomics	13
	2.3 Anthropometric	13

2.3.1 Anthropometric Data	13
2.3.2 Anthropometry and Its Use	14
2.3.3 Type of Anthropometric Data	15
2.3.3.1 Structural Anthropometric Data	15
2.3.3.2 Functional Anthropometric Data	16
2.3.3.3 Newtonian Anthropometric Data	19
2.3.4 Standardization of Measurement	19
2.3.5 Application of Anthropometry in Design	22
2.3.5.1 Stature	23
2.3.5.2 Eye Height, Standing	23
2.3.5.3 Shoulder Height, Standing	24
2.3.5.4 Elbow Height, Standing	24
2.3.5.5 Hip Height (Trochanter), Standing	24
2.3.5.6 Knuckle Height, Standing	24
2.3.5.7 Fingertip Height, Standing	25
2.3.5.8 Sitting Height	25
2.3.5.9 Sitting Eye Height	26
2.3.5.10 Sitting Shoulder, Height	26
2.3.5.11 Sitting Elbow, Height	26
2.3.5.12 Sitting Thigh, Height	26
2.3.5.13 Sitting Knee, Height	27
2.3.5.14 Sitting Popliteal, Height	27
2.3.5.15 Shoulder Elbow, Height	27
2.3.5.16 Elbow-Fingertip Length	28
2.3.5.17 Overhead Grip Reach, Sitting	28
2.3.5.18 Overhead Grip Reach, Standing	28
2.3.5.19 Forward Grip Reach	29
2.3.5.20 Arm Length, Vertical	29
2.3.5.21 Downward Grip Reach	29
2.3.5.22 Chest Depth	29
2.3.5.23 Abdominal Depth, Sitting	30
2.3.5.24 Buttock-Knee Depth, Sitting	30
2.3.5.25 Buttock-Popliteal Depth, Sitting	31

2.3.5.26 Shoulder Breadth, Biacromial	31
2.3.5.27 Shoulder Breadth, Bideltoid	31
2.3.5.28 Hip Breadth, Sitting	32
2.3.5.29 Span	32
2.3.5.30 Elbow Span (Arms Akimbo)	32
2.3.5.31 Head Length	33
2.3.5.32 Head Breadth	33
2.3.5.33 Hand Length	33
2.3.5.34 Hand Breadth	34
2.3.5.35 Foot Length	34
2.3.5.36 Foot Breadth	35
2.3.5.37 Weight	35
2.4. International Standard and Regulations from UNECE	35
2.4.1. Visibility	35
2.4.2 Ergonomic parameters	36
2.4.3 Visibility of the instruments	38
2.4.4.Design for the position to the line of sight	39
2.4.4.1. Inclination of the instrument surface	39
2.4.4.2 Distance to the instrument surface	39
2.4.4.3 Visibility of the instruments	40
2.4.5.Visibility of displays	41
2.5. General Safety Requirements	42
2.6. Zones of the Car Interior	43
2.6.1. A-Zone Areas	43
2.6.2. B-Zone Areas	46
2.6.3. C-Zone Areas:	46
2.7. Design Criteria	49
2.7.1. Displays	50
2.8. Computer Aided Design	53
2.9. Computer Aided Engineering	53
2.9.1 Human Builder Analysis-Manikin	54

CHAPTER 3	METHODOLOGY	55
3.1	Introduction	55
3.2	The Project Methodology	56
3.2.1	Define the problem	59
3.2.2	Data Collection	59
3.2.2.1	Anthropometry Data	59
3.2.2.2	Ergonomic Data	60
3.2.2.3	Real Time Data Collection	63
3.2.2.4	Conduct a Survey	65
3.2.2.4.1	Questionnaires	65
3.2.2.5	Concept Design Data	66
3.2.3	Evaluation	67
3.2.3.1	2D & 3D design Projection	68
CHAPTER 4	RESULT AND ANALYSIS	69
4.1	Survey results	69
4.1.1	Controls and Displays	70
4.1.2	Interface Element	74
4.1.3	Identification of Customer Needs for Car Dashboard	75
4.1.4	Conversion of Voice of Customer into Customer Needs	76
4.1.5	Prioritization of Customer Needs	77
4.1.6	House of Quality for Car Dashboard	78
4.2	Results from Benchmark	82
4.3	Data Development	85
4.4	Develop New Design Concept	86
4.5	Detail Design	87
4.5.1	Steering Wheel	87
4.5.2	Driver Seat	89
4.5.3	Car Dashboard and Instrument Panel	91
4.5.4	Driving Space	93
4.6	Ergonomics Analysis	94

4.6.1. Visibility Analysis	94
4.6.2. Achievability analysis	98
CHAPTER 5 DISCUSSION	102
5.1 Introduction	102
5.2. Trends	104
5.3. Today's Trends	104
5.4. Future Trends	105
CHAPTER 6 CONCLUSION	107
6.1 Conclusion of the Project	107
6.2 Recommendation	108
REFERENCES	110
APPENDICES	114

LIST OF FIGURES

NO	TITLE	PAGE
Figure 1	Audi RS 6	7
Figure 2	VW Golf Mark VI	8
Figure 3	VW Golf Mark IV	8
Figure 4	Some common structural anthropometric variables data	16
Figure 5	Dimensions which are determined using anthropometric considerations.	17
Figure 6	Illustration of a static versus dynamic fit in the context of cab design	17
Figure 7	Pattern of body movements in the shot put.	18
Figure 8a	Human sitting position and brief description of their use in ergonomics	20
Figure 8b	Human variable sitting position and brief description of their use in ergonomics	20
Figure 8c	Human standing position and brief description of their use in ergonomics.	21
Figure 8d	Human variable standing position and brief description of their use in ergonomics	21
Figure 9	Height measured on a person standing upright	23
Figure 10	Height measured on a person sitting upright	25
Figure 11	Arm and reach measurement	27
Figure 12	Measurement of body depth	30
Figure 13	Measurement of body width	31
Figure 14	Measurement of arm spans	32
Figure 15	Head measurement	33
Figure 16	Hand and foot measurement	34
Figure 17	Focusing times	36

Figure 18	Diagram of priority I	37
Figure 19	Diagram of priority II	37
Figure 20	Diagram of priority III	38
Figure 21	Inclination of the instrument surface from side view	39
Figure 22	Distance to the instrument surface from side view	39
Figure 23a	Visibility of the instruments from side view	40
Figure 23b	Visibility of the instruments from top view	40
Figure 24	H-point template	43
Figure 25	Layout of the driver's workstation using linkage anthropometry.	44
Figure 26	Occupant cell A-Zone area.	45
Figure 27	Below seat line C-Zone area	46
Figure 28	Dashboard and center console C-Zone area.	46
Figure 29	Steering control C-Zone area	47
Figure 30	Steering control nearest to pillar or sidewall C-Zone area.	48
Figure 31	Basic module of design process	57
Figure 32	Methodology flow chart of the project	58
Figure 33	Anthropometrics measurement	60
Figure 34	Ergonomics data measurement for driver	61
Figure 35	Ergonomics data measurement for driver foot	62
Figure 36	Anthropometrics measurement for 5% percentile	63
Figure 37	Anthropometrics measurement for 50% percentile	63
Figure 38	Anthropometrics measurement for 95% percentile	64
Figure 39	Dashboard of Alfa Romeo 156	64
Figure 41	Dashboard of Honda City	64
Figure 42	Dashboard of Proton Savvy	64
Figure 43	Variant of human percentile	67
Figure 44	Variant of human reach capabilities	68
Figure 45	Range of hand movement	68
Figure 46	Male-Female Ratio of the Subject Group	69
Figure 47	Functional properties of dashboard under the considerations of physical expectations of the respondents.	70
Figure 48	Physical Expectations from the Specific Interface Elements	74

Figure 49	CAD drawing for dashboard of Proton Savvy	85
Figure 50	CAD drawing for dashboard of Honda City	85
Figure 51	Sketching of first concept	86
Figure 52	Sketching of second concept	86
Figure 53	Sketching of third concept	87
Figure 54	Steering wheel from front view	87
Figure 55	Steering wheel from top view	88
Figure 56	Steering wheel from side view	88
Figure 57	Steering wheel from isometric view	89
Figure 58	Driver seat from isometric view	89
Figure 59	Driver seat from top view	90
Figure 60	Driver seat from side view	90
Figure 61	Driver seat from front view	91
Figure 62	New car dashboard from front view	91
Figure 63	New car dashboard from top view	92
Figure 64	New car dashboard from side view	92
Figure 65	New car dashboard from isometric view	92
Figure 66	Driving space from isometric view	93
Figure 67	Driving space from side view	93
Figure 68	Visibility analysis of manikin	94
Figure 69	Binocular vision of driver	95
Figure 70	2D projection of driver's vision from side view	96
Figure 71	2D projection of driver's vision from top view	97
Figure 72	Human manikin touch the temperature button	98
Figure 73	Reach envelop of human manikin.	99
Figure 74	Reach envelop of human manikin from top view.	100
Figure 75	Reach envelop of human manikin from side view.	101
Figure 76	Reach envelop of human manikin in isometric view	101

LIST OF TABLES

NO	TITLE	PAGE
Table 1	Results of Survey for Voice for Customer	75
Table 2	Voice of Customer Translated in Terms of Customer Needs	76
Table 3	Relative Importance of Customer Needs	77
Table 4	List of HOWs for Car Dashboard	78
Table 5	Relationship between HOWs and WHATs	79
Table 6	HOQ for Car Dashboard	81
Table 7	Measurement of driver parameter for Proton Savvy	82
Table 8	Measurement of driver parameter for Alfa Romeo 156	83
Table 9	Measurement of driver parameter for Honda City	84

CHAPTER I

INTRODUCTION

1.1 Background of the Project

Nowadays, technology development provides us an extra change and awareness in technology which lead to specific changes in economic and socio-cultural values. Along with the change in values, the society becomes more focus from production to information and creativity. As the result, the consumer of this era has started to assess creativity and innovation.

The attractiveness of a product depends on how we conscious about the product with all our senses in relation to the expected performance of the product. Normally, consumer attracted to a certain product related to its aesthetics value. However, this statement is an oversimplification, since the attractiveness of the product is related to how we conscious about the product with all our sense in relation to what we expect to get from the product. Hence, the product should have something better. Then, ergonomics, anthropometry, and human factor engineering can play an important role in the design phase. (Falou et. al, 2003).

Understand with scenario of the current dashboard design, this project will pointed on ergonomics aspect in order to develop a new concept design of car dashboard as well as fulfil the consumers needs and assessment. During the development of a new concept of car dashboard, the literature review of this project

used as a guide line. Later, the data collected from respondent and measurement is compared with the actual digital data gain from the new concept analysis. Overall, this paper describes and discusses the approach, development aspects, and evaluation phases of a new generation dashboard design of automobile.

1.2 Objective of the Project

This study mainly aims to explore the role of user-centred design criteria for design phase and the role of ergonomic and human factors for automobile dashboard design. The primary interest in the driver's environment is the relationship between the driver's seat, steering wheel and location of instrument on the dashboard. The dashboard extends from just under the inside portion of your windshield and includes all the dials, knobs, buttons, and instruments that essentially run the automobile. In essence, the dashboard of a car serves as the control centre. (Murata A., & Moriwaka, M., 2005).

The objectives of this project are:

1. To design and develop the digital data of instrument panel assembly and dashboard which fulfil the ergonomic and safety standard.
2. Evaluate and validate the digital data by using the Computer-Aided Engineering (CAE) software in order to design new concept of car dashboard.

1.3 Problem Statement

There are some problems with the existing car dashboard and instrument panel where it can influence the performance of the driver during handling the vehicle. It also can bring bad injuries on the drivers if ergonomics aspects take for granted by the designers.

The relevant of this project research have been supported by Burger et al., (1977) in their study in about ergonomics design. They claimed in their research is about 5% of all accident caused by the interaction between drivers and the car interior is not always successful (Burger et al., 1977). While Milosevic (1997), in his writing said that during a long distance, there are three most common fatigue sign found happened upon the drivers such as “pain in the back and in the legs”, “drowsiness and sleepiness”, and “bad mood and irritability” (Milosevic, 1997). On the other hands, Hedberg (1987) evaluated the health of bus, train, taxi and truck drivers concluding that a large proportion of professional drivers have disorders in lower back, extremities, neck and shoulders. These findings indicate that pain and fatigue are important factors to consider in the design of car interiors in order to avoid car-related discomfort and disorders.

The ergonomics specification that fulfil the drivers’ criteria for The unsynchronised posture of the driver and the interior instrument design encourage a slightly pain on the drivers’ body. So that, anthropometry parameter of human percentile also be considered during designing a product.

The problems that will be studied in this project are:

1. To understand the importance of ergonomics in automotive dashboard design.
2. The relationship between anthropometry parameter of the drivers with an ergonomics dashboard design.

1.4 Scope of the Project

This project is based on the ergonomics design of automotive dashboard. Scope of this project will be covering the case study through the literature review and journal for the existing cars. From this study, the characteristic of ergonomics design is known as well as its criterion for international standard and regulation.

By studying the literature review, the present trend and scenario of car dashboard design is understood especially in ergonomics aspect. These can give some information during developing a new design concept of car dashboard. The output data collected by a few methods applied during this project. One of the methods is conducting a survey about interior comfortability of the car where the feedbacks from the drivers are noted and fulfilled as customer requirements. The second method applied during this project is measuring the car existing dashboard dimension as a benchmark.

The scope of study also includes adaptation of Computer Aided Engineering (CAE) software to apply an analysis for the new dashboard concept design. New concepts of the dashboard will be developed based on the digital data inserted in the software by referring the output data from all resources.

Ergonomic analysis is executed on the new concept design to determine whether it fulfills the driver requirement. The findings will be compiled, validated and compared with the existing data for the present car dashboard.

Scopes of this project are:

1. Literature reviews on the international standard and regulation related to automotive dashboard design.
2. Study on the current trend and scenario of existing car dashboard with its instrument panel design.
3. Study on ergonomics interface specifications between driver and the car dashboard.
4. Collects real time data input from the real customer and the benchmarks.
5. Construct the digital data and develop a new design concept of car dashboard by using CAD software which is CATIA V5R16.
6. Run an ergonomics analysis on the new design of dashboard and its instrument panel in term of ergonomics criteria using the CAE.
7. Compile, validate, and compare the analysis result with the input data.

CHAPTER II

LITERATURE REVIEW

2.1 Automobile

The automobile design activity comprises the shaping of the automobile in all its visible aspects, in styling of the outer body shape and in graceful appointments of the interior; even the arrangement of the components in the engine compartment are included. Since direct sense perception acts strongly on the world of feelings, styling assumes a key function in the development of an automobile, Styling often determines individual acceptance or rejection of a given product even before technical features are evaluated (Seiffert and Walzer 1991).

A car can be symbolized as a power and prestige. It also can either be economic or expensive, practical or just beautiful as illustrated in Figure 1. Besides changing the way people move around, the car has also changed the way people live.



Figure 1: Audi RS 6
(source: <http://www.monstersandcritics.com>)

2.1.1 Inside the Automobile

As per Arslan, F. (2006), not only the automobile's exterior shape and interior comfort come to life as a result of good design, but also the engine compartment, even the shape of the floor pan, should be purposefully detailed and appealingly formed. These considerations are not entirely new. Some of the old-time automobiles delight us because engineering was made visible. (Arslan.F, 2006)

Nowadays, we are in the 3rd age of vehicle design era. With this era, manufacturers are beginning to

- focus on technology (engineering and productions)
- focus on brand equity
- focus on consumer.

Recent years, new sophisticated technology is being introduced faster in automobile sector. Sometimes, interior is developing faster rather than exterior of automobile.



Figure 2: VW Golf Mark VI
(source: <http://www.bushautoblog.com>)



Figure 3: VW Golf Mark IV
(source: <http://paultan.org>)

2.1.2 Trend of the Dashboard Design

Cebi, S., and Kahraman, C. (2010) in their report said that car manufacturers present various indicator panel designs of which shapes, colours, layouts, and location are different. Moreover, the indicators panel designs have been changed with respect to the automobile type such as off-road vehicle, passenger car, racing car, and others. Furthermore it has been changed with respect to the manufacturers for the same class automobile. In other words, there are no specific rules that determine the number of indicators, shape, and colour for a passenger car. The indicators and warning lamps which are most commonly used in an automobile are as follows:

- a) Speedometers
- b) Tachometer
- c) Fuel level gauge
- d) Water level gauge
- e) Oil warning light
- f) Belt warning light
- g) Door warning light
- h) Signal light
- i) Hand brake light
- j) Alternator light