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THE DESIGN OF MECHANISM MECHANICAL VENTILATION SYSTEM USING  
SOLAR SYSTEM FOR CAR BELOW THE SUNLIGHT

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This report is submitted in accordance with requirement for  
The Bachelor Degree of Mechanical Engineering  
(Design & Innovation)

Faculty of Mechanical Engineering  
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APRIL 2010

“I hereby declared that this thesis titled  
„The Design Mechanism Mechanical Ventilation System for Car Using Solar System“ is  
the result of my own effort except as cited in references”.

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I hope that this report may save the hands, eyes, and lives of countless youngsters who might never have about the car ventilation system. I also hope it may set many young people on their course toward becoming astronauts, engineers, technicians, and other kinds of scientists. I hope it may serve as a guidepost to many people, young and old, who are interested in rockets.

I have given much time and effort to it and I have learned that “knowledge is the enemy of learning.” In other words, if you think you already know it all, your mind becomes closed to learning anything new. Read this report, learn something, and if at all possible, go ahead and pass your knowledge on. “Do the same for others when you grow up.”

Finally, I would like to dedicate this to my caring father, Abd Aziz Bin Ismail, my beloved mother, Nazariyah Binti Kassim, my understanding sister and all my family for supporting me all the way long.

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This acknowledgment also appoint to the people who contribute directly and indirectly to successful of the project. I hope this report will be a reference to the next student.

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## ABSTRACT

Design of mechanism mechanical ventilation system using solar system for car below the sunlight is improvement from the previous mechanical ventilation system. Since the existing ventilation system only work during the engine run and cannot give enough comfort during the sunny day, the mechanical ventilation system using solar system able to run during the engine is idle. The design still remains environmental friendly without using any addition of gases. This system is using the solar system integrate with the existing ventilation system to control the thermal condition inside the car below the sunny day. The method used in preparing this project include the preparing of project mission statement, project outline, research, data analysis, product design specification (PDS), functional model analysis, generate concepts, metrics evaluation, concept selection, detail design, fabrication and hardware procurement, implementation and modification. When the part of product had been fabricated and assembled, experimental testing will be conducted before project realisation and verification started. This project will end by verification of supervisor and panel of seminal. The design of mechanism mechanical ventilation system using solar system that work efficiently and environmental friendly has been designed successfully in the end of this project. It is able to control the thermal condition inside the car. Lastly, as a recommendation for those who interested to proceed with this project, they should try to modify the design using more suitable material which is cheaper but at the same time has the equal or better quality design.

## ABSTRAK

Rekabentuk mekanisma sistem pengudaraan mekanikal menggunakan sistem solar untuk kereta di bawah sinar matahari adalah penambahbaikan dari sistem pengudaraan mekanikal dahulu. Kerana sistem pengudaraan yang ada hanya beroperasi selama enjin hidup dan tidak cukup untuk memberi keselesaan selama hari yang panas terik, sistem pengudaraan mekanikal menggunakan sistem solar dapat menjalankan mesin selama enjin tidak dihidupkan. Rekabentuk masih tetap mesra alam tanpa menggunakan sebarang gas. Sistem ini menggunakan sistem solar bergabung dengan sistem pengudaraan yang sedia ada bagi mengawal keadaan suhu di dalam kereta di bawah hari yang panas terik. Kaedah yang digunakan dalam menjalankan projek ini termasuklah projek dalam menyediakan misi projek, garis panduan projek, penyelidikan, analisis data, spesifikasi rekabentuk produk (PDS), fungsi model analisis, penjanaan konsep-konsep, penialian metrik, pemilihan konsep, rekabentuk terperinci, pembuatan dan perkakasan pemerolehan, pelaksanaan dan pengubahsuaian. Apabila semua bahagian produk telah difabrikasi dan disambungkan kesuluruhannya, ujikaji akan dijalankan sebelum pengesahan projek dimulakan. Projek ini akan berakhir dengan pengesahan penyeliaan dan panel seminalis. Rekabentuk mekanisma sistem pengudaraan mekanikal menggunakan sistem solar yang berfungsi dengan cekap dan mesra alam telah berjaya direka di akhir projek ini. Hal ini mampu mengawal keadaan suhu di dalam kereta. Akhirnya, sebagai cadangan kepada mereka yang tertarik untuk meneruskan projek ini, mereka harus cuba mengubahsuaikan reka bentuk ini dengan bahan yang lebih sesuai dan menggunakan kos yang lebih murah sama ada serupa atau dipertingkatkan lagi kualiti reka bentuknya berdasarkan reka bentuk roket yang dihasilkan dalam projek ini.

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## LIST OF SYMBOL

$T$	=	fluid temperature
$T_w$	=	temperature
$dQ/dt$	=	heat transfer
$A$	=	surface area
$\alpha$	=	heat transfer coefficient
$P$	=	net radiated power
$e$	=	emissivity (=1 for ideal radiator)
$\sigma$	=	Stefan's constant
$A$	=	radiating area
$T$	=	temperature of radiator
$T_c$	=	temperature of surroundings
$h$	=	heat transfer coefficient
$\Delta Q$	=	heat input
$A$	=	surface area
$\Delta T$	=	temperature difference
$\Delta t$	=	change in time
$AH$	=	absolute humidity
$m_w$	=	water vapor
$V_a$	=	cubic meter of air
$MR_i$	=	mixing/humidity ratio
$m_d$	=	kilogram of dry air
$\delta$	=	ratio of molecular weights of water vapor and dry air
$p_w$	=	partial pressure of water vapor in moist air
$p_a$	=	atmospheric pressure of moist air.

$RH/\emptyset$	=	relative humidity
$SH/w_1$	=	specific humidity
$v$	=	velocity
$\omega$	=	angular velocity
$r$	=	radius
$N$	=	speed in rotation per minutes (RPM)

## CHAPTER I

### INTRODUCTION

#### 1.1 Project Background

The title of this project is designing interior ventilation system for car using solar system. This project is an invention of the previous studies about the thermodynamics and application of the thermodynamics with including the design specifications and manufacturing process.

Ventilation systems in the car generally use to stabilize the temperature of the car to ensure the driver and passenger in a comfort condition. The air flow in and out of the car becomes a source to make the interior space of the car with the suitable temperature.

This study adopts airflow management technology to improve the local temperature distributions in an automobile to counteract the greenhouse effect. The automobile's temperature can be reduced to almost the outside temperature before the driver or passenger gets into the vehicle. When the engine is idling, the greenhouse-control system can be activated to remove the hot air from the car. An appropriate negative pressure is maintained to prevent stuffiness and save energy.

The greenhouse-control system requires electrical power when the engine is idle, and a battery cannot supply sufficient power. An auxiliary solar-power supply can save

energy and reduce the greenhouse effect of sunlight, while creating a comfortable traveling environment. It ensures that the engine is not overburdened and increases its service life, conserving energy, protecting the environment and improving comfort.

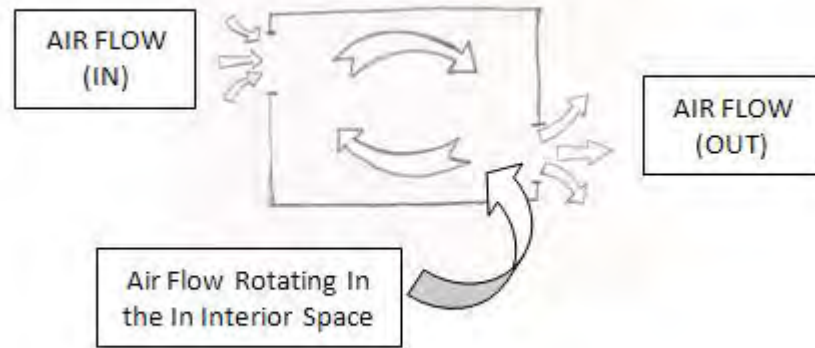


Figure 1.1: The concept idea of the mechanical ventilation mechanism

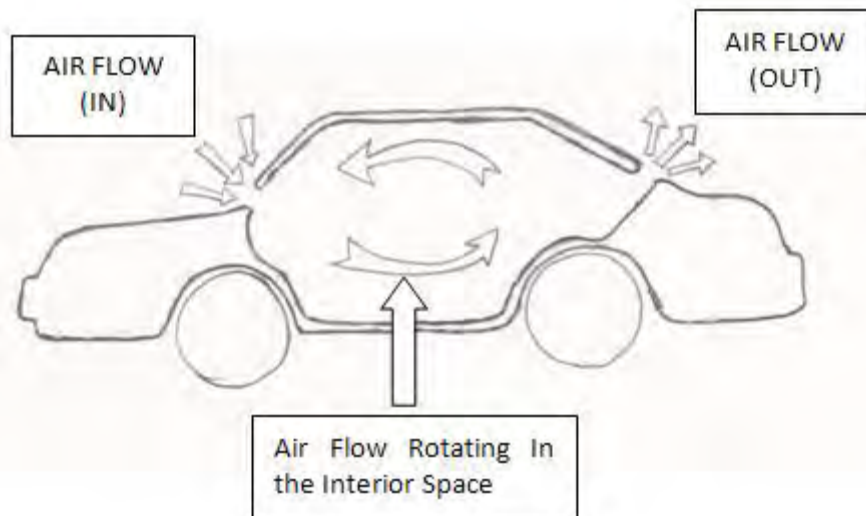


Figure 1.2: The concept idea applying to the car

## 1.2 Problem Statement/Definition

The global warming that we face now causes an increasing of the thermal condition. The small scope is in the car where is the car which is place in the site there is expose directly to the sunlight. What will occur to the interior space of the car? From our experience, we know that, the thermal condition in the interior space will increase due to the sunlight.

- a. A system to solve the increasing thermal condition problem for the interior space of car needed to be designed. The ventilation mechanism using solar system had been proposed and to be designed. It is device used to maintain the thermal condition of the car interior space so the passenger will be comfort they enter to the car. This system use a solar system to reuse again the sunlight becomes an energy source to blow in and out air inside and outside of the car.
- b. This ventilation system is an innovation from the previous invention.

## 1.3 Objectives

The objectives of the project are:

- a. To design a mechanical ventilation mechanism using solar system for car interior space that can solve the overheat problem effect by thermal condition when park a car directly below the sunlight.
- b. To design a mechanical mechanism ventilation system that is able to maintain the thermal condition for interior space when before and after the passengers enter to the car.
- c. To design a system that is use a solar system as an energy source for controlling the in out and the air.

In order to achieve the above objectives, a ventilation mechanism using solar system is fabricated to prove that it is working. Some equations derived from literature review are used to determine and analyse the engineering calculation for this product. Product refinement and implementation are done repeatedly in order to solve the problems faced and improve the product.

#### **1.4 Scope of Studies**

A structure of the ventilation mechanism using solar system will be generated at the end of this project. Its design is a new design but innovation from the previous invention using a solar system as a source of energy to control in and out of the air.

Here are some scopes of studies of the mechanical ventilation mechanism using solar system:

- a. Review all literature review about the ventilation system for a car and air conditioning system for a car.
- b. Study a theory about the thermal conduction such radiation and heat transfer.
- c. Study a concept of humidity and heat absorption and their relation to the project.
- d. Design and fabricate a prototype design.
- e. Do lab research and testing procedure to the prototype design.
- f. Complete final report thesis PSM.

#### **1.5 Thesis Outline**

Here are the summary of every chapter that will be described in each chapter. Chapter I introduced about the basic theory, problem encounter, also the main objectives

and scopes of producing mechanical ventilation mechanism using solar system for car interior space ventilation. Chapter II of this thesis is some literature review about the solar radiation, solar energy, ventilation system, theories about the radiation and heat transfer. Chapter III addressed the methodology that including research methodology, product development methodology and data analysis. Chapter IV will be express about the detail design and process design, including implementation and improvement of the current design. Chapter V is about the testing procedure and result from the testing. In this chapter also contain some calculation about the testing procedure and certain calculation that need to be considered. After that, in chapter VI addressed the discussion about the previous chapter which is will discuss about the result and outcome from the testing procedure and calculation. Lastly is chapter VII which is a conclusion chapter. In this chapter, the entire project outcome will be finish and concluded.

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 The Sun and the Earth

What is the Sun? Sun is a star at center of the solar system located in the Milky Way galaxy. The Sun is the most prominent feature in our solar system. It is the largest object and contains approximately 98% of the total solar system mass. One hundred and nine Earths would be required to fit across the Sun's disk, and its interior could hold over 1.3 million Earths. The Sun's outer visible layer is called the photosphere and has a temperature of 6,000°C (11,000°F). This layer has a mottled appearance due to the turbulent eruptions of energy at the surface.

What is the Earth? Earth is the third planet away from the sun. It is the largest terrestrial planet in terms of diameter, mass and density. It contains human and million species alive. Earth is the one planet in the universe that is known has a exist life.

Humans have long recognized the Sun's role in supporting life on Earth, and as a result many societies throughout history have paid homage to the Sun by giving it prominent roles in their religions and mythologies. [1]