



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT OF LOW COST INTEGRATED SOLAR PANEL  
HOLDER TO INCREASE SOLAR PV PANEL EFFICIENCY**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning System) with Honours.

by

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**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

**TAJUK: DEVELOPMENT OF LOW COST INTEGRATED SOLAR PANEL HOLDER TO INCREASE SOLAR PV PANEL EFFICIENCY**

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I hereby, declared this report entitled “**Development of Integrated Solar Panel Holder to Increase Solar PV Panel Efficiency at technology campus UTeM, Melaka**” is the result of my own research as cited in references.

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning system) with Honours. The member of the supervisor is as follow:

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## ABSTRAK

*Iklm Malaysia dikategorikan sebagai khatulistiwa yang panas dan sejuk sepanjang tahun. Masalah timbul apabila menghadapi suhu yang melampau ini apabila kereta yang diletakkan secara langsung di bawah matahari, suhu di dalam kabin kereta boleh mencecah sehingga 60 °C. Suhu melampau jelas tidak sesuai untuk manusia. Pelbagai masalah akan timbul akibat suhu melampau dalam kereta seperti terdedah kepada strok haba dan kerosakan kepada dalaman kereta. Tujuan projek ini untuk membangunkan pemegang panel solar bersepadu untuk meningkatkan kecekapan panel solar dan akan digunakan bersama-sama dengan kipas pengedar udara yang dikuasai oleh panel solar untuk mengeluarkan haba yang terperangkap di dalam kabin kereta. Selain itu, perberzaan di antara menggunakan penjejak solar dan tanpa penjejak solar akan dianalisis untuk melihat kaedah manakah yang lebih berkesan untuk digunakan. Eksperimen ini akan dijalankan pada kereta Proton Saga dan ujian projek ini akan dijalankan dari 11:00pagi sehingga 16:00petang dalam kawasan yang sama dengan keadaan yang sama di Taman Ayer Keroh Height, Melaka. Projek ini telah dibahagikan kepada dua kes yang menggunakan kipas pengedar udara tunggal bagi kes pertama dan dua kipas pengedar udara untuk kes kedua dan termokopel diletakkan di empat kedudukan di dalam kabin kereta untuk lebih banyak data diperolehi. Hasilnya, selepas menggunakan tracker solar suhu itu berjaya dikurangkan sehingga 41.07°C berbanding dengan panel solar yang tidak menggunakan penjejak solar hanya berjaya mengurangkan suhu sehingga 43.08°C. Ini menunjukkan peningkatan kecekapan penurunan suhu sebanyak 4.67%.*

## ABSTRACT

Malaysia climate is categorized as equatorial which is being hot and cold through the year. The problem when facing this extreme temperature when a car was parked directly under the sun, the temperature inside the car cabin can reach up to 60°C. This extreme temperature clearly not suitable for human being. Various problem will arise due to this extreme temperature inside the car such as vulnerable to heat stroke and damage to the interior compartment. The aim of this project to develop an integrated solar panel holder to increase the solar PV efficiency and to be used together with ventilator fan that are powered by the solar panel to remove the heat that are trapped inside the car cabin. Besides that, the different between using solar tracker and without solar tracker will be analysed to see which method is more efficient to be used. This experiment will be run on Proton Saga and the project testing will be run from 11.00am until 4.00pm in the same area with the same condition at Taman Ayer Keroh Height, Malacca. This project was divided into two cases which are using a single ventilator fan for the first case and two ventilator fans for the second case and the thermocouple was place on four position inside the car cabin for more data to be acquire. As a result, after using the solar tracker the temperature manages to reduce up to 41.07°C compare to the solar panel that are not using solar tracker only manage to reduce the temperature until 43.08 °C. This indicates an increase in efficiency of 4.67%.

## **DEDICATION**

I would like to dedicate my final year project to my beloved family, project supervisor and friends. And I would like to express my deepest gratitude to my father Mr. Zakaria Bin Yamin and my mother Mrs. Sazlina Binti Mohd Salleh for their love, dream and sacrifice throughout my life. their sacrifice had made to become who I am today. Not to forget my appreciation to my project supervisor Mdm. Noor Saffreena Bt Hamdan for supporting me throughout of my academic journey especially on this project and for whatever knowledge rendered to me from the beginning till the end of my final year project.

Lastly, I would like to send my gratitude to my friends and lecturers for their contribution whether it is directly or indirectly to my final year project.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background of the study

Car is one of the most common transportation used by people today. As the temperature in the Malaysia increasing year by year due to global warming, the car that parked under the sun will exposed to the high temperate and will increasing the car cabin temperature so much especially during midday. Driver and passenger will feel uneasy when reaching the vehicle due to the warmth that accumulates inside the vehicle compartment while being parked on midday.

The number of cars in Malaysia is growing rapidly and these cars are typically left in open or un-shaded parking areas due to restricted rooftop parking spaces. A large portion of the vehicle users need a couple of minutes to chill off the vehicle lodge temperature on account of the sun radiation laying open. The expansion of vehicle lodge temperature results in a corruption of the material and the inside nature of the vehicle lodge and is additionally associated with the threat of warmth strokes of travelers. The information was gathered in five unique modes. It was watched for three days to decrease uncertainty. The outcomes demonstrate that the vehicle lodge temperature could be surpass to 60% from the encompassing temperature when it was presented to the sun inside two hours and the relative moistness diminished from 25 to 54%. (Othoman, Mohd Fouzi, & Nordin, 2018)

Solar radiation or sunshine are the main causes of the heat accumulated inside the car cabin. Solar radiation can enter from the window. By using the cause of the heat, this project wants to use a solar panel to absorb the solar radiation and use the energy gain to reduce the heat in the car cabin. There are many solar panels, but most of them do not have a holder. Therefore, this research is aimed to design and develop an integrated solar tracking holder for solar panel to increase the solar panel thermal efficiency.

## **1.2 Problem Statement**

Nowadays the number of cars in Malaysia is increasing rapidly and the parking in shaded area are limited and most the cars parked at the unshaded area and exposed to solar radiation and can this lead the heat trapped inside the car cabin. Thus, it can lead the heat to be increasing up to 60°C in the car cabin and cause the user to feel uncomfortable and can damage the material inside the cars. Besides that, there are project that are using solar panels to remove the heat that accumulated in car but most of the solar panel do not change position based on solar radiation direction. This project aims develop an integrated solar tracking panel holder to increase the solar panel thermal efficiency.

### **1.3 Objective**

Car that expose to sun radiation of increasing concern to the general public. Several past studies have been done to reduce the car cabin temperature, so this study is to:

- To design solar tracking base on solar radiation direction.
- To develop low cost holder that can change position based on solar radiation direction.
- To analyze thermal efficiency of the solar panel with solar tracking holder.

### **1.4 Scope**

This project will be held at Taman Ayer Keroh Height, Melaka. This project will be run on the unmoving cars under the sun. This project will be held on 11.00am to 4.00pm under 2 condition. A solar holder that moves based on solar radiation is design and developed. The first condition data will be collected on static solar panel and the second condition data will be collect on holder that can change position based on solar radiation. Data collected will be analyzed and compared to see which method are more efficient.



## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Nowadays, the use of cars is very important in giving us the convenience of moving to either work or going to vacation and other uses. Working hours in Malaysia are from 8am to 5pm, so during working hours cars parked in open area will be exposed to extremely hot sunlight and will cause the temperature to be trapped in the car cabin and the temperature will rise sharply. In this chapter will discuss how heat is trapped in the car and ways to reduce heat in the car. Focusing on improving or creating an integrated solar panel holder.

## 2.2 Car cabin temperature

There is no protected time to be in a left vehicle with windows moved up particularly in radiant days (Baser,2013). In addition, he expressed that individuals don't understand how hot it could be inside the vehicle lodge. A few examinations led to know inside left vehicle temperature recorded and demonstrates that outer temperature 90F and inward temperature of increment soon after 10minutes of vehicle leaving under direct daylight which was 110F and following 20 minutes when outside temperature was steady inner temperature was recorded 120F yet think about expressed that expanding of inside temperature of the lodge relies upon the area, condition and sun based radiation. Regularly human body temperature somewhere in the range of 98F and 100F degrees yet once body temperature gets over a specific dimension, 105F and 106F, the temperature directing systems and the nerve centre in the cerebrum, every one of these things go haywire. Harm can be extremely fast to cerebrum and different organs in the body. In the outcome genuine demise can be caused. San Francisco State University, (2007) lead concentrate to know the inside temperature on various interim of times and their belongings following figure demonstrates inside vehicle temperature as for outside temperature. For the initial ten minutes when outside temperature was 90F and inside temperature ascend to 109F. At the point when outside temperature for an hour was same thus inner temperature was recorded for 30minutes and for 60 minutes. Beneath given figures demonstrates the aftereffect of quickly expanding temperature inside the lodge. Concentrate inferred that under direct daylight inside temperature of the lodge is 43 degree higher than outside temperature following 60 minutes.(Ahmad & Turi, 2018)



Figure 2.1: After 10 minutes(Ahmad & Turi, 2018)



Figure 2.2: After 30minutes(Ahmad & Turi, 2018)



Figure 2.3: After an hour(Ahmad & Turi, 2018)

Study led at college of Georgia, (2010) and built up a temperature, time table in shut left vehicle amid sweltering climate which may help each one of the individuals who left their vehicle and left behind something vital in the vehicle need to vehicle since concentrate expressed that following an hour vehicle lodge become like a broiler. Concentrate recorded temperature of shut vehicle left under daylight with variety of outside temperature at various time interim. In swelling environment in an accessible parking region, a vehicle's heat can rise by 7°F in five minutes, 13°F in 10 minutes, 29°F in 30 minutes and 47°F in 60 minutes. This means that indoor temperatures can reach concentrations that are damaging to little children in less moment than some guardians might believe.

Table 2.1: Times, temperature.(Ahmad & Turi, 2018)

<b>Initial Temperature 9(F)</b>	<b>120</b>	127	133	149	167
	<b>115</b>	122	128	144	162
	<b>110</b>	117	123	139	157
	<b>105</b>	112	118	134	152
	<b>100</b>	107	113	129	147
	<b>95</b>	102	108	119	137
	<b>85</b>	92	98	114	132
	<b>80</b>	87	93	109	127
	<b>75</b>	82	88	104	122
	<b>70</b>	77	89	99	117
		<b>5</b>	<b>10</b>	<b>30</b>	<b>60</b>
<b>Time(minutes)</b>					

### 2.3 Contributing Factors

This is critical to realize those variables influence warm solace of the vehicle lodge. From figure 2.4 there are numerous elements can conceivably influence the atmosphere of vehicle lodge. A few components incorporate inside upholstery, the inside and outside hues and by and large size of the vehicle, the attire of the travellers, warm protection, and the traveller limit of the vehicle lodge. The last factor focuses to a fairly interesting normal for vehicle lodges: Their generally little size implies that every distinctive individual in the lodge can influence the warm condition. This is on the grounds that each individual emanates a specific measure of warmth; if a vehicle is completely filled with inhabitants; the lodge temperature is probably going to be higher than if a solitary individual involved the vehicle. Ultimately the area and outer temperature of stopped region impact on age of warmth inside the lodge.(Ahmad & Turi, 2018)

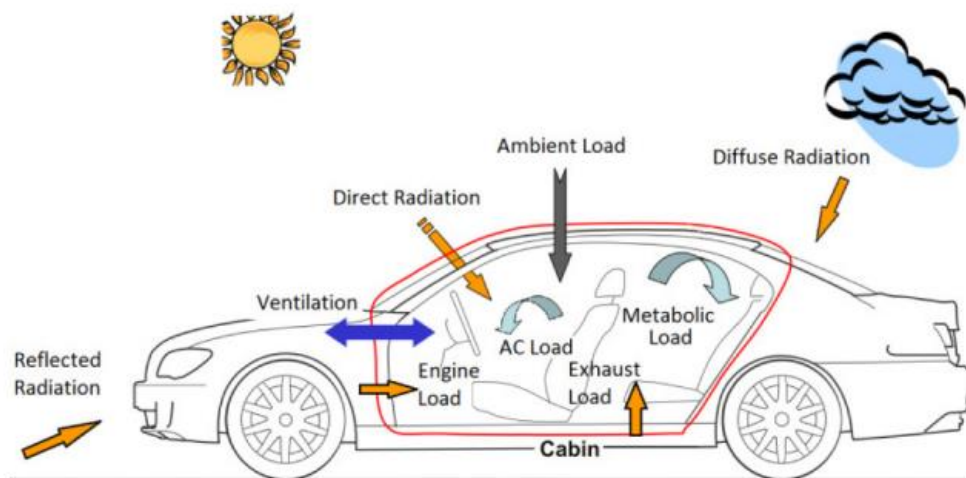


Figure 2.4: Heat enters the vehicle from many sources.(Fayazbakhsh & Bahrami, 2013)

### **2.3.1 Solar Radiation**

Sun oriented radiation is a standout amongst the most significant components to influence the atmosphere inside an engine vehicle. Sun powered vitality achieves the outside of the earth as an electromagnetic wave in the wake of going through the Earth's air. Sunlight based radiation at ground level fluctuates fundamentally with area, barometrical conditions time of day, season, dampness, and common habitat. One may consider radiation regarding reflectance and absorbance. For example, each outside surface of a vehicle, including the rooftop and entryways, reflects and retains certain parts of sun powered vitality. A bit of the retained vitality acts, thus, to build the air temperature inside the vehicle lodge. It should likewise be recalled that the sun powered vitality that is transmitted into the lodge additionally will be assimilated and reflected by whatever is inside, including upholstery, dashboard materials, and inhabitants. For each situation, the temperature of whatever is retaining sunlight-based vitality will increment. By and large, sun based radiation vitality is reflected, ingested, or transmitted on the glass contingent upon the optical properties.(Ahmad & Turi, 2018)

### **2.3.2 Ventilation in car**

Modern vehicles are intended to have a steady fresh air flow that keeps the interior environment enjoyable even with all the windows closed. The incoming air can be stirred by the motor to maintain the windows at a selected temperature free of fog and the interior of the vehicle. The incoming air can be warmed by the motor to maintain the windows free of fog and the interior of the vehicle at a selected temperature.

## 2.4 Method to reduce temperature

To take care of the issues related with the overheating in the vehicle, an item called Portable Car Cooling System is made. The motivation behind the vehicle cooling framework is to help chill the left vehicle under those hot radiant days. Along these lines, the point of this examination is to propose a framework that able to cool the traveller lodge without works the vehicle's motor. Materials utilized are additionally minimal effort and has high sturdiness. This compact vehicle cooling framework is utilized to control or keep up the temperature inside the vehicle at room temperature even under a hot condition. Accordingly, when the client begins the vehicle, the climate control system doesn't need to buckle down to bring the temperatures at agreeable dimension. This procedure lessens the fuel utilizations and costs. Other than that, the item is a green item since it utilized the Peltier cell to charge the battery.(M.F. Basar, M. Musa, M.Y. Faizal, 2013)



Figure 2.5: Mechanism for reducing temperature.(M.F. Basar, M. Musa, M.Y. Faizal, 2013)

The vehicle ventilation fan as appeared in Fig. 2.5 is utilizing sun-oriented framework and it can without much of a stretch find in the market. This item was made for the reason to keep vehicle cool at whatever point it is overheat by the daylight or hot encompassing, yet there are contrasts between this item and versatile vehicle cooling framework proposed in this paper in term of the item capacities, structure of the item, framework utilized, toughness also, some more. The vehicle ventilator fan appeared in Fig. 2.6 utilized a sun powered board and battery as a wellspring of vitality to run the ventilation fan, while versatile vehicle cooling framework as appeared Fig. 2.6, applying Peltier cell as its wellspring of vitality. Other than that, the downside of the vehicle ventilator is possibly can be set if the window's glass is marginally opened and this activity can be all things considered reason the things that are not wanted to happen, for example, vehicle robbery.(M.F. Basar, M. Musa, M.Y. Faizal, 2013). Therefore, since most of the solar panel used is only faced in one direction the idea of using a solar holder that can move based on the solar radiation used to reduce car cabin temperature is generate.



Figure 2.6: Portable, lightweight and easy to carry.(M.F. Basar, M. Musa, M.Y. Faizal, 2013)