



**OPTIMIZING THE AUTOMOBILE HEAT EXTRACTION CONTROL USING  
ARDUINO**



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**BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY  
(REFRIGERATION & AIR-CONDITIONING SYSTEMS) WITH  
HONOURS**

**2022**



**Faculty of Mechanical and Manufacturing Engineering Technology**



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**Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems) with Honours**

**2022**

# OPTIMIZING THE AUTOMOBILE HEAT EXTRACTION CONTROL USING ARDUINO

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A project report submitted  
in fulfillment of the requirements for the degree of  
Bachelor of Mechanical Engineering Technology (Refrigeration and Air-  
Conditioning Systems) with Honours


Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

## DECLARATION

I Declare That This Project Entitled “Optimize of Heat Extraction of Automobile Interior Cabin by Arduino” is The Result of My Own Research Except As Cited in The References. The Project Report has not been Accepted for Any Degree and is not Concurrently Submitted in Candidature of Any Other Degree.

Signature :  

Name : Muhammad Ismanajmi Bin Rozi

Date : 28/01/2022

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## APPROVAL

I Hereby Declare That I Have Checked This Thesis and In My Opinion, This Thesis is Adequate in Terms of Scope and Quality for The Award of The Bachelor of Mechanical Engineering Technology (Refrigeration and Air-Conditioning Systems) with Honours.

  
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Date : 28/01/2022



## DEDICATION

Alhamdulillah, my entire gratitude goes to Allah, The Glorious Lord, for providing me with the chance to live in His dominion. Initially, I would want to thank my family, particularly my parents, Mr. Rozi Bin Awang and Mrs. Shamsinar Bt Anuar, for their unwavering support and drive in completing this tremendous accomplishment. The prayers of my family had led me throughout the course of my bachelor's degree. Ts. Mohd Faez Bin Zainol is the second most significant individual for me to complete my report. Thanks again for your hard work and consistent direction during this whole process.

Thank you one again.



## ABSTRACT

According to the Department of Environment, the higher occurrence of wildfires relates to hot and dry weather, that also received 19,099 biomass burning reports over a three-year period from January 2019 to January 2022. Based to the ministry, Malaysia often suffers a hot and dry period from the month of January to the middle of March owing to the second stage of the northeast monsoon, when rainfall absorption percentages are minimal in most locations of the nation. A drastic climate change had caused in global warming which increase the chances of human in getting heat stroke. In addition, the heat stroke will not only happen at open space but can occur inside a vehicle. However, another advantage of the heat is the existence of solar power. The solar power will be used as a recyclable power in the system through a photovoltaic chip. In this project, the applied device called exhaust fan is invented by the usage of Blynk application to add in more features of maintaining the temperature in the cabin vehicle. This exhaust fan only requires an internet connection and can be controlled from further distance. The device is then tested in a used car with the interior dimension of 3263060 cm<sup>3</sup> starting from 1100 hours until 1600 hours. The device runs for 30 minutes after receiving a notification from the Blynk. The greatest temperature differential is seen on 1230, with a variation of 20 °C. Small differences on temperature due to cloudy weather of the day. The efficiency without exhaust fan is 12.73 % while the overall efficiency attained for all temperature, heat quantity, electric work, and power readings is just 12.93 % with differences of only 0.2%. This is a minimal percentage of efficiency, implying that the gadget can only be completely operational if the cabin dimension is anticipated to be 421913.66 cm<sup>3</sup>. However, if the quantity of fans or the placement of the device in the cabin automobile increases, the exhaust fan can be fitted to the 3263060 cm<sup>3</sup> cabin.

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## ABSTRAK

*Menurut Jabatan Alam Sekitar, pembakaran terbuka yang berlaku disebabkan oleh cuaca yang panas dan kering, yang menyebabkan 19,099 pembakaran bio jisim yang direkodkan dalam tempoh 3-tahun bermula daripada Januari 2019 sehingga Januari 2022. Berdasarkan fakta daripada Menteri, Malaysia kebiasaannya mengalami cuaca panas dan kering daripada bulan Januari sehingga pertengahan bulan Mac, berkait dengan peringkat kedua monsun timur laut, dan apabila hujan, peratus penyerapan adalah pada minima dalam kebanyakan lokasi di negara. Perubahan iklim yang drastik telah menyebabkan pemanasan global yang meningkatkan peluang untuk mendapat strok haba. Tambahan itu, strok haba bukan sahaja boleh berlaku di kawasan terdedah malah boleh berlaku di dalam kenderaan. Walau bagaimanapun, kelebihan haba adalah penghasilan kuasa solar. Kuasa solar boleh digunakan sebagai kuasa yang dipakai semula dalam sistem melalui cip fotovoltaiik. Dalam projek ini, peranti yang di aplikasikan dipanggil ‘kipas ekzos’ dicipta dengan penggunaan aplikasi Blynk untuk mengekalkan suhu dalam kabin kenderaan. ‘Kipas ekzos’ ini hanya memerlukan sambungan internet dan boleh dikawal dari jarak yang lebih jauh. Peranti itu kemudiannya diuji dalam kereta terpakai dengan reka bentuk dalaman yang berdimensi  $3263060\text{ cm}^3$  bermula dari jam 1100 hingga jam 1600. Peranti ini berjalan selama 30 minit selepas menerima isyarat daripada Blynk. Perbezaan suhu terbesar dilihat pada jam 1230, dengan variasi  $20\text{ }^\circ\text{C}$ . Perbezaan kecil pada suhu disebabkan oleh keadaan cuaca yang mendung pada hari itu. Kecekapan tanpa peranti ialah 12.73% manakala kecekapan keseluruhan yang dicapai untuk semua suhu, kuantiti haba, kerja elektrik dan bacaan kuasa hanyalah 12.93% dengan perbezaan 0.2% sahaja. Ini adalah peratusan kecekapan yang minimum, mendefinisikan bahawa alat ini hanya boleh beroperasi sepenuhnya jika dimensi kabin ialah  $421913.66\text{ cm}^3$ . Walau bagaimanapun, jika kuantiti kipas atau penempatan peranti dalam kereta kabin meningkat, ‘kipas ekzos’ boleh dipasang pada kabin bersaiz  $3263060\text{ cm}^3$ .*



## ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

Primarily, I want to appreciate and honour Allah the Almighty, my Creator and Preserver, for all I have earned from the commencement of my existence. I'd wish to thank Universiti Teknikal Malaysia Melaka (UTeM) for offering the project platform.

My heartfelt special gratitude to my primary supervisor, Ts. Mohd Faez Bin Zainol of Universiti Teknikal Malaysia Melaka (UTeM), for all his encouragement, advise, and inspiration. His unwavering patience in mentoring and imparting precious insights will be treasured for the rest of his life.

Ultimately, I would want to express the deepest appreciation to my dear parents, Mr. Rozi and Mrs Shamsinar, for their inspiration and for being a strong role model in all my attempts. Furthermore, I'd want to thank my siblings for respecting my situation and for their constant support throughout this academic adventure. Lastly, I'd want to convey my gratefulness to everyone who helped, supported, and inspired me to pursue my studies.

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## LIST OF SYMBOLS AND ABBREVIATIONS

D,d	-	Diameter
W,w	-	Work Done
P,p	-	Power
V,v	-	Voltage
E, e	-	Electric Current
Q, q	-	Quantity of Heat
H,h	-	Height
V,v	-	Volume





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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

This study is concerned with the ventilation of air in a confined space, this lets hot air to be replaced with natural sunlight from the outside into the interior car. The study aims at optimizing a ventilation mechanism for cars that keeps the temperature in the car's interior from rising excessively during parking time. It applies specifically to a ventilation system in which a solar panel converts sunlight to electrical energy that powers a fan that removes heated air from inside the car.

Besides that, the phenomenon of global warming in the atmosphere is now the most critical issue for the global environment. Global warming is hazardous to human health, throws our national security in jeopardy, and endangers other basic human needs. Any impacts, such as heat waves, rising sea levels, drought resistance, and drought, are becoming more prevalent.

Issue heat in car, such heat stroke is diagnosed by observation of the symptoms and signs in a person exposed to extreme temperatures (Keller, 2003) . Heat stroke usually cost when a person is exposed to a high temperature of sunlight in a long period of time. The individual usually suffers.

This can trigger dehydration of the body because intense temperature can cause dehydration if one does not drink enough water, and dehydration happens as the body lacks water and mineral salts such sodium, potassium, calcium, phosphate, and so on. Yet there's heat rash, which concerns not only youngsters but also senior citizens. When the weather is

hot and people are not embracing appropriate clothing, such as sweat-absorbing fabric, bright color fabrics, and not drinking enough water, the condition occurs. The sweat factory appears clogged and jammed because heat is trapped in the body. The skin surface will become infected and unpleasant as a culmination of this.

Beside from that, the solar can be used as a production of fuel to generate energy to run the blower engine. The principle behind a solar exhaust fan heat architecture is to achieve a new design based on a car air conditioning system. The new design piping in this system would help heat inside the cars to escape.

This time around, unlike any other experiments, they tend to place the system at the interior of the cabin. Instead of that, this device is located inside the air-conditioning system of the vehicle itself. It helps not by only managing the limited space of the interior cabin but also act as double act of cooling. Cooling during the car's movement (engine on) and during the rest, where the speed of the car is zero in a certain period.

As a response, the hot air inside the automotive will be eliminated, encouraging the heat trapped inside the vehicle to be diminished. When the heat method senses a high temperature, the solar exhaust heat module inhales warm air into the cabin.

As the stress increases the reference position, the solar panel unlocks, and the blower activates to evacuate the warm air from the engine through a hose located under the car's hood. The solar exhaust heat develops from the original component in the car air-conditioning process to generate the nature of the blower flow to two directions. This program comprises a solar plate as well as a power supply to the system as a contributor. The solar is used to conveniently get solar energy to the solar panel and obtain power supply for the blower fan to perform.

Each sun power is easy to obtain, saves resource utilization, and ecological. The result of this device is that it will decrease the ventilation inside the car, making the

passenger more comfortable. Furthermore, this would eliminate the temperature issue that refers to a situation where the driver stops or leave their cars in sunshine.

## 1.2 Problem Statement

Most of the Malaysian nowadays refers secondhand car rather than the original with the main purpose of saving budget, adding in receiving the same car as the original one. However, the major disadvantage of buying second grade car is early-onset problem. Mechanical breakdown usually does not occur in new original car and owner will not be concern for the problem within 1 or 2 years of usage.

Nevertheless, the condition of the used cars is not the same even if one another. The sale price represents the condition of the car itself. Table 1.1 explains Perodua's Axia (used car) price and specifications. The main purpose Perodua Axia is chosen for this project testing due to the higher demand in automotive industry in Malaysia due to its affordable price range. The price different is based on several factors which in this situation can be seen in the interior design. The interior design helps in controlling the price market.

Despite of the price range, the foremost problem of each used car owner is to maintain the interior and exterior of the car especially with the extreme climate in Malaysia which are hot and dry seasons. These situations increase in the car paint's damage when exposed to direct sunlight in a long period of time.

Besides that, the amount of solar heat ( $> 30^{\circ}$ ) emitted to the vehicle over a long period of time in open areas, can cause vehicle users to feel less comfortable when wanting to drive it again. In addition, the number of close parking sites are still in minimum range in Malaysia. Parking lots are not only located at mall, parks or other social activities places yet; the front yard of houses areas is also considered to be a parking site. Normally, at condominium or flats area, closed parking are provided with some extra fees of entrance. Nonetheless, overheat interior cabin problem still occur due to the

limited closed parking lot as most of the other cars owners still need to park somewhere else which cause the vehicle to be exposed directly to the sunlight repeatedly.

Although, the specification of the car had indeed stated that the interior or car paint will not be affected. However, long period of sun exposure or interior's temperature overheat (maximum) can lead on the continuous cabin problems such as dashboard and car cushion.



Table 1.1 Perodua Axia (used car) with price and specifications.

CAR BRAND AND TYPE	SPECIFICATION	CAR PRICE	EXAMPLES
Perodua Axia 1.0 Special Edition (SE) Advanced, AT ( (Arvind, July,2020).	<ul style="list-style-type: none"> <li>• 1.0L Petrol Engine, 3 Cylinder 12 Valve DOHC.</li> <li>• Power: 67 hp @ 1,200 rpm</li> <li>• Torque: 91 Nm @ 2,400 rpm</li> <li>• Transmission: 4-speed automatic, front-wheel drive</li> <li>• Safety: Two airbags, ABS with EBD, ISOFIX</li> <li>• Price: RM42,000 – March 2018 launch (OTR with insurance)</li> </ul>	RM42,000.00	

Malaysia's government had prepared public parking lots which are mostly exposed directly towards sunlight which releases a chemical known as UV ray. UV rays had been known to be at its highest during 10 a.m until 4 p.m Malaysia, country of Southeast Asia, lying just north of the Equator, that is composed of two noncontiguous regions:

Peninsular Malaysia (Semenanjung Malaysia), also called West Malaysia (Malaysia Barat), which is on the Malay Peninsula, and East Malaysia (Malaysia Timur), which is on the island of Borneo (Ahmad, 2021). This is the reason why Malaysia had been considered having only 2 seasons which are dry and wet seasons yearly. The dry seasons happens in May to September while wet season is predicted from November until March.

This issue had become worsen this year, 2021 and a newspaper report even stated it in Figure 1.1, Figure 1.2 , Figure 1.3, and Figure 1.4 below.

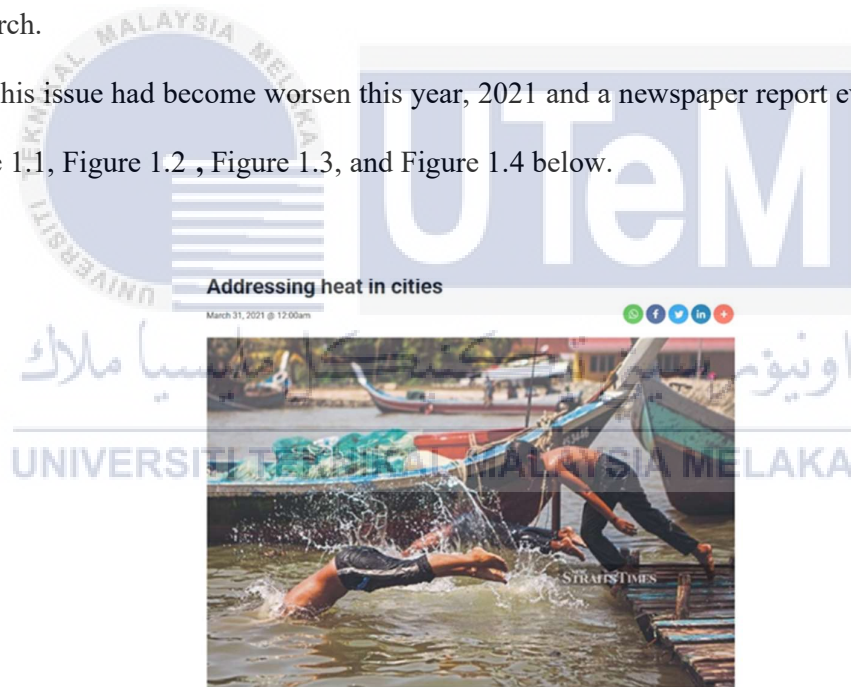


Figure 1.1 Addressing heat in cities (Ahmad, 2021).

**LETTER:** According to reports by non-governmental organisation Think City, which did a land temperature study for five cities in Malaysia, there have been increases in temperatures of between 1.640C and 6.750C over the last few decades due to development and changing urban trends.

The peak temperature increases of only 1.640C in the Kuala Lumpur city centre over a 30-year period between December 1989 and October 2019 was attributed to the efficiency of domestic gardens, parks and woodlands in the city.

Ipoh recorded a peak temperature increase of 6.750C within a 21-year period between November 1998 and March 2019, the highest temperature increases among the five cities studied.

This was due to an increase in areas with a maximum temperature range, by 245 per cent in 2019, or from 66km to 163sq km, which indicated extreme ecological change and urban trends in Ipoh.

#### MORE NEWS

- Yellow level heat wave in seven areas in Peninsula
- Pahang firemen battle forest, peat fires in three districts [NSTTV]
- Time for Malaysia to think about setting carbon neutrality target
- Volvo to help make Gothenburg climate-neutral city by 2030

It is obvious from the report that temperatures in Malaysian cities are increasing. Unless a drastic and holistic action is taken to address it, we will suffer from severe health problems related to heat, which will also lead to internal migration among the people to places that are lower in temperature.

Figure 1.2 The news on Malaysia's heat problem nowadays (Solhi, March 2021).

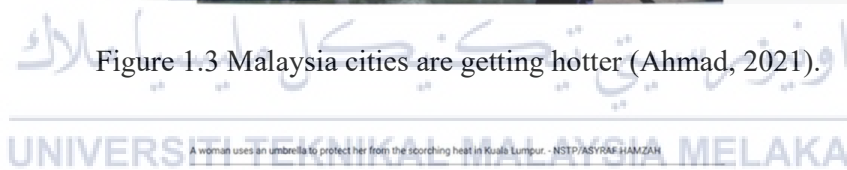


Figure 1.3 Malaysia cities are getting hotter (Ahmad, 2021).

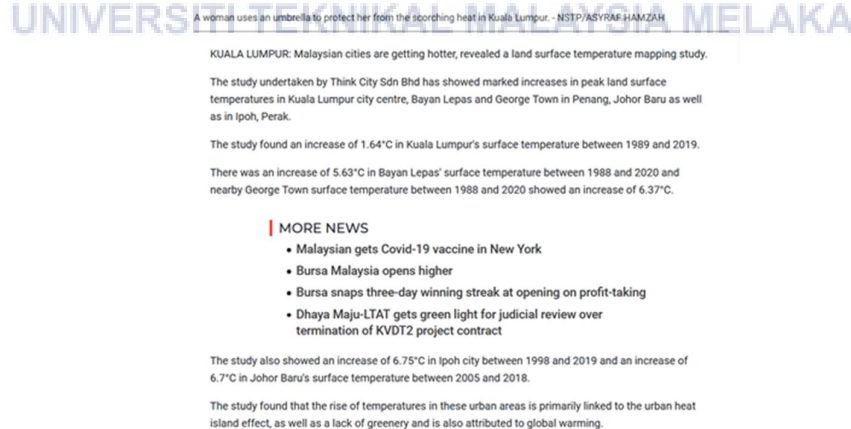


Figure 1.4 The news on Malaysia's heat problem nowadays (BENJAMIN, March 2021).