

Advanced Car Shading System

Course :

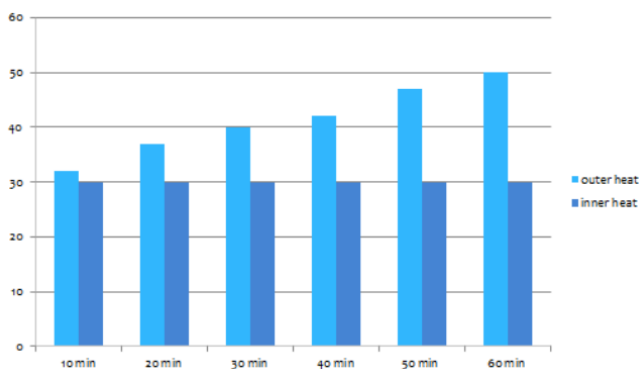
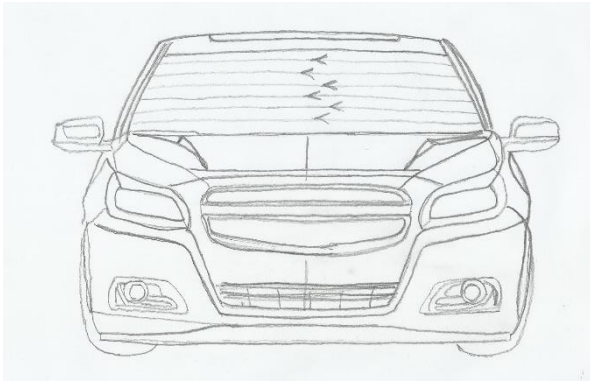
Introduction to engineering design
(GE 105)

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Introduction

More than a million vehicles a day are passing through the streets of Riyadh, according to the latest statistics of the Riyadh Development Authority the number of private cars in the capital reached 985 thousand cars.

During summer, the temperature increases significantly, causing high temperature difference between outside and inside the car. In addition, it causes the inner parts to get hot.

In general, people always keep their closed areas such as home, hospital, and malls cool during summer using AC, fans ...etc.

Living in a suitable comfortable environment is an important psychologically factor for humans. Driving the car in a high temperature is annoying and uncomfortable.

The available solutions in the market right now do not take control this problem, Most of these solutions are temporary, traditional, and not effective.

This research will create a compatible, advanced, and effective solution to help to overcome this problem.

Problem Statement:

During summer, the temperature in cars increases significantly causing high temperature in the inner parts of the car, such as steering wheel and driver seat and other parts of the car.

Figure 1 shows the difference between the temperature inside and outside the car within a duration of 60 minutes, but it only shows for a duration of 60 min. In fact, the cars are left under the sun for long period of time.

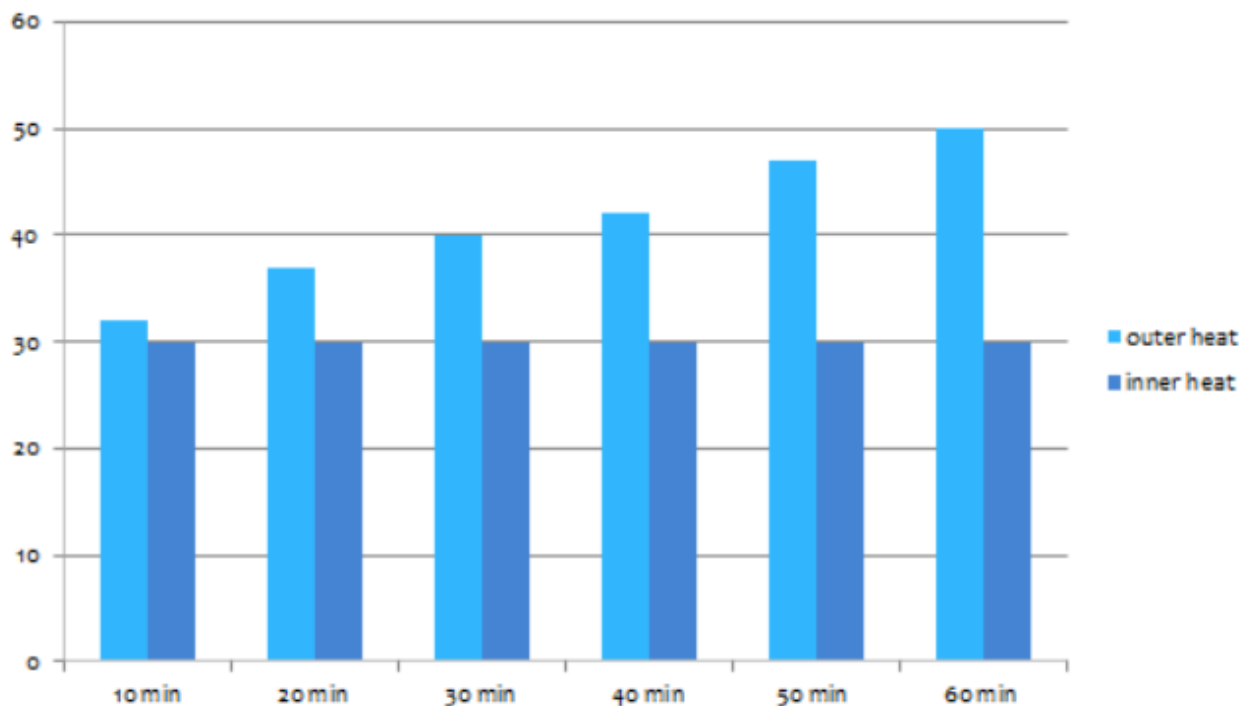


Figure 1: difference between the temperature inside and outside the car

Objectives

Primary objectives:

- The main objective is to create a new compatible system that solve and overcome the inner heat of our cars.
- Can be used in all weather seasons.

Secondary objectives:

- Ease of use
- Efficiency and low economic cost compared to competitors

Need Analysis:

1- reduce the temperature difference between inside and outside the car.

The main purpose and function of our product is all about reducing the heat and make a cool environment in hot summer inside the car.

2-Light and easy to install and use.

Since customer will use one product (one compatible system) for his car, the processes of using our product will be completely fast and easy. (it will be shown later in the “concept” part)

3-Fit and cover all the car glasses

One of the most challenges to us is how to make our product compatible to most types of vehicles, and cover every edge of the car windows . (it will be shown later in the “needed information” part)

4-Can be started automatically when turn on the car

One of main reasons to make the use of our product easy and fast: is to make it work automatically. In other words : ones the system of car shading is installed, no need to touch anything to make it work.

5-Low economic cost

Our product (car shading system) has a low cost compared to other services or devices. Don't have to pay plenty on money every summer! Our product can be used in every weather season.

6-Legal to use

product is completely legal to use. The car will not be shaded while driving or using the car.

Needed Information:

1-Knowing the annual temperature schedule.

Knowing the temperature throughout the year to extract the highest, lowest, and the average temperature. Table 1 and figure 2 show the annual temperature degrees in Riyadh city.

Table 1: annual
degrees in Riyadh

temperature

Month	Greatest	Minor
January	20.2	9
February	23	11
March	27.3	15
April	33.3	20.3
May	39.1	25
June	42.2	27.6
July	43.5	29.1
August	43.2	28.8
September	40.3	25.7
October	35	20.9
November	27.7	15.4
December	22	10.6

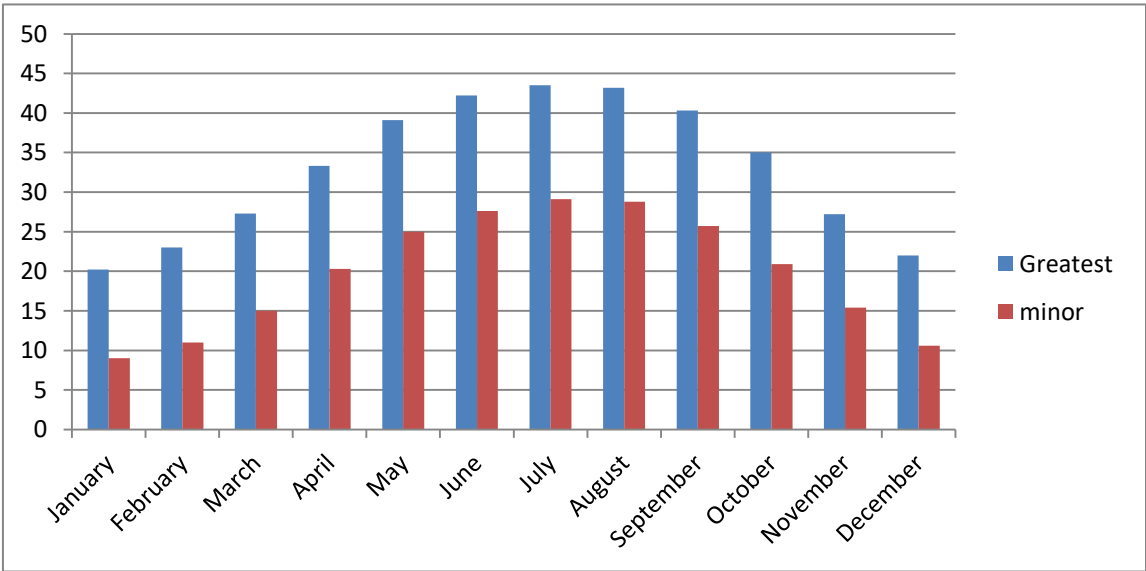


Figure 2: annual temperature degrees in Riyadh

It is important to study the annual temperature so we can put our product

under test in realistic temperature values, and determine and study the insulating percentage.

2- Study car windows dimensions and sizes:

Each car came with a different sizes and dimensions, that's mean the car windows also will be different from car to car.

Here is a study recorded the most common cars that can fit the product, and figure 3 show some examples.

1- Hatchback Cars:

Which is divided into:

- Ultracompact car.
- City car.
- Supermini/subcompact car.
- Small family car/compact car.
- Large family / mid-size.
- Hot hatch.

2- Saloons / sedans

Which is divided into:

- Large family / mid-size.
- Compact executive.
- Full size / large.
- Executive/mid-luxury.
- Full-size luxury / Grand saloon.
- Sports saloon / sports sedan.

3- Sports cars and grand tourer.

Which is divided into:

- Sports car.
- Grand tourer.
- Supercar.
- Muscle car.
- Pony car.

4- Vans and Mini Vans.



Figure 3: Examples on most common cars

3-A study on the chemical and physical properties of insulating materials

Each material has its own properties, the material needed to be considered is mentioned below, and figure 4 shows some differences.

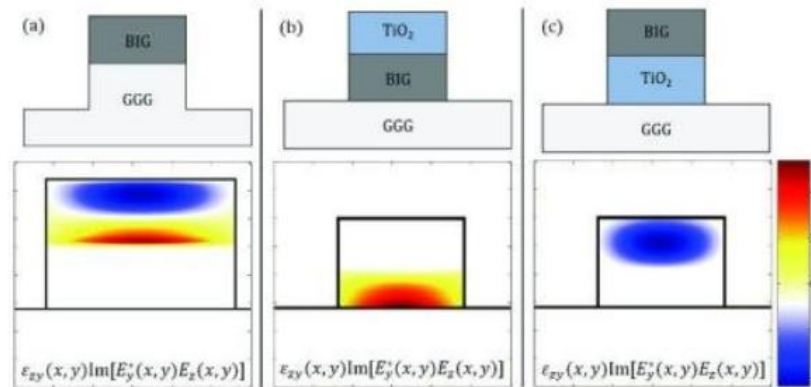


Figure 4: difference between materials.

i-Visible light transmitted

The percentage of the light entering .

ii-Total solar energy rejected

Heat isolation percentages

iii-Visible light reflected

The percentage of the light reflected

iv-UV rejection

The percentage of Ultraviolet rejected

v-Glare reduction

Ease the glare of the sun

vi-IR

The percentage of the infrared isolated.

Constraints

Ease of install and use.

Since our product will work automatically, we will make it easy to install, use, and work.

As the product needs to be professionally installed, it should be installed by someone who knows about car electricity and internal parts. Anyway, our challenge is that it is easy to be installed and won't take much time (compared with traditional shading methods).

The product will be available in car accessories shops and will be installed by the technician.

In traditional shades (figure 5), people usually don't like it because of its inefficiency and difficulty in use.

We mean by “ease of use” that most people forget to shade the front glass before leaving the car, so there is no benefit from the shading!

The product will solve the problem mentioned above. The shading system will be automatically activated as soon as the driver turns off the car. And sure when the driver goes back and turns it on, it will be activated again, and the shades will go back to its place.



Figure 5: Traditional shades

Quality and price commitment

The product is new for people, so it shouldn't be expensive for people. In addition, people should feel safe for paying money to get high quality product.

The market is full of low quality products, people got rid of it, they need something they can rely on.

Suitable size.

Taking into account the different types of vehicles and its glasses.

The product will come in different sizes to match to most car windows.

Our challenge is to make it suitable and effective at the same time.

Criteria:

1-Provide maximum heat isolation possible

By studying the chemistry and physics for each material used in heat insulation.

2-Used in all-weather seasons

Adding a heat sensor that can be adjusted is what can make our product able to work in all-weather seasons. (the use of the sensor will be shown later in “concept” part).

3-Provide the product to most types of vehicles

By studying the vehicles types we can provide the product to the most vehicles.

4-Quality commitment

can be used up to 2 years (warranty) without any problem in performance.

Problem definition:

The design will overcome the high temperature difference between outside and inside the car using this advanced system.

The design has shades that is automatically operated. When the driver turns off the car, the shades will cover the car windows and reflect sun shines and prevent it from heating the air inside the car. The shade goes back to its place when the driver turns on the car again.

The shades should be made from highly reflective to get the highest efficiency possible.

Morphological Analysis

Definition

Morphological analysis or general morphological analysis is a method developed by Fritz Zwicky (1967, 1969) for exploring all the possible solutions to a multi-dimensional, non-quantified complex problem.

Figure 6 is the Morphological analysis for the product, and shows what












Morphological analysis				
material				
	aluminum	steel	wood	plastic
power supply				
	batteries	solar cell	car battery	no power
operation				
	manual	automatic	both	

Figure 6: Morphological analysis.

options we could have.

We chose three options to compare between them as follows :

Option 1 : aluminum / car battery / both manual and automatic

Option 2 : steel / batteries / automatic.

Option 3 : plastic / no power / manual.

Professional scenario/ weight

	Manufacturability	Efficiency	ease of use	low cost	score
weight	15	35	35	15	
option 1	6	10	10	6	880
	90	350	350	90	
option 2	8	8	2	6	560
	120	280	70	90	
option 3	10	2	10	10	720
	150	70	350	150	

Best Design

Best design is options-1, which uses the car battery as a power supply, and the main parts of it is made from aluminum because it is solid and light in weight at the same time. The design can be operated either automatically or manually for best efficiency.

Human Factor:

Physiological Factor

Using the car while having a traditional car shades in night is dangerous. Also, it is illegal to use it at night in many countries.

The product is physiologically comfortable and safe to the eye of the “driver” and the passengers.

Also living in a suitable thermal environment is an important psychologically factor for humans! And driving the car in a high weather temperature is annoying and uncomfortable. One of the important functions for the product is to reduce this annoying heat inside the car.

Concept (How it works?):

The following graphs show exactly how the system (product) works:

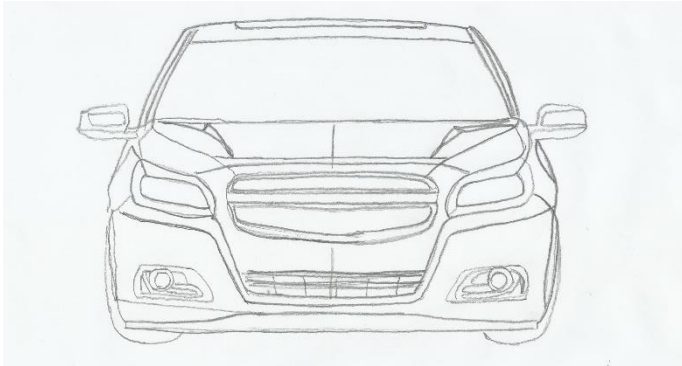


Figure 8: The car without shading system applied

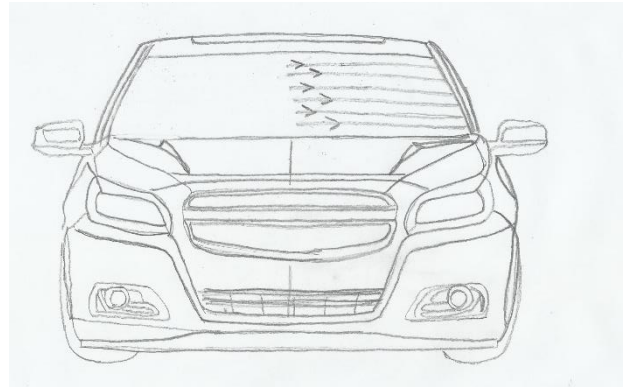


Figure 9: The shading goes back to its place after turning on the car.

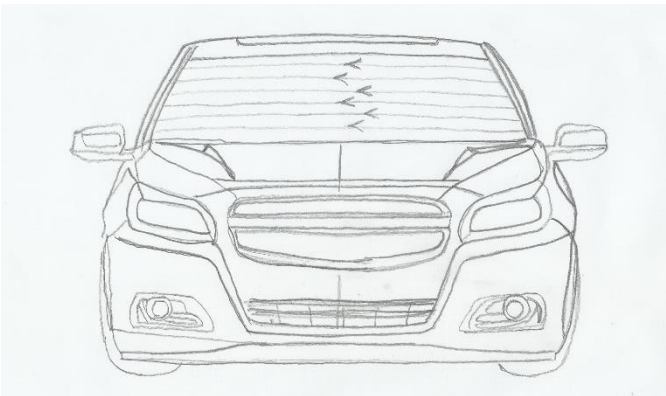


Figure 10: The shading system starts from one end and goes to the other end, after car turn off.

Conclusion:

The main purpose of the product is to reduce the inner temperature of the most types of vehicles And in the same able to be used in winter “thanks to thermal sensors”

So, our product can be used through the year in every weather season

References

- 1- [http://en.wikipedia.org/wiki/Morphological_analysis_\(problem-solving\)](http://en.wikipedia.org/wiki/Morphological_analysis_(problem-solving))
- 2- <http://www.assayarat.com/forums/t254620.html>
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