

DESIGN AND DEVELOPMENT OF AN AUTOMATIC WIPER RETRACTOR  
SYSTEM

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## APPROVAL

I hereby approve have read this thesis submitted to the senate of UTeM and have accepted this thesis as partial fulfillment of the requirements for the degree in Bachelor of Mechanical Engineering (Automotive).

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Date : 13 MEI 2008.....

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This report is submitted in partial fulfillment of the requirement for the Bachelor of  
Mechanical Engineering (Automotive)

Faculty of Mechanical Engineering  
Universiti Teknikal Malaysia Melaka

MAY 2008

## DECLARATION

I hereby, declare this thesis entitled  
“THE DESIGN AND DEVELOPEMMENT OF NEW WIPER RETRACTOR”  
is the results of my own research except as cited in the reference.

Signature : .....

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Date : 13 MEI 2008 .....

## **DEDICATION**

*To my beloved family.*

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## ABSTRACT

The project of design and development of automotive wiper retractor is divided in two parts. First part of the project is about proposal and the second part is about project implementation. This report fully describes about the combination of both part, which contains six chapters starting from introduction, literature review methodology, results, discussion and conclusion and recommendation respectively. The first chapter describes about scope and objective of the project and expected results. The main objective of the project is to develop an automatic wiper retractor which can extend when the ignition key is turned off and retract when the ignition key in turn on. The second chapter discusses about the literature review. The literature search is performed to study, analyses and design the wiper retractor. The next chapter is methodology. This chapter describes about steps or procedures that is used to complete this project. In this project the measurement of wiper load applied by the spring in measured using the force gauge. Then the clearance between the wiper and windscreen is measure using the vernier caliper. From the measurement obtained, the design of the retractor is created using CATIA software and its quality is analyzed using Solid Work (COSMOSWORK). Therefore, some experimental results are obtained and described in Chapter Four. The following chapter is discusses about the result, problems and suggestion to overcome the problems. Finally, the overall project and its achievements are concludes in Chapter Six.

## ABSTRAK

Projek Sarjana Muda yang dilaksanakan ialah merekabentuk dan menghasilkan sistem penganjal wiper kereta. System berkenaan berfungsi untuk menganjal wiper kereta secara automatik semasa suis kereta dimatikan. Sebaik sahaja suis kereta dihidupkan semula, penganjal tersebut akan menurunkan semula lengan wiper ke keadaan asal. Tujuan sistem ini adalah untuk memelihara jangkahayat getah pada wiper yg berfungsi mengilap cermin kereta. Projek ini terbahagi kepada dua bahagian, bahagian pertama ialah kajian ilmiah dan penentuan jalan kerja dan bahagian kedua ialah pengaplikasian jalan kerja untuk menghasilkan produk. Laporan ini terdiri daripada 6 bab. Bab 1 merupakan pengenalan kepada objectif tajuk dan skop. Bab 2 merupakan kajian ilmiah akan tajuk projek dan perkara yang berkait secara langsung dengan projek. Bab 3 ialah jalan kerja yang dipilih untuk menyiapkan projek penganjal wiper ini. Lagkah-langkah pelaksanaan disusun dengan teratur. Kemudian, Bab 4 menerangkan keputusan yang diperolehi melalui jalan kerja yang dilaksanakan. Keputusan disokong dengan analisis yang dibuat melalui (Solid Work) Cosmoswork. Seterusnya, Bab 5 membincangkan keputusan yang diperolehi dengan terperinci. Seterusnya, laporan diakhiri dengan kesimpulan dan idea penambah baikan yang sesuai untuk dijalankan pada masa hadapan dalam Bab 6.



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## LIST OF SYMBOL

ECU	=	ELECTRONIC CONTROL UNIT
F	=	Force
T	=	Torque
R	=	radius
T	=	time
V	=	voltage, V
I	=	current, A
R	=	resistant, Ohm
D.C	=	Direct current
$\omega$	=	angular velocity, rad/s
$\tau$	=	torque, N
P	=	Power, Watt
NO	=	Normally Open
NC	=	Normally Closed
SPST	=	Single Pole Single Throw
DPST	=	Double Pole Single Throw
DPDT	=	Double Pole Double Throw
QPDT	=	Quadruple Pole Double Throw
CATIA	=	Computer Aided Three Dimensional Interactive Application



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## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Introduction**

The main purpose of this report is to develop a wiper retractor device which can retract/extend automatically with the touch of a button/switch. Wiper is an important element in a vehicle that functions to wipe rain drop and dirt from windscreen. Wipers are also used in other vehicles, such as buses, trams, locomotives, aircraft and ships.

#### **1.2 Problem Statement**

The problem that brought the idea of developing a new wiper retractor system is the weariness of the rubber of the wiper which cleans the windscreen from moist and dirt. The rubber blade tends to lose its quality due to too much exposure to sun light. The contact between rubber and windscreen during the hot weather is the major factor for the wiper rubber to wear off and lose its property. The recommended design can be used as a bench mark to solve the problem of the rubber from wear off.

With the new system design, as the driver brings the car to a stop and turns off the ignition switch, the wiper retractor will be triggered to extend and move the wiper blade away from the windscreen. The retractor action is reversed when the

ignition key is turned on. Almost all car wipers are retracted manually by hand and it is very troublesome at times.

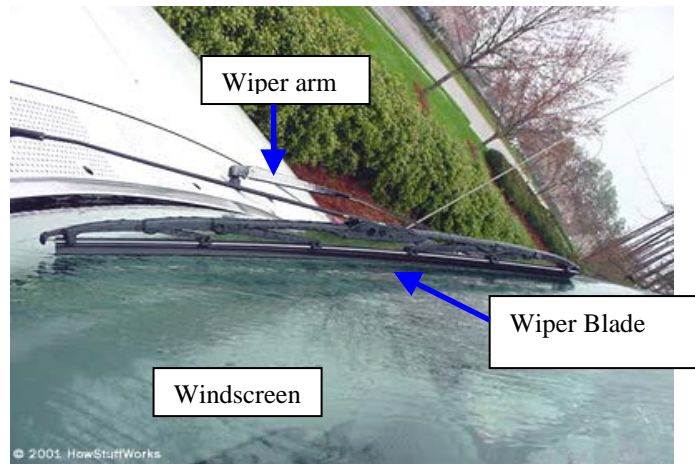


Figure 1.1: Wiper Blade

### 1.3 Objective

The objective of this project is to design and analysis new automotive wiper retractor system, which can increase the life safe of the blade from excessive exposure to heat and moist.

### 1.4 Scope

1. Design the retractor system for the wiper for passenger vehicle.
2. Modeling in CATIA/Solid Work for component involved to create the retractor.
3. Develop an electrical circuit for wiper retractor system to function effectively.
4. Perform an analytical study on critical component using COSMOSWORK.
5. Create a working model to present idea and workability of the system.
6. Recommend correct material to be used for the retractor system actual production.

## **1.5 Expected Results**

It is expected that, the product will be able to fulfill the task required. Firstly proper system is developed. Through the developed system and design of the retractor, the driver can now be able to control the wiper retractor from inside the vehicle. The time to come out of the vehicle to lift the wiper can be avoided. The rubber of the wiper is also preserved for longer time. The wiping during rainy and dusty day also becomes much more efficient.

## **1.6 Content Overview**

Chapter One describes the project aim and its scope of study. In Chapter Two, there is a complete literature study on electrical as well as mechanical system of a wiper. Chapter Three explains thoroughly about the method used to achieve the project objective and Chapter Four is the result obtained from the method used. The discussion of the product and the problem encountered is explained in Chapter Five. Conclusion and recommendation for future works are explained in the final chapter.

## **CHAPTER II**

### **LITERATURE REVIEW**

A literature search was performed to study, design and analysis the retractor system for the car wiper. It also includes the investigation of what others have done in this area. This study included the areas of electric and electronic as a guide to design the circuit for the retractor.

#### **2.1 Background of The Project**

The importance of wiper blades is not given much attention not only nowadays, but also during the first introduction of the blades. These results in many blades which are cracked split, torn, brittle, worn or otherwise in obvious need of replacement. Some may seem to be in good condition, but in fact does not perform to a good quality wiping when put to test.

Ninety percent of all driving decisions are based on a clear unobstructed view of the road, which means good visibility is absolutely essential, especially during wet weather and dusty environment. This is because vision may be obscured by water, road splash, dust, sleet or snow on the windscreen. But good visibility requires wipers that are in good condition that can wipe away the dust. If the wipers are chattering, streaking or failing to wipe cleanly and consistently, new blades should be replaced with the old ones. Most experts say wiper blades should be replaced

every six to twelve months for optimum performance and driving visibility. This is because wiper blades do not last forever due to natural rubber deteriorates over time. Halogen-hardened rubber as well as synthetic rubber provides longer life. (Dewulf, W.1999). But eventually all blade materials fall victim to environmental factors. Exposure to sunlight and ozone causes the rubber to age, even if the wipers are not used much.

Blades which have lost its flip over flexibility cannot perform the wiping task cleanly. They may develop a permanent set called "parked rubber" or curvature which prevents full contact with the windscreen (everblades.com). This tends to be more of a problem on vehicles that is parked outside in the hot sun all day. The sun bakes and hardens the rubber. Then when the wipers are needed, they streak and chatter because they have taken a set and would not follow the curvature of the windshield. It can be annoying and dangerous.

Cold weather also can affect blade life. Freezing temperatures makes rubber hard and brittle, which increases the tendency to crack and split. The wiper arm can become clogged with ice and snow, preventing the holder from distributing spring tension evenly over the blade. The blade "freezes up" and leaves streaks as it skips across the glass. (A. Koenen, 2007).

Heavy use can be hard on wiper blades too. This is because dust, abrasives, road grime and even bug juice wear away the edge that the blades need to wipe cleanly. As the blade loses its edge, water gets under the blade and remains on the glass. It results in reduced visibility and poor wiping action. Blade that is chattering, streaking or not performing well should be replaced. Blade that is cracked, torn, nicked or damaged should be replaced as well.

This project is to create a wiper retractor that operates automatically to lift and lower the wiper blade from touching the glass. This is intending to increase the life cycle of the wiper blade rubber because can avoid contact of blade with glass at hot and cold weather. So the temperature effect can be reduced.

Electrical system is used to operate this retractor. The idea is to enable the retractor to extend and retract itself as the ignition switch is turned on and off. A

direct current from the battery is used to give the power supply to the retractor. In relation to develop this system, the knowledge and understanding of the working principle of the wiper system, electrical circuit and fatigue analysis must be obtained.

## **2.2 Understanding the Wiper System**

### **2.2.1 Functional Requirements**

The requirement of the wiper system is simple. The windscreen must be clean enough to provide suitable visibility at all times. To do this, the wiper system must meet the following requirements.

- Efficient removal of water and snow
- Efficient removal of dirt.
- Operate at temperature from -30 to 80°C
- Service life in the region of 1500 000 wipe cycles
- Resistant to corrosion from acid, alkali and ozone

In order to meet the above criteria, components of good quality are required for both the wiper and washer system. The actual method used by the blades in cleaning the screen can vary, providing the legally prescribed area of the screen is cleaned. Figure 2.0 shows four such techniques. (Anthony E. Schwaller)

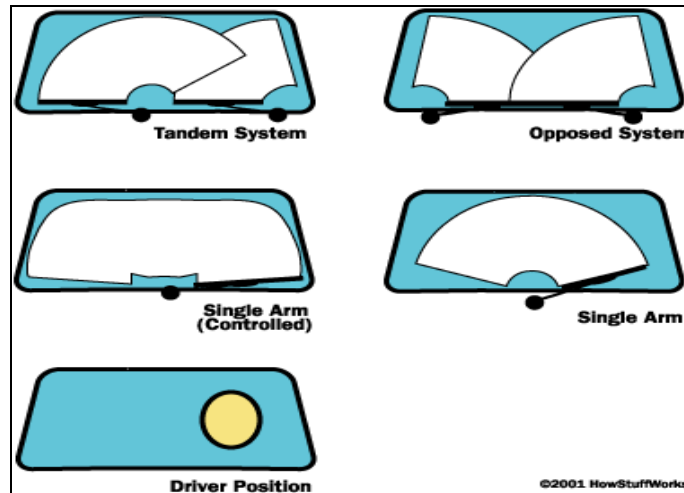


Figure 2.1: Windshield Washer Technique

(Source: howstuffworks.com)

### 2.2.2 Wiper blades

The wiper blades are made of a rubber compound and are held on to the windshield wiper glass by a spring in the wiper arm. The aerodynamic properties of the wiper blades have become increasingly important due to the design of the vehicle as different air currents flow on and around the screen area. The strip on top of the rubber element is often perforated to reduce air drag. A good quality blade will have a contact width of about 0.1mm. The lip wipes the surface of the screen at an angle of about 45°. The pressure of the blade on the screen is also important as the coefficient of friction between the rubber and glass can vary from 0.8 to 2.5 when dry and 0.1 to 0.6 when wet. Temperature and velocity will also affect these figures. (Total Automotive Technology, Anthony E. Schwaller).

There are two type of wiper blade which is rubber and silicone. Wiper blades are like squeegees. The arms of the wiper drag a thin rubber strip across the windscreen to clear away the water. When the blade is new, the rubber is clean and has no nicks or cracks. It wipes the water away without leaving streaks. When the wiper blades are old, nicks or cracks form, road grime builds up on the edge and it does not make as tight a seal against the window, so it leaves streaks. A little extra