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STUDY OF THE EFFECT OF VARIABLE SPEED FAN ON THE RADIATOR COOLING SYSTEM

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This report is presented in

Partial fulfillment of the requirements for the

Degree of Bachelor of Mechanical Engineering (Automotive)

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"I declare this report is on my own work except for summary and quotes that I have mentioned its sources"

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To all that helped me:

Thank you very much

ACKNOWLEDGEMENT

First, I would like to express my greatest gratitude to Almighty Allah for giving me a chance to complete my project with all His blessings. I would like to acknowledge my project supervisor, Mr. HerdyRusnandi. The fundamental idea of this project is his and he was a valuable source of information about this project. I am very thankful that he supervised my work and provided my with the much needed assistance in understanding the project. Without his guidance and support, I may not be able to achieve the goals of this project.

To all my lecturers who had thought me this far, very special thanks to them. To all my friends who gave their support to construct my project. Also to any website, to their web inventor, special thank you on providing all data and knowledge far my project.

Finally, I would also like to thank both my parents, En. AwangZainal B Pg. Tajudin and Mdm. HalimahBtePiut for their lifelong encouragement. Without their support and confidence in me, I won't have made until this far.

Abstract

Objective of this project is to study the effect of variable speed fan on the radiator cooling system and to archive the optimum temperature of engine. Over excess heat from the engine will damage the equipment around the engine. The process conditions demand adjustment of flow from fan radiator, varying the speed may save energy compared with on/off switch technique for flow control. In this project, functions of variable speed fan and its effect can be determined. By changing the on/off system into variable speed fan, we can control the temperature of the engine. Therefore, experiment conducted based on PeroduaKancil cooling system. Conclusion of this project is the RPM of radiator fan increasing with temperature of engine.

Abstrak

Tujuan projek ini adalah untuk mengkaji kesan yang berlaku jika menggunakan kipas radiator yang berubah mengikut suhu enjin dan mendapatkan suhu yang optimum dalam enjin. Suhu yang melampau akan merosakkan peralatan yang berada sekitar enjin.Dalam eksperiment ini, fungsi dan kesan menggunakkan kipas radiator yang berubah dapat ditetapkan.Dengan menukar sistem on/off yang ada sekarang dengan sistem berubah-ubah pada kipas penyejuk, suhu pada enjin dapatdikawal.Eksperimen yang dijalankan berkisar dalam model sistem penyejukan bagi keretaPerodua Kancil.Graf yang diperoleh selepas menjalani eksperimen ialah RPM kipas berkadarlangsung dengan suhu pada enjin.

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Symbol 1	MCU	= microcontroller
Symbol 2	SHT	= sensor heat temperature
Symbol 3	V	= voltage
Symbol 4	BLDC	= brushless direct current
Symbol 5	ROM	= read-only-memory
Symbol 6	^{0}C	= degree Celsius

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CHAPTER I

INTRODUCTION

1.1 Introduction of the project

The car radiator fan is a technology that has been around almost since automobiles were invented. Cooling system is one of the most important considerations in engine design. Electrical fan is one of type and many new cars are taking advantages of electrical cooling fans because of their smaller engine compartments and greater airflow demand. It is well known that an engine can cool itself at cruising speeds of roughly 60 miles/hour or 96.6 km/hour in an average climate. If we compare with other method, the electrical fan give much benefits like noise is reduced, horsepower is gained, mechanical water pumps last longer, and more efficient low speed cooling.

1.2 How it works.

The fan is powered by an electric motor, which is wired to a relay. The relay is a magnetically controlled switch. It typically has 4 terminals, two of which are current feeds from a fused source of 12-volt electricity. At the relay has one current feed into an electromagnetic coil, and one feed into a set of contacts for the switch, which is open.

The other terminal is for open switch where is connected to the electric motor for the fan. The last terminal, also for the coil, is wired to the PCM, which may take at various signals to determine whether or not to provide an electrical ground for that coil. If, as in this example, it gets a high-temperature signal from the coolant temperature sensor, also wired to it, the PCM can choose to ground the coil terminal. This energizes the coil, creating a magnetic field that pulls the arm on the power feed contact, so that it touches the terminal for the wire to the electric motor. That closes the switch of the relay. Current flows through the closed contacts of this switch to the electric motor, which spins to operate the fan.

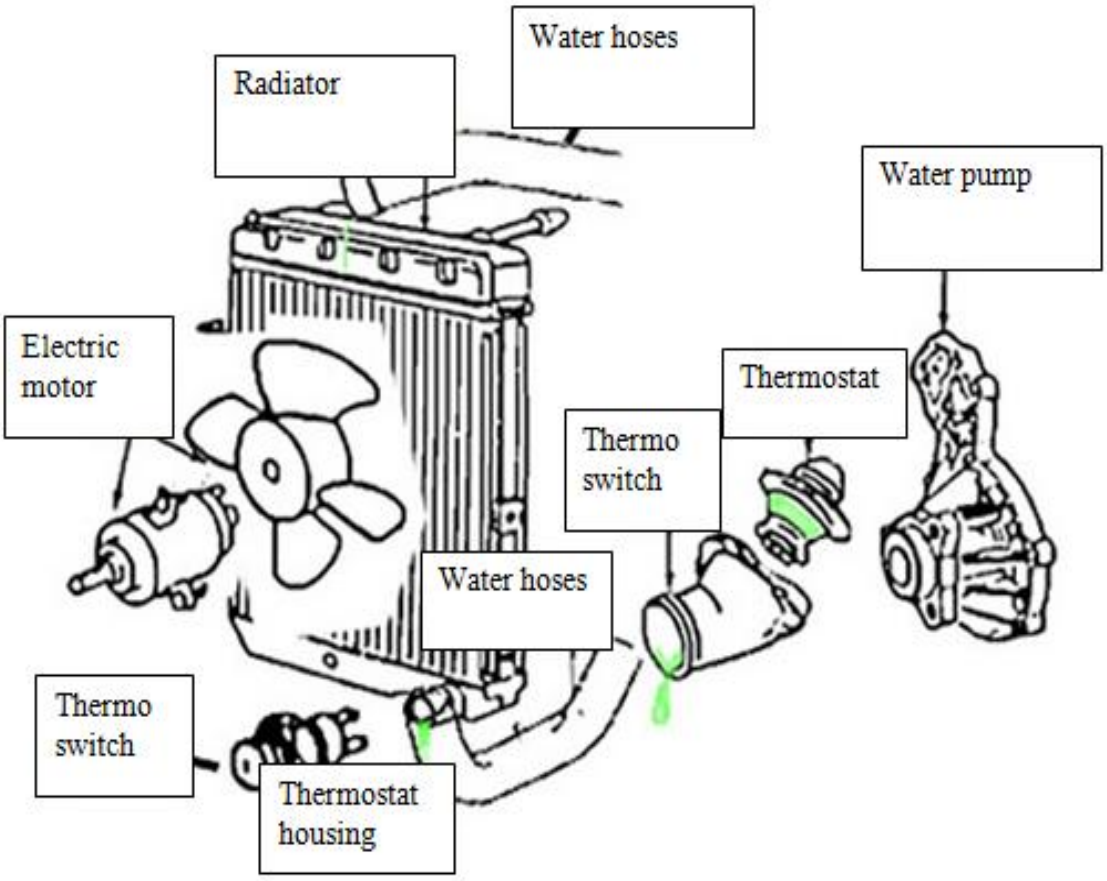

Figure 1.2.1 Engine cooling schematic

1.3 Problem statement

In design of an electrical variable speed fan on the radiator cooling system for cooling engine, the major literature must be sure know like the study the basic function on how the system will be.

A simple model of cooling system with variable speed fan radiator must be design to study of the effect. Thus, the following question regarding what is the problem that occurs in this project;

1) How the system operates and their performance.
2) Why variable speed fan is used.
3) What is the factor involve design development.

1.4 Objective of the project

This project is mainly about study of the effect of variable speed fan on the radiator cooling system. As formally know, our cooling system in car is now using on off switch.

The objective of the study is based on the problem statement.

1) To determined functions of variable speed fan and its effect.
2) To develop a small scale model of cooling system and to get ambient temperature.
3) To study the specification that been use to increase the performance of the fan design.

1.5 Scope of study

The title of this project is to study of the effect of variable speed fan on the radiator cooling system. Therefore, the scope of this project is related to:

1) Understand the basic principle of cooling system and the effect using variable speed fan radiator.
2) Relation between output heat and fan speed.
3) Understand how its work.

Radiators are used for cooling internal combustion engine. They operate by passing a liquid coolant through the engine block, where it is heated, then through the radiator itself where it loses this heat to the temperature. The coolant is usually water-based, but may also be oil. It's usually for the coolant flow to be pumped, also for a fan to blow air through the radiator. Other factor influence the temperature of the engine is the type of radiator fan. The size of the radiator is chosen such that it can keep the engine at the design temperature under the most extreme conditions of a vehicle.

Airflow speed from the fan through the radiator is a major influence on the heat it loses. Cooling fan which driven by the motor and the additional airflow from vehicle speed also effect the temperature of the engine. On this case, we have considered the electric fans which are controlled by a thermostatic switch or the engine control unit. Electric fans have the advantage of giving good airflow and cooling at low engine revs or when stationary, such as in slow-moving traffic.

First component among cooling system is the water pump. The water pump is function to pump the coolant through the system. The pump is belt driven, except in the case of some modified race cars that need fast cooling system and more efficient, they use electric water pump. Next is the radiator hose, which in every cooling system has a number of rubber hoses that move the fluid from one place to another. These need to be replaced before they become brittle and cracked. Then is the thermostat and the thermostat function when the car engine isn't always at same temperature. When you start engine in the morning, it will get warm quickly. If stopping during rush hour, it must cool off. The thermostat controls the flow of coolant so it cools down more or less depending on the temperature of the coolant. It rests in housing just after the radiator bottom hose.

The radiator is the most prominent part of the system. Coolant that has traveled through the engine is pumped through the tubes of the radiator and is cooled off for another round. The radiator fan has 4 or more blades that spin rapidly to provide sufficient air that would cool the engine. It is usually mounted between the radiator and the engine so that the air can easily get to the radiator.The fan draws air through the radiator when you aren't moving fast enough to get things cooled down. Then is thermo-time switch also known as the fan switch. This is the temperature sensor that tells the electric fan when to blow.

In my project, I will change the on/off method into variable speed fan. In additional, I'll add microcontroller (MCU), sensor heat temperature (SHT) and maybe changing the fan motor for better result.As the engine burns the air and fuel mixture, it produces much heat causing its parts to get so hot. To avoid damage to the engine system, the cooling system removes extra heat from the engine. By this, it's allowing it to work at the most efficient temperature.

The cooling system is composed of various parts including the radiator. Then, the coolant will absorb the heat from the engine and cooled as it transfers it heats to the air that goes around the tube of the radiator.

Similarly to others, the radiator just won't work by its own, it has supporting parts that help it perform its function efficiently. In order for the radiator to cool the water and the coolant mixture that went through the engine, it needs air that would absorb the heat. Air passes through the grill but however it is never enough to cool down the engine. Therefore, a radiator fan is used to draw the air towards the radiator and help in the cooling process.

There are a lot of important component in the cooling system. All of the parts that make up the cooling system have one goal of moving coolant around the engine so it can absorb and dissipate heat. The basic system is made up of the following component:

1) Radiator
2) Radiator top hose
3) Radiator bottom hose
4) Water pump
5) Thermostat
6) Thermostat housing
7) Electric cooling fan
8) Thermo-time switch

Radiator = the radiator is the most prominent part of the system. Coolant that has traveled through the engine is pumped through the tubes of the radiator and is cooled off for another round. The radiator fan has 4 or more blades that spin rapidly to provide sufficient air that would cool the engine. It is usually mounted between the radiator and the engine so that the air can easily get to the radiator.

Radiator Hoses = every cooling system has a number of rubber hoses that move the fluid from one place to another. These need to be replaced before they become brittle and cracked.

Water Pump = the water pump function to pump the coolant through the system. The pump is belt driven, except in the case of some modified race cars that need fast cooling system and more efficient, they use electric water pump.

Thermostat = car engine isn't always at same temperature. When you start engine in the morning, it will get warm quickly. If stopping during rush hour, it must cool off. The thermostat controls the flow of coolant so it cools down more or less depending on the temperature of the coolant. It rests in housing just after the radiator bottom hose.

Electric Cooling Fan = the fan draws air through the radiator when you aren't moving fast enough to get things cooled down.

Thermo Time Switch = also known as the fan switch. This is the temperature sensor that tells the electric fan when to blow.

Adjustable speed or variable-speed describes equipment used to control the speed of a mechanism. The process conditions demand adjustment of flow from fan radiator, varying the speed may save energy compared with on/off switch technique for flow control. In variable speed, the speed of fan may be selected from several different pre-set ranges. The output speed can be changed without step over a range. Ex: using on/off switch= 0-10 speed. Using variable speed switch = 0-2-4-6-8-10 speed which it changes increase and decrease from one level to another according to temperature of the engine.

CHAPTER II

LITERATURE REVIEW

2.1 Literature review

In this project, we must get some information that can help to learn more knowledge on the main point that must include to this project. So any information that is related to the scope of the project must be considered.

2.2 Theory

A fan is typically a mechanical device that causes a movement of air, vapor & other gases in a given system. The conventional type of fan used with engines for cooling the water has certain disadvantages and hence alternative systems have been devised recently to overcome these drawbacks.

It may be mentioned that the cooling fan is only essential when the engine is operating when the vehicle is at rest or it is moving at slower speeds of the order of 25-30 km per hour. When the vehicle is running at higher speed, there is sufficient flow of air through the radiator to maintain the temperature of the circulating water at its correct value. Hence, at this stage, the operation of the fan is not necessary.

With the conventional type of belt-driven fan, the horsepower required to operate it increases with the engine speed, thus causing loss of power. In order to avoid this, the fan can be driven by an electric motor. This motor is switched on and off by a thermostatically controlled switch.

Reducing the operating speed of a system cooling fan only saves power, but also extends the operating life of the fan and lower acoustic noise. Fan speed can be controlled by sensing the ambient temperature in the system enclosure and reducing the fan supply voltage unless a temperature rise is detected. A previous design by Don Alfano ("Fan Speed Control Adjusts to Temperature," ELECTRONIC DESIGN, Analog Applications Issue, Nov. 18, 1996, p/83) for a 12-V brushless DC fan used a linear-voltage-regulator approach to provide fan voltages range from 6-12V.