Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF MICROCONTROLLER BASED REAL TIME MONITORING AND TEMPERATURE CONTROL IN VEHICLE APPLICATION

IZZUL IDLAN BIN MAZLAN

Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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Tajuk Projek : Development Of Microcontroller Based Real Time Monitoring And Temperature Control In Vehicle Application

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Tarikh: 13th January 2023

Tarikh: 1st February 2023

DECLARATION

I declare that this project report entitled "Development Of Microcontroller Based Real Time Monitoring And Temperature Control In Vehicle Application" 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 : Izzul

Student Name : Izzul Idlan bin Mazlan

Date : 13th January 2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

Signature : ....

Supervisor Name : Dr. Fara Ashikin binti Ali

Date : 13th January 2023

Signature : ....

Co-Supervisor Name (if any) : ....

Date : ....

DEDICATION

To my beloved parents Mr. Mazlan bin Mudaker and Mrs. Idayu binti Shamsudin,
Thank you for providing all the encouragement you have never given up.

To my supervisor Dr. Fara Ashikin,
Thank you for all your untiring guidance and assist. Your patience, support and words of encouragement gave me great strength to accomplish this project.

To all my friends,
Thank you for your opinion and motivations

ABSTRACT

In most situations, each vehicle including car has a cooling system. In a cooling system, a radiator is an important component to maintain the temperature of an engine. There are two different types of radiator fans which are mechanical fans and electrical fans. Belt-driven fan and clutch fan are two names that are occasionally used as mechanical fan. The mechanical fan slows when the vehicle does. This might happen in a traffic jam or if the engine is idling while waiting for the green light. Due to a lack of airflow while the car is moving slowly, the engine might be overheated. They degrade the performance of the car. Nowadays, electrical radiator fans are currently capable of resolving mechanical radiator fan issues but it still using a thermostat. A thermostat is used to regulate the fan. However, there has been situations when the electrical fan thermostat stuck due to corrosion which caused the fan running continuously or not spinning. Therefore, several systems have been proposed to overcome the issue. In this paper, a vehicle real-time temperature monitoring and control have been proposed. In this system, Arduino Uno, temperature sensor, LCD display, keypad and DC fan are utilized as the main hardware, while Arduino Uno and the Arduino IDE as software to write and upload computer code to the physical board. The temperature sensor is attached to the coolant, and once it does, the DC fan will begin to spin. User able to set the desired temperature for the engine, so that the DC fan start to spin. The air from the DC fan will decrease the temperature of engine. As a result, circuit has been constructed and simulation has been done. By implementing this system to the car engine, user able to know their engine temperature in real time and take action if necessary. Experiment results show an average of 4.12 minutes is taken to cooldown the coolant mixture to less than 45 °C. The experiment also demonstrates that a DC fan can save 48.88% of the cooling time required to cool down the coolant mixture. Lastly, the experiment results show that the DC fan with an average speed of 3193 rpm is stable and acceptable to be used in all experiments.

ABSTRAK

Dalam kebanyakan situasi, setiap kenderaan termasuk kereta mempunyai sistem penyejukan. Dalam sistem penyejukan, radiator merupakan komponen penting untuk mengekalkan suhu sesebuah enjin. Terdapat dua jenis kipas radiator yang berbeza iaitu kipas mekanikal dan kipas elektrik. Kipas dipacu tali pinggang dan kipas klac adalah dua nama yang kadangkala digunakan sebagai kipas mekanikal. Kipas mekanikal menjadi perlahan apabila kenderaan bergerak. Ini mungkin berlaku dalam kesesakan lalu lintas atau jika enjin melahu sementara menunggu lampu hijau. Disebabkan kekurangan aliran udara semasa kereta bergerak perlahan, enjin mungkin menjadi terlalu panas. Mereka merendahkan prestasi kereta. Kini, kipas radiator elektrik pada masa ini mampu menyelesaikan masalah kipas radiator mekanikal tetapi masih menggunakan termostat. Termostat digunakan untuk mengawal selia kipas. Walau bagaimanapun, terdapat situasi apabila termostat kipas elektrik tersekat akibat kakisan yang menyebabkan kipas berjalan secara berterusan atau tidak berputar. Oleh itu, beberapa sistem telah dicadangkan untuk mengatasi masalah tersebut. Dalam kertas ini, pemantauan dan kawalan suhu masa nyata kenderaan telah dicadangkan. Dalam sistem ini, Arduino Uno, sensor suhu, paparan LCD, pad kekunci dan kipas DC digunakan sebagai perkakasan utama, manakala Arduino Uno dan IDE Arduino sebagai perisian untuk menulis dan memuat naik kod komputer ke papan fizikal. Penderia suhu dilekatkan pada penyejuk, dan apabila ia berlaku, kipas DC akan mula berputar. Pengguna boleh menetapkan suhu yang dikehendaki untuk enjin, supaya kipas DC mula berputar. Udara dari kipas DC akan menurunkan suhu enjin. Hasilnya, litar telah dibina dan simulasi telah dilakukan. Dengan melaksanakan sistem ini kepada enjin kereta, pengguna dapat mengetahui suhu enjin mereka dalam masa nyata dan mengambil tindakan jika perlu. Keputusan eksperimen menunjukkan purata 4.12 minit diambil untuk menyejukkan campuran penyejuk kepada kurang daripada 45 °C. Percubaan juga menunjukkan bahawa kipas DC boleh menjimatkan 48.88% masa penyejukan yang diperlukan untuk menyejukkan campuran penyejuk. Akhir sekali, keputusan eksperimen menunjukkan bahawa kipas DC dengan kelajuan purata 3193 rpm adalah stabil dan boleh diterima untuk digunakan dalam semua eksperimen.

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V	-	Voltage
A	-	Ampere
Ω	-	Resistor
mm	-	Millimeter
°C	-	Degree Celcius

LIST OF ABBREVIATIONS

Approx	-	Approximately
Max	-	Maximum
Min	-	Minimum
Temp	-	Temperature
IDE	-	Integrated Development Environment
LED	-	Light Emitting Diode

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

In most situations, the component that makes up engine cooling system is a radiator fan. Mechanical and electrical radiator fans are the two types of radiator fans. Belt-driven fan or clutch fan are another name for mechanical fans. The fan speed was adjusted in accordance with the engine speed.

The mechanical fan has an issue that it operates slowly whenever the car slows down. This could happen if the car is delayed in a significant traffic jam or if the engine remains idle while waiting for the green light. The reason for this is that there is no working ventilation system when the car is in a slow condition, the temperature of the engine has the potential to exceed the temperature at which it should be operating, which can result in the engine overheating and causing damage.

An engine that is running too hot might result in a variety of issues, including leaving the car unusable and costing a lot of money to fix. It would be a problem when driver need to check the engine temperature gauge to ensure that the engine is at its optimum temperature, in particular when stopping at a traffic signal or when caught in a traffic congestion. When the engine is operating at low rpm, the belt-driven fan doesn't always circulate a sufficient amount of air to effectively cool the engine.

Currently, electrical radiator fans can solve mechanical radiator fan difficulties. The majority of the fans are controlled by a thermostat. The thermostat serves as a switch, opening or closing the valve that allows coolant to flow into the radiator and operate the electrical fan. Although an electrical fan could solve the problem, there have been situations when the electrical fan thermostat has become stuck due to corrosion, causing the fan to run continuously and exhausting the car batteries.

So implementing a microcontroller-based fan that does not need a thermostat is one method to overcome these issues. Furthermore, the system's versatility is increased because the user or driver can choose the turn-on temperature based on their preference.

1.2 PROBLEM STATEMENT

A radiator fan circulates cooler air through the radiator to reduce coolant temperature and dissipate heat generated by the car engine. Obviously, the engine produces heat when it is running. That heat must be dissipated in order for the engine to avoid overheating or becoming excessively hot. Cooling air is drawn via the radiator by the radiator fan. Cooling fan, which are located between the radiator and the engine, are especially useful when the automobile is stationary or travelling at too slow a speed to force air through the grille.

Generally, there are two types of radiator fan used in vehicle for cooling which are mechanical and electrical fan. The mechanical fan speed is adjusted by the vehicle’s engine speed that may result the engine overheat as the vehicle moves slowly. Besides, the electrical fan operates by using thermostat which acts as a switch to open or close a coolant valve. However, there is a case that the thermostat unable to functions properly due to corrosion, hence result overheating of the vehicle’s engine.

Therefore, this work proposes a microcontroller based temperature control in vehicle application

1.3 PROJECT OBJECTIVE

The goal of this project is to create, develop, and implement a smart technology that can do the following:

i. To develop a device for monitor vehicle’s temperature in real-time

ii. To develop a device that control the vehicle’s temperature

1.4 SCOPE OF PROJECT

The scope of this project is to develop microcontroller based real-time monitoring and temperature control in vehicle. This project is focus on the working principle of car’s engine cooling system especially car that using belt-driven or clutch fan. Because the project's purpose is to improve the car cooling system, understanding how it works, where the system's weak points are, and which elements may be improved is critical. Basically, the brain of project would be a microcontroller. There are various types of microcontrollers available including Arduino, Raspberry PI, PIC microcontroller, and others. This microcontroller's programming language may differ from one another; there are numerous programming languages that can be utilised, including C, C++, and assembly language. For this project, choosing the suitable microcontroller is very important. A study need to be made on which type of microcontroller would come in handy considering the amount of input and output provided, the programming language used and the ease of compiling the code into the microcontroller. The appropriate sensors for monitoring temperature among the main criteria to consider in this project. The prototype was supposed to achieve the project’s objective. As a result, selecting the appropriate components will result in the achievement of the goal.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter gives a brief overview of the project and an overview of the most important parts. This chapter also talks about the academic and journal papers that have already been found and looked over for this project.

2.2 SYSTEM IN A MODERN CAR

Nowadays, a modern vehicle is made up of various elements and components that all combine to form a vehicle. These pieces and components are grouped together to execute various responsibilities. These groups are called system in a car. The modern vehicle is made up of various systems, some of which operate together to fulfil a bigger, sometimes more complex purpose and others which act independently to complete a specific duty. Hundreds of individual components all work in perfect harmony. Despite the fact that each system interacts directly with one or more other systems, the tasks that each performs alone are highly specialized and critical to a car's performance, safety, and overall health. Therefore, there are several major systems that make up the modern vehicle.

2.2.1 ENGINE SYSTEM

The car's main source of power is the engine. This is the process of converting chemical energy into mechanical energy. According to [1] , Internal Combustion Engine (ICE) is the most common form of engine. Internal combustion engines, which insert into the cylinder that spark and transform the resulting heat energy into a force that causes motion, are found in the majority of modern cars nowadays. This engine uses an air and fuel mixture to move a series of pistons and connecting rods, which in turn move a crankshaft, producing a continuous rotational motion with which to power the vehicle and other components. Lubrication and cooling systems are also part of the engine system. The cooling system keeps the engine at a safe operating temperature, while the lubrication system keeps all of the moving parts lubricated for a long life span. Figure 2.1 shows the basic component in a car engine.

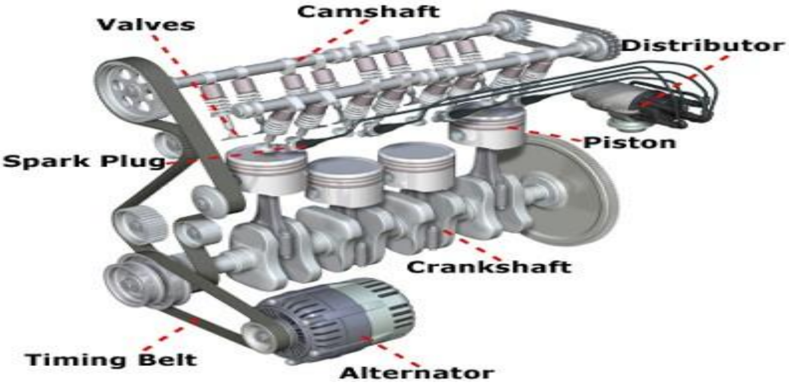

Figure 2. 1 Basic component in a car engine [2]

2.2.2 FUEL SYSTEM

The purpose of the fuel system is to store and deliver fuel to the engine. Early automobile fuel systems were entirely mechanical, delivering gasoline via a mechanical fuel pump and atomizing and mixing the fuel with air via a carburetor. The majority of today's systems are either electronically controlled or monitored. The Evaporative Emission System, which stores raw gasoline vapours that would otherwise be released to the atmosphere before being pulled in and burned in the engine under normal operating conditions, may also be included in the fuel system [3]. Figure 2.2 illustrates the car fuel system.

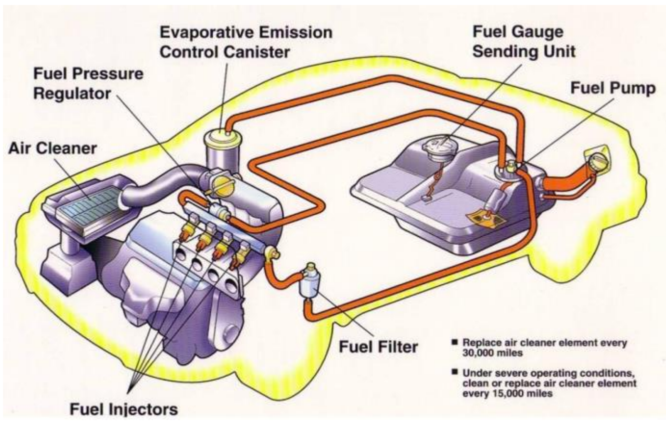

Figure 2. 2 Car fuel system [3]