UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CONVERSION OF CARBURETTED ENGINE TO FUEL INJECTION SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Sejak abad ke-21, enjin karburetor telah digunakan untuk pelbagai jenis kenderaan terutamanya kereta dan motorsikal. Karburetor adalah komponen utama yang digunakan sebagai sistem penghantaran bahan api untuk enjin automotif. Walaupun kos rendah, enjin karburetor mempunyai beberapa kelemahan seperti penggunaan bahan api yang tinggi, pelepasan asap berbahaya dan kecekapan operasi yang rendah. Suntikan bahan api elektronik (EFI) telah dicipta untuk mengatasi masalah tersebut. Sistem EFI dibuat untuk meningkatkan kecekapan bahan api dan mengurangkan perlepasan asap yang berbahaya. Sistem EFI dibahagikan ke dalam dua (2), iaitu liang suntikan bahan api (PFI) dan suntikan petrol terus (GDI) bagi motorsikal. Komponen utama bagi sistem EFI, contohnya, Unit Kawalan Elektronik (ECU), Kapasitor Melaksanakan Pencucuhan (CDI), pam minyak, badan pencekik dan sensor, penyuntik bahan api, pancarongga pengambilan, talian bahan api bertekanan tinggi dan abah-abah pendawaian. Setiap komponen perlu disambungkan kepada ECU bagi mendapatkan perjalanan sistem yang betul. Sensor akan memberi isyarat kepada ECU dan mentafsirkan data sebelum membuat sebarang keputusan. Sebagai contoh, jumlah campuran udara dan bahan api yang diperlukan akan dikira sebelum ia masuk ke dalam kebuk pembakaran dan tindakan serta keputusan dilakukan berdasarkan prestasi motosikal. Penukaran suntikan bahan api elektronik telah memberikan hasil yang baik. Selepas proses penukaran, motosikal telah diuji dan ia lulus semua dalam ujian yang telah dijalankan bagi tiga (3) operasi berbeza.

ABSTRACT

Since 21st century, the carbureted engine has been used for many type of vehicle especially cars and motorcycle. Carburettor is a main component that used as a fuel delivery system for automotive engine. Even though the cost is low, carbureted engine has some disadvantages such as, it is high fuel consumption, hazardous emission and low operating efficiency.

Electronic Fuel Injection (EFI) has been invented to overcome the problems. The EFI system is made to improve the fuel efficiency and decreasing the hazardous emissions. The EFI system was divided into two (2), Port Fuel Injection (PFI) and Gasoline Direct Injection (GDI) for motorcycles. The main components for EFI system were, Electronic Control Unit (ECU), Capacitor Discharge Ignition (CDI), Fuel pump, Throttle body and its sensor, Fuel injector, Intake manifold, High pressure fuel line and wiring harness. Each of the components needs to be connected with the ECU to properly operate. The sensors will give a signal to the ECU and interpreted the data before it making any decision. For example, the amount of air and fuel mixture needed to be calculated before it enters into the combustion chamber and the action will based on the motorcycle performance. The conversion that has been made gave a good result. After the conversion process, the motorcycle has been tested and it passed all the run testing for three (3) different operations.

DEDICATION

I would like to dedicate this thesis to my beloved family especially my parents Mr. Hj. Ramli bin Hj Hambali and my mother Mdm Hjh. Rosemini binti Joji for supporting me and give me strength to finish this thesis very well. I am also would like to give an appreciation to my supervisor, Mr. Adnan bin Katijan, friends and those people who have guided and inspired me throughout my journey of education.

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LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
1	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

CHAPTER 1

INTRODUCTION

1.1 Background

Carburetor is the mechanical device which mixes up the gasoline and air together in proper ratio for internal combustion engine. Carburetors have generally supplanted in the automotive especially in cars, motorcycles and to a lesser extent, flight businesses by gasoline injection. It is still used in conventional small engines for a lot of machine, transportation and other equipment. However, the carburetor has the disadvantages such as high fuel consumption, hazardous emission and low operating efficiency.

Spark ignition engine is a system where fuel is either blended with the air preceding the admission stroke or not long after inlet valve closure and an electric start to ignite the air-fuel mixture. The air fuel proportion is the primary and critical variable that we should concentrated on to control the emissions. The air fuel proportion for the internal ignition motor is controlled by the fuelling system which is either via carburettor system and the air fuel injection system.

Thus, the EFI technology is implemented to improve the fuel economy and decreasing motor out contamination emissions. ECU which controls the EFI system also controls the injection system by special projects as per the estimation and examination of the contributions of different sensors. Be that as it may, the advanced fuel injection motorcycle's ECU costs are very high and utilize the utilization of lock up table stand complex numerical calculations.

The proposed of installation for fuel injection system includes three fundamental parts motor's system, port fuel injection (PFI) and ECU. The system is focused to work with the current carbureted motorcycles, case, the carbureted bike is modified with the fuel injection component by replacing the carburetor and complex parts while holding all the conventional components and electrical systems.

There are some findings and the previous challenges of the previous study for the fuel injection system. It is said that the additional cost of the FI system should not give an increment in total cost of automobile. Besides, it is also said that, the lower power of fuel pump must be use and small enough to fit into the fuel tank and the vaporization of the fuel must be forestalled because of higher encompassing temperature around the air-cooled motor. More than that, the FI system components must be sufficiently minimal in size to fit into the small bikes and it must have the ability to work by a kick-start when the battery is totally released (Mohd Faisal Husim 2012).

1.2 Problem Statement

In the 21st century, the usage of the transportation is huge. With the continuous increasing of the fuel prices, small-engine transportation especially the motorcycles is becoming more and more popular. The motorcycle is very popular vehicle transportation due to its mobility and convenience and high power to weight ratio which gives the good fuel economy compare to cars. Most of the motorcycles in the developing country use the carburettor system as the fuel delivery system especially for the models with the cubic capacity less than 125cc.

Even though the EFI technology had been invented and implemented in the certain motorcycle models, most of the people still preferring using the carburettor motorcycle with the small cylinder gasoline engine because the price is lowest and can be affordable for most of the people and also the low cost in the maintenance.

However, the small gasoline fuelled engine operators with the carburettor suffer from the low-operating efficiency, high fuel consumption and high level of hazardous emissions. The increased of the carburetted motorcycles had result the serious air pollutions and health problems related to humans.

Among these variables, the low operating efficiency that will produce less power on the engine is the main and important variable that we must focus besides the air-fuel consumption and how to control the emissions. The air fuel ratio for the internal combustion engine is controlled by the fuelling system which is either by carburettor system and the air fuel injection system. Thus, in this project, new system will be use to control the air fuel ratio by using the Port fuel injector that controlled by Electronic Control Unit.

1.3 Objective

i. To convert the carburetted engine to fuel injection system.

ii. To study and analyze the conversion process.

1.4 Scope of work

i. Make sure the engine run in good condition without any minor or major problems.

ii. Motorcycle engine with four-stroke cycle.

iii. Motorcycle engine with capacity of 110cc.

iv. Running the motorcycle engine using conventional fuel which is RON 95.

v. Use EFI to get accurate air- fuel mixture ratio in combustion chamber.

vi. Inspection of mechanical parts at the lab provided.