

DEVELOPMENT OF AUTOMOTIVE ECU AND IGNITION WIRING SYSTEM
TRAINING MODULE

MOHAMAD NASHRIK BIN SUHAIMY

UNIVERSITY OF TECHNICAL MALAYSIA MELAKA

SUPERVISOR DECLARATION

“I hereby declare that I have read this report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Automotive)”

Signature:.....

Supervisor Name: DR. NOREFFENDY BIN TAMALDIN

Date :.....

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MOHAMAD NASHRIK BIN SUHAIMY

This report is presented in Partial fulfilment of the requirements for the award of
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University Of Technical Malaysia Melaka

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DECLARATION

“I hereby declare that the work in this report is my own except for summaries and quotations which have been duly acknowledged.”

Signature :.....

Author : MOHAMAD NASHRIK BIN SUHAIMY

Date :.....

Especially for beloved mom, dad and family

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ABSTRACT

The advancement of modern vehicle in term of electronics integration is vital for safety aspect, comfort, accessory, fuel economy and emission control. The electronic control unit (ECU) system is very important in the car today, because ECU will be act as a brain will process and control the system in car. This study is to prepare and design a training module for students in automotive ECU and ignition wiring system. To prepare for this training module, a rig will be fabricated so the relevant components such as ECU, relay, ignition switch and wiring system can be placed on this rig. Then the system will be connected to the engine Daihatsu Mira L200 with the capacity engine of 659cc. With this training module, students will be able to see how this system works and know the component function in this system. This will help UTeM students to understand the evolution of automotive electronics in vehicle

ABSTRAK

Seperti yang diketahui setiap tahun system kereta akan bertambah lebih canggih ianya termasuklah dari segi keselamatan, keselesaan, aksesori, penjimatan minyak dan kawalan keluaran ekzos, dan sistem „ECU“ merupakan sistem yang sangat penting pada kereta zaman kini kerana „ECU“ yang akan bertindak sebagai otak yang akan memproses dan mengawal sistem di dalam kereta. Kajian ini disediakan untuk mencipta satu alat bantuan mengajar untuk pelajar-pelajar tentang automotif „ECU“ dan system pendawaian penyalaan. Untuk menyediakan alat bantuan mengajar ini, sebuah pelantar akan di fabrikasi supaya komponen-komponen yang berkaitan seperti „ECU“, suis geganti, suis penghidup dan sistem pendawaian dapat ditempatkan diatas pelantar ini. Setelah itu, sistem ini akan disambungkan pada sebuah enjin Daihatsu Mira L200 yang berkapasiti 659cc. Dengan adanya alat bantuan mengajar ini, para pelajar akan dapat melihat sendiri bagaimana system ini berfungsi dan turut dapat mengetahui komponen-komponen yang terlibat. Ini dapat membantu pelajar UTeM lebih mengetahui tentang sistem yang makin digunaka dipasaran masa kini.

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LIST OF ABBREVIATIONS AND SYMBOLS

ABS	Anti-Lock Breaking System
AC	Alternate Current
ACC	Adaptive Cruise Control
CATIA	Computer Aided Three-dimensional Interactive Application
ECM	Engine Control Module
ECT	Engine Coolant Temperature
ECU	Engine Control Unit
EFI	Electronic Fuel Injection
EGR	Exhaust Recirculation Gases
IAT	Intake Air Temperature
KNO ₃	Potassium Nitrate
LKP	Lane Keeping Control
MIG	Metal Inert Gas
N ₂	Nitrogen Gas
NaN ₃	Sodium Acid
PCM	Power-Train Control Module
RPM	Round per Minutes
TFC	Trajectory Following Control
UTeM	University of Technical Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Most of the modern car have transformed from the first car manufacture in 1672. Basically the transformation of car covers speed, fuel economy, better emission control, safety and comfort. Most of us are not aware that all of this can be achieved or controlled by one powerful computer located in the car. The computer knows as the electronic control unit (ECU).

ECU is like a brain in the car. The manufacture of ECU started from mid 1980s with limited functions. Now the function of ECU has improved over the year. Today only have a two main manufacture produce ECU base on geographical location (European vs Japanese). Most of European and American car manufacture uses the Bosch ECU while Japanese and Asian car manufacture uses the Denso ECU.

Basically the operation of ECU system can be divide in three phases. The operation is input sensor, ECU process and output actuator. Before this, all of the engine operation is controlled by mechanical devices such as carburator and vacuum, at present this is all done by ECU to manage and monitor the engine function.

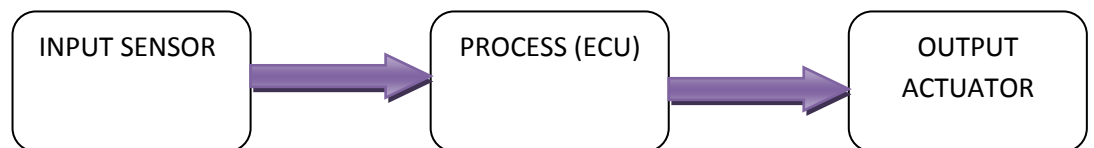


Figure 1.1: Basic ECU system

Figure 1.1 shows the input sensor phase, the ECU utilizing information from the input sensor to monitor engine operating condition. Second phase, ECU uses the input information to make operating decisions such as about spark advance and fuel system. The output phase for ECU system is the output actuator, fuel injectors and igniter. It was controlled by the ECU. This proses will be repeated in order to obtain the perfect combustion.

1.2 OBJECTIVES

The objectives of this project is to design and fabricate suitable rig for ECU and ignition wiring system for teaching purpose. Another objective this study is to assemble and mount existing ECU and wiring system from a three cylinder L200 engine into the training module kit and prepare material (document) for teaching purpose.

1.3 SCOPE OF PROJECT

The main scopes of this project are:

- Design and fabricate engine ECU wiring training module in UTeM. The wiring system is the main focus for ignition system.
- To study existing ECU wiring system and propose a highly integrated system to become “smart vehicle” for future generation.

1.4 PROBLEM STATEMENT

In UTeM, a suitable module to help students understand the ECU wiring system is not available. The current training equipment in UTeM using half cut vehicle with all wiring system which is untraceable and very complex to describe. Based on that, the automotive ECU and ignition wiring system training module was propose and designed in order to solve this problem.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter is to show the necessary background information as to understand the research background of this study. In this chapter introduces some of the fundamental ideas involved in the development of an automotive ECU and ignition wiring system. It includes fundamental knowledge about ECU, electronic fuel injection (EFI) and ignition system.

2.2 ENGINE CONTROL UNIT (ECU)

An engine control unit (ECU), in the vehicle controlling the engine is the important job, for most of the car ECU is the powerful computer that controls the amount of fuel, ignition timing and other parameter an internal combustion engine needs to keep running. Based on the article 2CarsPros, the ECU monitors and adjusts the air/fuel mixture and utilizes a catalytic converter to minimize the amount of pollution produce from the engine. There are two modes of operation, closed loop, which means the computer has completely taking over the operation system and open loop which is used when the engine is cold and operates on a preset program. The engine must be at operating temperature before it can go to close loop.

Figure 2.1 and Figure 2.2 shows the Daihatsu Mira ECU and ECU board. The ECU is the most powerful computer on modern vehicles. It uses a variety of sensors to monitor and control most of the engine functions. Including the electrical, fuel, and emission control systems. Another task, the ECU controls the fuel injector on fuel-injector engines, fires the spark plugs, and controls valve timing, the fuel/air mixture, battery charging and even the cooling fan. It's the key to the diagnostics that pinpoint problems and is primarily responsible for managing the fuel efficiency and performance of your vehicle. (Deanna Sclar, 2009).



Figure 2.1: Daihatsu Mira ECU



Figure 2.2: ECU board.

(Source: Car mods Australia,2011)

2.3 CURRENT ECU

Base on the research (Erjavec, J., 2009), the ECU is like a brain in the car. It not only controls the engine of the car, but also controls the emission and fuel economy of the car. At present the ECU function does not only focus to engine system but also control about the safety, comfort and another system in the car.

There are the several system basically controlled by the ECU in the car today, for the safety for the driver and passenger, the important system need in car is air bags module and anti-lock breaking system (ABS). Comfort while driving the car is also very important, so now there have some system that could be use for convenience while driving, another system available on the car now is adaptive cruise control module, transmission controller and for the expansive car have the climate control module, it for monitor interior temperature and control heating and cooling in the car. These are some of the system used at present, and it is impossible to say there will be more system will be added in the future.

2.3.1 Air Bags Module

As we know, air bags have been around about 40 years and until now still in use to save the driver and passenger from injury or death. The main purpose of the air bag is a slow forward movement of passengers without injury. But every year this system will upgrade and now have a many type of the air bags. Figure 2.3 shows the different type of air bags used in the car today.

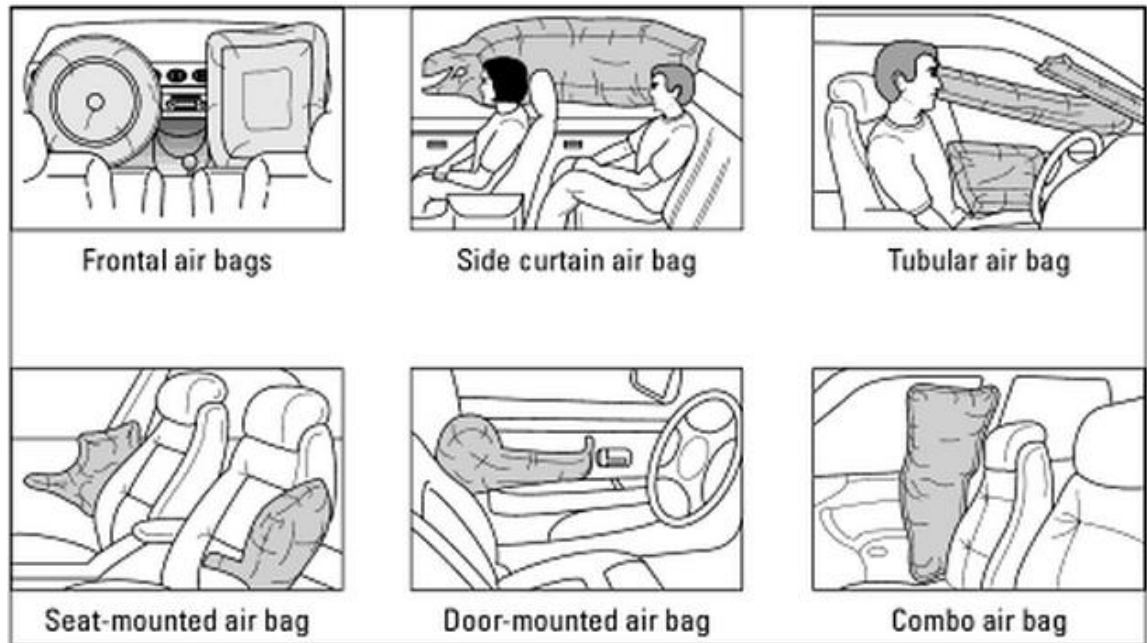


Figure 2.3: The different type of air bags
(Source: Deanna sclar, 2009)