THE STUDY OF DATA ACQUISITION SYSTEM AT FKM, UTeM ENGINE DYNAMOMETER

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PENGAKUAN

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DEDICATION

This report is dedicated to my beloved parent,
Mr. Samad Bin Puteh,
and Madam Maznah Binti Hj Hanafi
Whose always highly support me, and understanding to make it all possible
throughout my Bachelor Degree program.

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ABSTRACT

Data acquisition (DAQ) can be elaborated as the method of collecting data, and information from the real world. DAQ system widely uses in many electronic and mechanical industries likewise for the automotive industry. For the research and development (R&D) of engine, DAQ system is the most paramount part. It has been used for collecting, storing, and analyzing information from the engine and dynamometer. Furthermore, DAQ system helps to reduce errors and time during logging the data. Another important part in engine dynamometer test cell is the instrumentations. The instrumentations function as the connecting element between measure part and DAQ system. At FKM, UTeM also has an engine testing facility including DAQ and instrumentations. However, there are many problems, and limitations within the systems. These problems include lack of a DAQ system for engine and environment monitoring, lack of signal conditioning to protect the main control board, OPEN-LOOP system, lack of heat exchanger system and separate fuel flow meter and controller. The main objective of this project is to familiarize with the current instrumentation at FKM, UTeM dynamometer test cell and industrial standard instrumentations such as PROTON. This project basically focuses on the study and research on DAQ system, and instrumentations such as the control console, interface processor, fuel flow meter, sensor transducer, cooling system, and detail engine testing standard operation procedure. An ideal DAQ system and instrumentations are to be determined at the end of this project. This project is intended as a method and references for the technicians interested in using a PC for data acquisition, analysis, and control application. The specification of the sensors and other instrumentations is listed as further usage to develop the complete DAQ system and instrumentations at FKM, UTeM.

ABSTRAK

Sistem Maklumat Perolehan dapat dihuraikan sebagai salah satu kaedah untuk mengumpul informasi yang diperoleh daripada keadaan sebenar. Sistem Maklumat Perolehan digunakan secara meluas dalam bidang elektronik, dan mekanikal, begitu juga dalam bidang automotif. Sistem Maklumat Perolehan adalah salah satu bahagian terpenting dalam proses pembangunan, dan kajian untuk sesebuah enjin. Biasanya ia digunakan untuk mengumpul, menyimpan, menganalisa informasi yang diperoleh daripada ujian enjin dan membantu mengurangkan ralat dan masa semasa mengumpul maklumat. Selain itu, instrumentasi juga memainkan peranan yang penting untuk melengkapkan sesebuah Sistem Maklumat Perolehan. Instrumentasi dapat dianalogikan sebagai alat perantaraan antara keadaan sebenar dan Sistem Maklumat Perolehan. FKM, UTeM juga mempunyai kemudahan bilik ujian enjin yang dilengkapi dengan Sistem Maklumat Perolehan dan instrumentasi. Walaubagaimanapun, sistem tersebut mempunyai beberapa masalah dan kekurangan. Antara masalah utama ialah kekurangan instrumentasi untuk mencatat maklumat dari enjin dan dinamometer. Selain itu, sistem tersebut tidak mempunyai penapisan arus elektrik dan frekuensi untuk melindungi komponen-komponen elektronik yang terdapat dalam kotak kawalan utama, sistem “OPEN-LOOP”, sistem kawalan minyak yang terpisah daripada sistem kawalan utama dan mempunyai sistem penyejukan yang kurang komprefensif. Objektif utama kajian ini adalah untuk mengenalpasti secara menyeluruh setiap peralatan yang digunakan dalam Sistem Maklumat Perolehan di FKM, UTeM dan industri. Kajian ini juga memberi fokus terhadap Sistem Maklumat Perolehan dan instrumentasi yang ideal untuk FKM, UTeM. Sistem yang sesuai dan ideal ditentukan sebagai rujukan kepada juruteknik untuk penambahbaikan di masa hadapan.

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NOMENCLATURES

A.C	: Altenate Current
ADC	: Analogue Digital Converter
BMEP	: Brake Mean Effective Pressure
BNC	: Bayonet Neill-Concelman
BSFC	: Brake Specific Fuel Consumption
D.C	: Direct Current
DAQ / DAC	: Data Acquisition
DTM	: Desk-Top Module
Dyno	: Dynamometer
ECU	: Electronic Control Unit
ES	: E-STOP : Energency Stop
FKM	: Fakulti Kejuruteraan Mekanikal
GPM	: Gram per Liter
I/O	: In / Out
I/O	: In and Out
IEEE	: Institute of Electrical and Electronic Engineers
LCD	: Liquid Crystal Display
LVDT	: Linear Variable Differential Transformer
NVH	: Noise, Vibration, and Harshness
PC	: Personal Computer
PID	: Proportional, Integral, and Derivative
PROTON	: Perusahaan Otomobil Nasional
PRT	: Platinum Resistence Thermocouple.
Q.A	: Quality Assurance
SCSI	: Small Computer System Interface
SOP	: Standard Operation Procedure

UIP	: User Interface Processor
UTeM	: Universiti Teknikal Malaysia Melaka
UTM	: Universiti Teknologi Malaysia

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CHAPTER 1

INTRODUCTION

1.0 PROJECT BACKGROUND

Engine testing methods are divided into two categories, first is engine dynamometer testing, and second is chassis dynamometer testing. Both tests can measure the parameters such as power, torque, brake mean effective pressure (BMEP), brake specific fuel consumption (BSFC) and many more. To measure all this parameter, the control console, and data-acquisition system are required. Before setting-up all this facility, the detailed planning is necessary. One of the important parts in the test cell is instrumentations. Without instrumentations such as control console, DAQ system, temperature sensors, pressure sensors, fuel supply and measurement system, and electrical system, the test is useless, and the quality of the measured data will be decrease.

1.1 PROBLEM STATEMENT

At FKM, UTeM, the engine dynamometer was installed with the all facilities. However, there are numbers of constraint which make this test cell unefficiently used. The constraints of this engine dynamometer are; it only can operate with the OPEN-LOOP system, insufficient engine cooling capacity, lack of DAQ system for engine and environment monitoring, lack of signal conditioner to protect the main

board, and separate fuel flow and engine controller system. In order to enhance its functions and performance, study on the industrial standard facilities is required especially about the DAQ system.

1.2 Objectives

The main aim of this project is to familiarize with all the DAQ system and instrumentations at FKM, UTeM and industrial standard engine dynamometer test. Others target of this project is to identify the ideal DAQ system for engine dynamometer at FKM, UTeM. Another objective of this project also includes the preparation of cooling assembly supporting engine test bed.

1.3 Scopes

The scopes of this project are to identify the limitation, and weaknesses of FKM, UTeM engine dynamometer DAQ system. The scopes of this project include developing the standard operating procedure (SOP), and run the sample engine test at FKM, UTeM. The scopes moreover involve design and fabricate the cooling tower test bed.

1.4 Chapter Summary

1.4.1 Chapter 1: Introduction

This chapter explains about the problem statement, objective, and scope of this project. The main idea of this project is to study the instrumentations, and DAQ system at FKM, UTeM test cell. Other than that, this project is about to propose the ideal DAQ system and instrumentations for FKM, UTeM test cell.

1.4.2 Chapter 2: Literature Review

This chapter describes the detail about the standard instrumentations that used in typical engine dynamometer test cell. This explanation includes the DAQ system, and other's measurement devices that used in the engine testing.

1.4.3 Chapter 3: Methodology

This chapter explains about the methodology and procedures used in order to achieve the project's objective. In this project, research on the FKM, UTeM, and industrial standard PROTON DAQ systems are performed. This chapter also includes the detailed research on DAQ system and instrumentations. The functions and operating procedures for each device were included. This chapter also includes a valid standard operating procedure for engine testing.

1.4.4 Chapter 4: Results and discussion

This chapter discusses about the output of the study that been made regarding engine dynamometer DAQ system in the FKM, UTeM and industrial standard PROTON. In this chapter include the sample result of the engine testing in order to ensure the data from the DAQ system is valid. The important devices or components of the ideal DAQ system were also identified.

1.4.5 Chapter 5: Conclusion and Recommendation

This chapter includes the overall of the DAQ system study. Several problems in the FKM, UTeM dynamometer test cell were identified, and the recommendations have been made for further improvement.