

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

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This technical report is submitted in accordance with the requirements of the
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PENGAKUAN

“Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya saya telah jelaskan sumbernya”

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

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Date:

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 diuraikan sebagai salah satu kaedah untuk mengumpul informasi yang diperolehi 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 diperolehi 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 komprehensif. 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.

TABLE OF CONTENTS

CHAPTER	CONTENTS	PAGE
	SUPERVISOR DECLARATION	i
	DECLARATION	iv
	DEDICATION	vi
	ACKNOWLEDGEMENT	vii
	ABSTRACT	viii
	ABSTRAK	ix
	TABLE OF CONTENTS	x
	LIST OF TABLES	xiii
	LIST OF FIGURES	xv
	NOMANCLATURES	xvii
	LIST OF APPENDIX	xix
CHAPTER 1	INTRODUCTION	
	1.0 Project Background	1
	1.1 Problem Statement	1
	1.2 Objectives	2
	1.3 Scopes	2
	1.4 Chapter Summary	2
CHAPTER 2	LITERATURE REVIEW	
	2.1 Dynamometer	4
	2.2 Engine Dynamometer Test Cell	6
	2.3 Design of the Test Cell and Control Room	6
	2.4 Test Cell Control	8

CHAPTER	CONTENT	PAGE
	2.5 Data Acquisition System (DAQ)	9
	2.6 Measurement System in Data Acquisition (DAQ) Process	10
	2.7 Transducer Box	16
	2.8 Volumetric Fuel Measurement System	19
	2.9 Cooling System	21
	2.10 Air Services	23
	2.11 Data Logging and Recording	24
	2.12 Basic Test Cell Safety System	25
CHAPTER 3	METHODOLOGY	
	3.1 Introduction	27
	3.2 Research on FKM, UTeM Engine Dynamometer Test Cell DAQ System and Instrumentations	28
	3.3 Performance Analysis at FKM, UTeM Engine Dynamometer	38
	3.4 Research on Industrial Standard Data Acquisition System and Instrumentations	41
	3.5 Performance Analysis at PROTON Engine Dynamometer	51
	3.6 PROTON Engine Testing Capabilities	54
CHAPTER 4	RESULT AND DISCUSSION	
	4.1 Comparison Analysis	56
	4.2 Identification of the Problems	65

CHAPTER	CONTENT	PAGE
CHAPTER 5	CONCLUSION AND RECOMMENDATION	
	5.1 Conclusion	66
	5.2 Recommendation and Suggestions	66
	REFERENCES	78
	BIBLIOGRAPHY	80

LIST OF TABLES

NO	TITLE	PAGE
2.1	Actual cell dimensions found in UK industry (Source: Martyr, A and Plint, M.A, 2007)	7
2.2	Control Sequences of Engine Test	8
2.3	General Categories of Thermocouple	12
2.4	Instrumentation and Transducer Required For Measurement (Source: Martyr, A and Plint, M.A, 2007)	18
2.5	Classification of the Cooling System for Engine Test Cell	21
3.1	Standard Industrial Packages for Signal Conditioning	46
3.2	Basic Parameters Viewed By User Interface (PC) (Source: PROTON Test Cell Request, 2011)	47
3.3	AVL 733S Technical Data (Source: PROTON, 2007)	48
4.1	Comparative Analysis between FKM, UTeM and PROTON Software Used In Engine Dynamometer DAQ System.	57
4.2	Comparative Analysis between FKM, UTeM and PROTON Main Controller Used In Engine Dynamometer DAQ System.	57
4.3	Comparative Analysis between FKM, UTeM and PROTON Power Module/Sub Relays System Used In Engine Dynamometer DAQ System.	58
4.4	Comparative Analysis between FKM, UTeM and PROTON Main Control Box Used In Engine Dynamometer DAQ System.	58
4.5	Comparative Analysis between FKM, UTeM and PROTON Transducer Box Used In Engine Dynamometer DAQ System.	59

4.6	Comparative Analysis between FKM, UTeM and PROTON Throttle Actuator Used In Engine Dynamometer DAQ System.	60
4.7	Comparative Analysis between FKM, UTeM and PROTON Fuel Measurement System Used In Engine Dynamometer DAQ System.	60
4.8	Comparative Analysis between FKM, UTeM and PROTON Cooling System Used In Engine Dynamometer DAQ System.	61
4.9	Comparative Analysis between FKM, UTeM and PROTON Ventilation System Used In Engine Dynamometer DAQ System.	61
4.10	Comparative Analysis between FKM, UTeM and PROTON Data Recording Used In Engine Dynamometer DAQ System.	62
4.11	Comparative Analysis between FKM, UTeM and PROTON Alarm/Feedback System Used In Engine Dynamometer DAQ System.	63
4.12	Comparative Analysis between FKM, UTeM and PROTON SOP Used In Engine Dynamometer DAQ System.	63
4.13	Summary of Identification DAQ System and Instrumentations Weaknesses at FKM, UTeM Test Cell.	65
5.1	List of Recommended Instrumentation According To Specific System.	67
5.2	Specification of Transducer Box.	69
5.3	Standard Operating Procedure	73

LIST OF FIGURES

NO	TITLE	PAGE
2.1	70 kW Eddy Current Dynamometer (Source: UTM, 2011)	4
2.2	A typical test cell layout (Source: Richard D. Atkins, 2009)	7
2.3	Thermocouple circuit (Richard D. Atkins, 2009)	12
2.4	Cut section view of Pressure Transducer (Richard D. Atkins, 2009)	14
2.5	Gravimetric Gauge (Source: Richard D. Atkins, 2009)	20
3.1	Ignition Control Panel (Source: UTeM, 2011)	29
3.2	In Cell Emergency Stop and Power Supply for Starter Motor (Source: UTeM, 2011)	29
3.3	MD Mustang DAQ Box Control Module (Source: UTeM, 2011)	31
3.4	ADR2000 Analog/Digital Interface Card	31
3.5	Sample of Basic DAQ System	32
3.6	Standard Configuration of ONO SOKKI Fuel Flow Measurement System (Source: ONO SOKKI, 2011)	33
3.7	FP Series Detector (Source : UTeM, 2011)	34
3.8	FM-2500A Housing The DF-0400A Measurement Module (Source: FM-2500A User Manual, 2007)	36
3.9	Engine Cooling System Storage Tank (Source: UTeM, 2012)	37
3.10	Cooling Tower (Source: UTeM, 2012).	37
3.11	Outline of Data Acquisition at R&D Powertrain PROTON. (Source: PROTON TEXCEL V6, 1999)	41
3.12	Desk-Top Control Module (Source: PROTON, 2011)	42
3.13	Transducer box position in test cell (Source: PROTON, 2011)	45

3.14	Cooling System at PROTON	49
3.15	Location of the Sensors at the Cooling Water Supply Piping (Source: PROTON, 2012)	50
3.16	Low level inlet and high level outlet ducted system (Source: Martyr A. and Plint M.A, 2009)	51
5.1	Super Transducer Box	69
5.2	Medium Transducer Box	69
5.3	Lite Transducer Box	69
5.4	Recommended Signal Conditioning Card	70
5.5	Connection between Fuel Flow Meter and Main DAQ Control Box.	71
5.6	Cooling Tower Test Bed Design and Fabrication Process	72
5.7	Layout of the Important DAQ Components in the FKM Engine Test Cell.	76

NOMENCLATURES

A.C	: Alternating 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 : Emergency 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 Resistance 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

LIST OF APPENDICES

APPENDIX A	PSM 1 Flowchart
APPENDIX B	PSM 2 Flowchart
APPENDIX C	PSM Ganttchart
APPENDIX D	ADR 2000 Circuit/Board
APPENDIX E	ADR 2000 Technical Specification
APPENDIX F	FM Series Volumetric Fuel Flow Measurement
APPENDIX G	PROTON Engine Test Standard Operation Procedure
APPENDIX H	FKM, UTeM Engine Dynamometer Specification
APPENDIX I	PROTON Engine Dynamometer Specification
APPENDIX J	PROTON TEXCEL V6 System Specification
APPENDIX K	Test Cell Instrumentations Request (TCIR)
APPENDIX L	Calculation and Analysis of Cooling Tower Based Support
APPENDIX M	Data of the Sample Engine Testing Done at FKM, UTeM and PROTON

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.