

SUPPORTING MAINTENANCE MANAGEMENT SYSTEM (SMMS)
FOR MARA COLLEGE KUALA NERANG

RIZANAWATI BINTI RAMLI

UNIVERSITI UTARA MALAYSIA 2011

SUPPORTING MAINTENANCE MANAGEMENT SYSTEM (SMMS)
FOR MARA COLLEGE KUALA NERANG

A project submitted to the College of Arts and Sciences in Partial Fulfilment of the
requirement for the degree Master of Science (Information Technology)
Universiti Utara Malaysia

January 2011

By

Rizanawati Binti Ramli



KOLEJ SASTERA DAN SAINS
(College of Arts and Sciences)
Universiti Utara Malaysia

PERAKUAN KERJA KERTAS PROJEK
(Certificate of Project Paper)

Saya, yang bertandatangan, memperakukan bahawa
(I, the undersigned, certifies that)

RIZANAWATI BT RAMLI
(802384)

calon untuk Ijazah
(candidate for the degree of) **MSc. (Information Technology)**

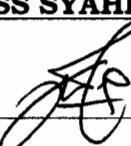
telah mengemukakan kertas projek yang bertajuk
(has presented his/her project of the following title)

SUPPORTING MAINTENANCE MANAGEMENT SYSTEM (SMMS) FOR MARA
COLLEGE KUALA NERANG

seperti yang tercatat di muka surat tajuk dan kulit kertas projek
(as it appears on the title page and front cover of project)

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan
dan meliputi bidang ilmu dengan memuaskan.
(that this project is in acceptable form and content, and that a satisfactory
knowledge of the field is covered by the project).

Nama Penyelia
(Name of Supervisor) : **MISS SYAHIDA HASSAN**

Tandatangan
(Signature) :  Tarikh (Date) : 27/2/2011

Nama Penilai
(Name of Evaluator) : **MR.AZMI MD SAMAN**

Tandatangan
(Signature) :  Tarikh (Date) : 24.2.2011

PERMISSION TO USE

In presenting this project of in partial in fulfilment of the requirements for a Master of Science in Information Technology (MSc. IT) from Universiti Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this project in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor or in their absence, by the Dean of Postgraduate and Research. It is understood that any copying or publication or use of this project or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to Universiti Utara Malaysia for any scholarly use which may be made of any material from my project.

Request for permission to copy or make other use of materials in this project, in whole or in part, should be addressed to:

Dean of Research and Postgraduate Studies
College of Arts and Sciences
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman
Malaysia

ABSTRAK

Perkembangan teknologi terkini semakin meningkat penggunaannya dalam aktiviti harian terutamanya di bahagian pengurusan pentadbiran dalam sesebuah organisasi. Fokus utama projek ini adalah untuk merekacipta dan membangunkan Sistem Sokongan Pengurusan Penyelenggaraan (*SMMS*) untuk Kolej MARA Kuala Nerang Kedah. Sistem ini menyediakan antaramuka pengguna untuk staf, juruteknik dan staf pentadbiran dan operasi utamanya adalah menyediakan kemudahan kepada pengguna untuk mentadbir laporan kerosakan peralatan secara dalam talian. Kaedah yang terlibat dalam membangun Sistem ini diambil dari Papan Kerja Kitaran Pembangunan Sistem (*SDLC*) dan hanya empat fasa yang terlibat iaitu Analisa keperluan, Merekacipta, Membangun dan Menguji Sistem. Model UML telah digunakan dalam fasa menganalisa keperluan, Sistem ini dibangunkan dengan menggunakan Bahasa pengaturcaraan *ASP (Active Server Pages)* dan *HTML*. Model *Technology Acceptance Model (TAM)* digunakan untuk menguji Sistem dan tiga puluh dua (32) staff Kolej MARA Kuala Nerang telah terlibat dalam proses ujikaji ini. Faedah yang diperolehi daripada penggunaan Sistem ini ialah laporan kerosakan peralatan di Kolej MARA Kuala Nerang dapat dijalankan secara dalam talian dan dapat mengurangkan masa memproses permohonan. Selain itu, sistem ini juga dapat menjimatkan masa, kos dan tenaga terutama kepada staf yang sibuk dengan tugas-tugas harian.

ABSTRACT

The system technologies are rapidly increasing uses in routine daily work specifically for the administration department applications in organizations. The aim of the study is to design and develop the Supporting Maintenance Management System for MARA College Kuala Nerang (SMMS), Kedah. SMMS is an online report application system which provides a convenient graphics user interface (GUI) for staff, technician and administration staff. This system allows users to do any report regarding to the equipments break down or malfunctioning equipment. The methodology for developing the prototype is derived from the System Development Life Cycle (SDLC) framework and contained only these four phases (i) Requirement analysis, (ii) Design, (iii) Develop and (iv) Evaluate the prototype. The UML model is used to model the system requirement, Active Server Pages (ASP) language and HTML coding is used to develop the prototype. Technology Acceptance Model (TAM) is used to evaluate the prototype which thirty two (32) staffs of MARA College Kuala Nerang are involved in this process. The significant of the study are the maintenance report will be done via online without using any application form, reduce application processing time and save time, cost and energy of the staff especially to those who are busy in daily work.

ACKNOWLEDGEMENT

Praise and gratitude to Allah, the Almighty, for bestowing me with great strength, patience, and courage in completing this project. My gratefulness to my supportive and helpful supervisor, Miss Syahida Bt Hassan for assisting and guiding me in the completion of this research. With all truthfulness, without her, the project would not have been a complete one. She has always been my source of motivation and guidance. I am truly grateful for her continual support and cooperation in assisting me all the way through the semester.

Also I would like to thanks to Mr Azmi bin Md Saman to give me feedback and comments regarding my project. I would like to present my thanks to my husband, my mother and all my family who has always been there for me. Finally, I would like to express my appreciations to all my friends, colleagues, FTM staff, and everyone who has helped me in this journey.

TABLE OF CONTENTS

	Page
PERMISSION TO USE	i
ABSTRAK	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENT	v
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF APPENDICES	xiii
LIST OF ABBREAVIATIONS	xiv

CHAPTER ONE: INTRODUCTION

1.0 Introduction	1
1.1 Problem Statements	2
1.2 Research Question	3
1.3 Objectives Of The Study	3
1.4 Scope Of Study	4
1.5 Significance Of The Study	4
1.6 Report Organization	5

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction	6
2.1 Web-Based Application	6
2.2 Type Of Web Based Application	7
2.3 Advantage Of Web Based Application	8
2.4 Physical View Of The Web Application Architecture	9
2.5 Maintenance Management	10
2.6 A Framework Of Maintenance Processes	11
2.7 Maintenance Management System	14
2.7.1 Computerized Maintenance Management System (CMMS)	14
2.7.1.1 Type Of CMMS	14
2.7.1.2 Advantage Of CMMS	14
2.7.2 Computer-Aided Facility Management (CAFM)	15
2.7.3 Maintenance, Repair, And Operations (MRO)	16
2.8 Technology Acceptance Model (TAM)	16
2.9 Summary	18

CHAPTER THREE: METHODOLOGY

3.0 Introduction	19
3.1 Requirements Analysis	20
3.1.1 Observation	21
3.1.2 Document Sampling	21
3.1.3 Interview	22
3.2 Design	22
3.2.1 System Modelling	22
3.2.2 Determine Web Server Application	23
3.2.3 Determine Scripting Language Application	23
3.3 Develop The Prototype	24

3.4 Evaluate The Prototype	24
3.5 Summary	25

CHAPTER FOUR: ANALYSIS AND DESIGN

4.0 Introduction	26
4.1 System Requirements	26
4.1.1 The Functional Requirement	27
4.1.2 Non-Functional Requirement	28
4.1.3 Software Requirement	29
4.2 Design Requirements Model	29
4.2.1 Use Case Model	30
4.2.2 Use Case Specification	32
4.2.3 Sequence Diagram	32
4.2.3.1 Login	32
4.2.3.2 View Report	34
4.2.3.3 Search Report	35
4.2.3.4 Manage Report	36
4.2.3.5 Add Report	37
4.2.3.6 View Status	38
4.2.3.7 Maintenance Report	39
4.2.4 Class Diagram	40
4.3 Summary	41

CHAPTER FIVE: FINDING

5.0 Introduction	42
5.1 Design User Interface	42
5.1.1 Main Prototype Page	44
5.1.2 Login Page	45
5.1.3 Main Staff Page	46
5.1.4 Add Report Page	47
5.1.5 View Report Page	48

5.1.6 View Status Page	49
5.1.7 Main Management Staff Page	50
5.1.8 Manage Report Page	51
5.1.9 Search Report Page	52
5.1.10 Search Report By Record No	53
5.1.11 Search Report By Report Status	54
5.1.12 Search Report By Technician Name	56
5.1.13 Main Technician Page	57
5.1.14 Maintenance Report	58
5.2 Evaluating User Acceptance	59
5.2.1 Evaluation Techniques	60
5.2.2 Data Analysis	61
5.2.2.1 General Information	61
5.2.2.2 System Aspects	64
5.3 Summary	83

CHAPTER SIX: DISCUSSION AND CONCLUSION

6.0 Introduction	86
6.1 The Research Objectives	86
6.2 Problem And Limitations	86
6.3 Recommendation	86
6.4 Future Work	87
6.5 Summary	87

REFERENCES	88
-------------------	----

LIST OF TABLES

Table 4.1: Functional Requirements	27
Table 4.2: Non Functional Requirements	28
Table 4.3: Software Requirements	29
Table 5.1: Descriptive Statistics For Perceived Usefulness	65
Table 5.2: Descriptive Statistics For Perceived Usefulness	72
Table 5.3: Descriptive Statistics For Attitude Toward Using	78
Table 5.4: Descriptive Statistics For Intention To Use	81

LIST OF FIGURES

Figure 2.1: Physical View Of A Web Application	9
Figure 2.2: Web Application Architecture	10
Figure 2.3: The Generic Framework Of Maintenance Management Processes	12
Figure 2.4: Maintenance Management System Process	13
Figure 2.5: Technology Acceptance Model (TAM)	17
Figure 3.1: Model Of The Systems Development Life Cycle Phase	20
Figure 4.1: Use Case Diagram	31
Figure 4.2: Login For Users Diagram	33
Figure 4.3: View Report Diagram	34
Figure 4.4: Search Report Diagram	35
Figure 4.5: Manage Report Diagram	36
Figure 4.6: Add Report Diagram	37
Figure 4.7: View Status Diagram	38
Figure 4.8: Maintenance Report Diagram	39
Figure 4.9: Class Diagram For SMMS_KMKN	40
Figure 5.1: Flow User Interface Design	43
Figure 5.2: Main Prototype Page	44
Figure 5.3: Login Page	45
Figure 5.4: Main Staff Page	46

Figure 5.5: Insert Employee No Page	47
Figure 5.6: Add Report Form	48
Figure 5.7: View Report	48
Figure 5.8: Insert Report No Page For View Status	49
Figure 5.9: View Status Page	50
Figure 5.10: Main Management Staff Page	51
Figure 5.11: Insert Report No Page For Manage Report	51
Figure 5.12: Manage Report Page	52
Figure 5.13: Search Report Page	53
Figure 5.14: Insert Report No Page To Search Report	53
Figure 5.15: View Report By Report No Page	54
Figure 5.16: Search Report By Report Status Page	55
Figure 5.17: View Report By Report Status Page	55
Figure 5.18: Search Report By Technician Name Page	56
Figure 5.19: View Report By Technician Name Page	57
Figure 5.20: Main Technician Page	58
Figure 5.21: Insert Report No Page For Maintenance Report	58
Figure 5.22: Maintenance Report Page	59
Figure 5.23: Percentage Of The Gender	61
Figure 5.24: Percentage Of The Post	62
Figure 5.25: Percentage Of Year Working	63
Figure 5.26: Percentage Of The Education Background	64
Figure 5.27: Reliability Analysis For Perceived Usefulness	65

Figure 5.28: Question 1 Statistical Diagram	67
Figure 5.29: Question 2 Statistical Diagram	68
Figure 5.30: Question 3 Statistical Diagram	69
Figure 5.31: Question 4 Statistical Diagram	70
Figure 5.32: Question 5 Statistical Diagram	71
Figure 5.33: Reliability Analysis For Perceived Ease Of Use	72
Figure 5.34: Question 6 Statistical Diagram	73
Figure 5.35: Question 7 Statistical Diagram	74
Figure 5.36: Question 8 Statistical Diagram	75
Figure 5.37: Question 9 Statistical Diagram	76
Figure 5.38: Question 10 Statistical Diagram	77
Figure 5.39: Reliability Analysis For Attitude Toward Using	78
Figure 5.40: Question 11 Statistical Diagram	79
Figure 5.41: Question 12 Statistical Diagram	80
Figure 5.42: Reliability Analysis For Intention To Use	81
Figure 5.43: Question 13 Statistical Diagram	82
Figure 5.44: Question 14 Statistical Diagram	83

LIST OF APPENDICES

Appendix A: Questionnaire	92
Appendix B: Use Case Specification	96
Appendix C: Project Time Schedule	111

LIST OF ABBREVIATIONS

ASP	-	Active Server Pages
CAFM	-	Computer Aided Facility Management
CMMS	-	Computerized Maintenance Management System
FM	-	Facility Management MRO - Maintenance Repair and Operation
GUI	-	Graphics User Interface
HTML	-	Hypertext Markup Language
HTTP	-	Hypertext Transfer Protocol
IT	-	Information Technology
IIS	-	Internet Information Services
SMMS	-	Supporting Maintenance Management System
SDLC	-	System Development Life Cycle
TAM	-	Technology Acceptance Model
URL	-	Uniform Resource Locator

CHAPTER ONE

INTRODUCTION

1.0 INTRODUCTION

Maintenance is an activity such as tests, measurements, replacements, adjustments and repairs to retain or restore a functional unit in or to a specified state in which the unit can perform its required functions. Maintenance Management is an orderly and systematic approach to plan, organize, monitor and evaluate maintenance activities and their costs. A good maintenance management system coupled with knowledgeable and capable maintenance staff can prevent health and safety problems and environmental damage; yield longer asset life with fewer breakdowns; and result in lower operating costs and a higher quality of life (TID-AM-01, 2000). Due to that, the system proposed in this study is a Supporting Maintenance Management System for MARA College Kuala Nerang, uses to manage online maintenance report and it is one of the web based application technology. Perhaps by using this system, it will improve and facilitate the process of maintenance report and action will be taken faster than before. Moreover, management staff could use this system to monitor the report daily and it can be accessed anytime and anywhere. Depending on the application and design,

The contents of
the thesis is for
internal user
only

REFERENCES

Al-qatan, S.S. (2009). On-line Programming Course Registration System (OPCRS) for UUM, Retrieved, Oct 17, 2010 from <http://ep3.uum.edu.my/1905/>

AeroSapience. (2010). Aviation MRO Application Software Marketplace, Retrieved, Nov 10, 2010 from <http://aerosapience.com/>

Allwebco Design Co. (2011). New Window Links on Pages, in Menus and in Search Forms. Retrieved, Dec 29, 2010 from http://allwebco-templates.com/support/S_target_link.htm

Braun, D., Sivils, J. Shapiro, A. & Versteegh, J. (2001). Object Oriented Analysis and Design Team: UML Toturial. Retrieved, Dec 10, 2010 from <http://atlas.kennesaw.edu/~dbraun/csis4650/A&D/index.htm>

Bell, D. (Feb,2004). UML basic: The sequence diagram. Retrieved, Dec 15, 2010 from <http://www.ibm.com/developerworks/rational/library/3101.html>

Coakes, Sheridan J., Steed, L., Dzidic, P. (2006). SPSS Version 13.0 for Windows Analysis without Anguish . National Library of Australia. John Wiley & Sons Australia, Ltd.

EzineArticles.com. (2010). Benefit of Computerized Maintenance Management System (CMMS).) Retrieved, Nov 20, 2010 from [http://ezinearticles.com/?Benefits-of-Computerized-Maintenance-Management-Software-\(CMMS\)&id=4315899](http://ezinearticles.com/?Benefits-of-Computerized-Maintenance-Management-Software-(CMMS)&id=4315899)

Generation5. (2005). Expert system for car maintenance and troubleshooting. Retrieved, Nov 10, 2010 from <http://www.generation5.org/content/2005/CarMaintenance.asp>

Hassanain, M. A., Froese, T. M., & Vanier, J. (2001). IFC-Based Model for Intergrated Maintenance Management. National Research Council of Canada (NRCC)

Ignyte Software. (2008). Custom Application Development. Retrieved, Feb 19, 2011 from <http://www.ignyte.com/services-application-development.html>

InfoSpectrum. (2010). MRO & Asset Management: MRO Application, Retrieved, Dec 5, 2010 from <http://www.info-spectrum.com/>

Marquez, A. C., & Gupta, J. N. D. (Jan 2005). Contemporary maintenance management process,framewok and supporting pillars. *International Journal of Management Sciences*

Masrom, M. (May,2007). Technology Acceptance Model and E-learning. Universiti Teknologi Malaysia City Campus. 12th International Conference on Education, Sultan Hassanal Bolkiah Institute of Education Universiti Brunei Darussalam

Malhotra, Y., & Galletta, D. F. (1999). Extending the Technology Acceptance Model to Account for Social Influence: Theoretical Bases and Empirical Validation. Proceedings of the 32nd Hawaii International Conference on System Sciences - 1999.

Mazhar, N. (2011). Technology Acceptance Model. Retrieved, Jan 31, 2011 from <http://ezinearticles.com/?Technology-Acceptance-Model&id=202354>

Microsoft Corporation. (2010). Installing IIS 7 on Windows Vista and Windows 7. Retrieved, Nov 20, 2010 from <http://learn.iis.net/page.aspx/28/>

Microsoft Corporation. (2010). ASP Technology Feature Overview. Retrieved, Nov 23, 2010 from <http://msdn.microsoft.com/en-us/library/ms972202.aspx>

Microsoft Corporation. (2010). Developing IIS Modules. Retrieved, Nov 23, 2010 from <http://msdn.microsoft.com/en-us/library/bb757040.aspx>

Microsoft Corporation. (2011). Chapter 20: Choosing an Application Type. Retrieved, Jan 28, 2011 from <http://msdn.microsoft.com/en-us/library/ee658104.aspx#WebApplicationArchetype>

Microsoft Corporation. (2011). Add and format page numbers. Retrieved, Jan 30, 2011 from: <http://office.microsoft.com/en-us/word-help/insert-page-numbers-HP001226513.aspx#BM4>

Mitchell, S., & Atkinson, J. (2000). *Sams Teach Yourself Active Server Pages 3.0 in 21 Days*. United States of America. Bradley Jones

Negrino, T., Smith, D. (2007). *Visual Quickstart Guide Dreamweaver CS3 For Windows and Macintosh*. United States of America. Peachpit Press.

Netsity. (2010). Web based Application. Retrieved, Jan 11, 2011 from <http://www.netsity.com/webbasedapplication.htm>

Pixeldigest.com. (2007). Create a Admin Login using Dreamweaver. Retrieved, Jan 1, 2011 from <http://www.pixeldigest.com/aspnetlogin.html>

Plant Maintenance Resource Center. (2009). Implementing a Computerized Maintenance Management System. Retrieved, Jan 12, 2011 from http://www.plant-maintenance.com/CMMS_imp.html

Plus2net.com. (2011). Creating Login form and validation using ASP MSSQL. Retrieved, Jan 1, 2011 from <http://www.plus2net.com/asp-tutorial/lg-login.php>

Robin Good. (2006). Benefits Of Web-Based Applications And Microsoft Announcement Of The "Live" Era. Retrieved, Jan 11, 2011 from http://www.masternewmedia.org/web-based_applications/

Saad, F. A. F. (2009). A designing and developing a web-based post graduate application system for UUM.

Shiratuddin, N., & Hassan, S. (2010). Design Research in Software Development. Sintok :Universiti Utara Malaysia

Startvbdotnet.com. (2004-2010). System Development Life Cycle. Retrieved, Nov 27, 2010 from <http://www.startvbdotnet.com/sdlc/sdlc.aspx>

Schaeffer, D. (2008, Feb 22). APA Format 5 Edition. Library Guide University Library

Smashing apps.com. (2010). Online website builder. Retrieved, Jan 28, 2011 from <http://www.smashingapps.com/>

TID-AM-01. (Oct 2000). Maintenance Management Systems . Retrieved, Oct 12, 2010 from <http://dsp-psd.pwgsc.gc.ca/Collection/P25-5-2-2000E.pdf>

Tizag.com. (2008).ASP If Statement. Retrieved, Jan 4, 2010 from <http://www.tizag.com/aspTutorial/aspIfStatement.php>

University of Scranton. (2011). SPSS Tutorial. Retrieved, Jan 11, 2011 from <http://academic.uofs.edu/department/psych/methods/cannon99/spssmain.html>

U.S.Department of Justice. (2003). Chapter 13 Aternative SDLC Work Patterns. Retrieved, Jan 1, 2011 from <http://www.justice.gov/jmd/irm/lifecycle/ch13.htm>

Wade, M., & Schneberger, S. (2006). Theories used in research Technology Acceptance Model. Retrieved, Jan 1, 2011 from <http://www.istheory.yorku.ca/Technologyacceptancemodel.htm>

WBDG. (2009). Computer-Aided Facility Management (CAFM) Retrieved, Nov 20, 2010 from <http://www.wbdg.org/om/cafim.php>

WBDG. (2010). Computerized Maintenance Management System (CMMS). Retrieved, Nov 20, 2010 from <http://www.wbdg.org/om/cmms.php>

Wikipedia Encyclopedia (2010). Internet Information Services, Retrieved, November 9, 2010 from http://en.wikipedia.org/wiki/Internet_Information_Services

Wikipedia Encyclopedia (2010). Retrieved , November 9, 2010 Computer-Aided Facility Management from <http://en.wikipedia.org/wiki/CAFM>

Wikipedia Encyclopedia (2010). Maintenance repair and operations, Retrieved, Oct 12, 2010 from http://en.wikipedia.org/wiki/Maintenance,_repair,_and_operations

Wikipedia Encyclopedia (2010). Computerized Maintenance Management System, Retrieved, Nov 10, 2010 from
http://en.wikipedia.org/wiki/Computerized_Maintenance_Management_System

Wilie.com. (2008). Web Based Application. Retrieved, Jan 28, 2011 from
<http://www.welie.com/patterns/showPattern.php?patternID=application>

WiseGEEK. (2011). What Is System Maintenance?. Retrieved, Dec 1, 2010 from
<http://www.wisegeek.com/what-is-system-maintenance.htm>

WordiQ.com. (2010). Technology Acceptance Model-Definition. Retrieved, Jan 31, 2011 from http://www.wordiq.com/definition/Technology_acceptance_model

Zaenen, A. (2010), Chapter 7 Document Processing, Retrieved, Dec 15, 2010 from
<http://cslu.cse.ogi.edu/HLTsurvey/ch7node2.html>

Ziemer, S. (2002, Nov 28). Architecture for Web Applications Essay in DIF 8914 Distributed Information Systems. Retrieved, Jan 11, 2011 from
<http://www.idi.ntnu.no/emner/dif8914/essays/Ziemer-essay2002.pdf>