BORANG PENGESAHAN STATUS TESIS

JUDUL: PREVENTIVE MAINTENANCE MANAGEMENT DECISION SUPPORT SYSTEM (PMMDSS)

SESIPENGAJIAN: 2006/2007

Saya LEE HWANG CHIN mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Kolej Universiti Teknikal Kebangsaan Malaysia.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Sila tandakan (/)

   _____ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

   / / TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

   _____ TIDAK TERHAD

(TANDATANGAN PENULIS)

Alamat tetap :
63-B.LRG SRJKC(c) HWA
MING, MUAR, JOHOR

Tarikh : 31/10/2006

(TANDATANGAN PENYELIA)

SITI AZIRAH A SMAI
Nama Penyelia

PREVENTIVE MAINTENANCE MANAGEMENT DECISION SUPPORT SYSTEM FOR PALM OIL MILL (PMMDS)

LEE HWANG CHIN

This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Software Engineering)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA
DECLARATION

I hereby declare that this project report entitled

INTELLIGENT CONSULTATION SYSTEM

is written by me and is my own effort and that no part has been plagiarized without citations.

STUDENT: ___________________________ Date: 23/11/2006

(LEE HWANG CHIN)

SUPERVISOR: ___________________________ Date: 23/11/2006

(PN SITI AZIRAH BT ASMAI)
DEDICATION

To my beloved family and boyfriend
ACKNOWLEDGEMENTS

Writing this report isn’t a one-man (or woman) operation, and I would like to thank the people who give me the useful advices and their experiences. So I can complete this report from the concept stage to reality.

I’d like to say a special thanks to my faculty supervisor, Puan Siti Azirah Bt Asmai, who gives me advices to be a good researcher and report writer during the PSM I. Thanks for her too because willing spend her hour to listen my problems and gives me the useful advices.

Once again, Hidayah and Mok Pei Yi, who are the students from BITM. They patiently give me advices through the process of interface design since they are major in multimedia who talents in interface design. It’s a pleasure to work with them. Thanks, Dayah and Ah Mok!

Thanks to David Marshall, who gives me some advices during writing this report. He also suggested ways for me to improve the flow of the text and otherwise ensured that the overall quality of the book was up to par. Beside that, he is also borrowing his computer for me to online for searching the information.

My apologies to anyone who I may have inadvertently omitted. A number of people helped me that I never had direct contact with. Thanks to all friends that helped me a lot in this report.
ABSTRACT

All the chapters that will be discussed in this thesis will contain the overall proposed system – Preventive Maintenance Management Decision Support System. It is start from the Introduction, Literature Review and Project Methodology, Analysis, Design and Conclusion. In the chapter introduction, the scopes that will be discussed are briefly describing the project background. From the project background, the problem statements have been found and the proposed system will be suggested by discussing the objectives of developing proposed system. The scopes of the proposed system have stated as a guideline to make sure the proposed system develop within the scopes. After that, the project significant has been listed to let the reader understand about the business value of proposed system. In the chapter literature review and project methodology, fact and finding has been done for all the information that related with the proposed system. From the research has done the appropriate project methodology- V-Model; has been chosen to use to develop the proposed system. In the chapter analysis, the analysis skills are required here to analysis the process of the current system and the problems that the current system had faced. After that, the requirements analysis has been done to analysis the basic requirements that required developing the proposed system. In the chapter design, there contain the information of high-level design that discussed about the raw data input/ output, system architecture, user interface design and database design of the proposed system. At last, the conclusion has been done for the overall proposed system where the observation weakness and strengths, propositions for improvement and contribution of the proposed system are stated too.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>SUBJECT</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PROJECT TITLE</td>
<td>i</td>
</tr>
<tr>
<td></td>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td></td>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td></td>
<td>ABSTRAK</td>
<td>iv</td>
</tr>
<tr>
<td></td>
<td>TABLE OF CONTENTS</td>
<td>v</td>
</tr>
<tr>
<td></td>
<td>LIST OF TABLES</td>
<td>ix</td>
</tr>
<tr>
<td></td>
<td>LIST OF FIGURES</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>LIST OF APPENDIXES</td>
<td>xi</td>
</tr>
<tr>
<td></td>
<td>LIST OF ABBREVIATIONS</td>
<td>xiv</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHAPTER I INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1 Project Background</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1.2 Problem Statement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1.3 Objectives</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1.4 Scopes</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>1.5 Project Significance</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1.6 Expected Output</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>1.7 Conclusion</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHAPTER II LITERATURE REVIEW AND</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PROJECT METHODOLOGY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1 Introduction</td>
<td>11</td>
</tr>
</tbody>
</table>

© Universiti Teknikal Malaysia Melaka
2.2 Fact & Finding

2.2.1 Domain

2.2.2 Existing System Research
   2.2.2.1 COGZ CMMS
   2.2.2.2 PMXpert Software
   2.2.2.3 FaciliWork Software
   2.2.2.4 Existing System VS Proposed System

2.2.3 Technique
   2.2.3.1 Authentication
   2.2.3.2 PM Scheduling
   2.2.3.3 Work Order Automation
   2.2.3.4 3D Snapshot
   2.2.3.5 FMECA

2.3 Project Methodology
   2.3.1 Requirement Analysis Phase
   2.3.2 Analysis Modeling Phase
   2.3.3 Design Phase
   2.3.4 Coding Phase
   2.3.5 Testing Phase
   2.3.6 Implementation Phase

2.4 Project Requirements
   2.4.1 Software Requirements
   2.4.2 Hardware Requirements
   2.4.3 Others Requirements

2.5 Project Schedule and Milestones

2.6 Conclusion
CHAPTER III ANALYSIS

3.1 Introduction 38

3.2 Problem Analysis (Current System)
  3.2.1 Background of Current System 39
  3.2.2 Problem Statements 40

3.3 Requirement Analysis
  3.3.1 Functional Requirements 44
  3.3.2 Business Flow 46
  3.3.3 Use-Case View 47
  3.3.4 Actors 47
  3.3.5 Use Case Description 47
  3.3.6 Interaction/Sequence Diagram 57

3.4 Software Requirements
  3.4.1 Operating System 55
  3.4.2 Supporting Software 56

3.5 Hardware Requirements 58

3.6 Network Requirements 58

3.7 Conclusion 58

CHAPTER IV DESIGN

4.1 Introduction 60

4.2 High Level Design 61
  4.2.1 Raw Input/Data 61
  4.2.2 System Architecture 64
    4.2.2.1 Static Organization 66
    4.2.2.2 High-Level Class Diagram 68
  4.2.3 User Interface Design 68
    4.2.3.1 Navigation Design 69
CHAPTER V IMPLEMENTATION

5.1 Introduction 90
5.2 Software Development Environment Setup 91
5.2.1 Operating System 93
5.2.2 Software Development Tools 93
5.3 Software Configuration Management 94
5.3.1 Configuration Environment Setup 95
5.3.2 Version Control 99
5.4 Implementation Status 101
5.5 Conclusion 101

CHAPTER VI TESTING

6.1 Introduction 103
6.2 Test Plan 104
6.2.1 Test Organization 104
6.2.2 Test Environment 104
6.2.3 Test Schedule 105
6.3 Test Strategy 106
6.3.1 Classes of Tests 106
6.4 Test Design 109
6.4.1 Test Description 109
6.4.2 Test Data 110
6.5 Test Result and Analysis 111
6.6 Conclusion 111

CHAPTER VII CONCLUSION
7.1 Observation on Weakness and Strengths 113
7.1.1 System Weakness 113
7.1.2 System Strength 114
7.2 Propositions for Improvement 115
7.3 Contribution 116
7.4 Conclusion 116

REFERENCES
BIBLIOGRAPHY
APPENDIX
<table>
<thead>
<tr>
<th>TABLE</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Access right for each level</td>
<td>21</td>
</tr>
<tr>
<td>2.2</td>
<td>Software Requirements for PMMDS system</td>
<td>24</td>
</tr>
<tr>
<td>2.3</td>
<td>Minimum specification of Server Side</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Raw Data Description</td>
<td>66</td>
</tr>
<tr>
<td>6.1</td>
<td>Hardware Specification</td>
<td>105</td>
</tr>
<tr>
<td>6.2</td>
<td>Test Schedule</td>
<td>105</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Sample interface for COGZ work order list</td>
<td>14</td>
</tr>
<tr>
<td>2.2</td>
<td>Sample interface for COGZ Work Order Sort</td>
<td>15</td>
</tr>
<tr>
<td>2.3</td>
<td>Sample interface for COGZ Work Order Text Filter</td>
<td>16</td>
</tr>
<tr>
<td>2.4</td>
<td>Sample of interface for PMXpert work order</td>
<td>17</td>
</tr>
<tr>
<td>2.5</td>
<td>Sample of interface for PMXpert PM Schedule</td>
<td>18</td>
</tr>
<tr>
<td>2.6</td>
<td>Sample interface FMMS Work Order</td>
<td>19</td>
</tr>
<tr>
<td>2.7</td>
<td>Sample interface FMMS Maintenance Scheduling</td>
<td>20</td>
</tr>
<tr>
<td>2.8</td>
<td>V-Model Diagrams</td>
<td>27</td>
</tr>
<tr>
<td>3.1</td>
<td>Overview of Preventive Maintenance Management Decision Support System (To-be System)</td>
<td>46</td>
</tr>
<tr>
<td>3.2</td>
<td>Sample interface of User Login</td>
<td>49</td>
</tr>
<tr>
<td>3.3</td>
<td>Sample interface of Preventive Maintenance</td>
<td>52</td>
</tr>
<tr>
<td>3.4</td>
<td>Sample interface of Work Order</td>
<td>56</td>
</tr>
<tr>
<td>3.5</td>
<td>Sample interface of Data Analysis</td>
<td>58</td>
</tr>
<tr>
<td>4.1</td>
<td>CSCI of P PMMDS System</td>
<td>70</td>
</tr>
<tr>
<td>4.2</td>
<td>System Architecture of PMMDS System</td>
<td>71</td>
</tr>
<tr>
<td>4.3</td>
<td>CSCI PMMDS system Packages</td>
<td>72</td>
</tr>
<tr>
<td>5.1</td>
<td>Software Development Environment Setup Architect</td>
<td>91</td>
</tr>
<tr>
<td>5.2</td>
<td>User Interface of Delphi Workspace</td>
<td>95</td>
</tr>
<tr>
<td>FIGURE</td>
<td>TITLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>5.3</td>
<td>Tool Bar and Menu Bar</td>
<td>95</td>
</tr>
<tr>
<td>5.4</td>
<td>Component Palette</td>
<td>96</td>
</tr>
<tr>
<td>5.5</td>
<td>User Interface Project Manager</td>
<td>97</td>
</tr>
<tr>
<td>5.6</td>
<td>Interface Skeleton Code</td>
<td>97</td>
</tr>
<tr>
<td>5.7</td>
<td>Sample Executed Application</td>
<td>98</td>
</tr>
<tr>
<td>5.8</td>
<td>Sample Code for Writing Version Information</td>
<td>101</td>
</tr>
</tbody>
</table>
LIST OF APPENDIXES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>COMPARISON CURRENT SYSTEM AND TO_BE SYSTEM</td>
</tr>
<tr>
<td>A.1</td>
<td>Functional Requirements</td>
</tr>
<tr>
<td>A.2</td>
<td>Non-Functional Requirements</td>
</tr>
<tr>
<td>B</td>
<td>PROJECT SCHEDULE</td>
</tr>
<tr>
<td>B.1</td>
<td>Project Schedule PSM I</td>
</tr>
<tr>
<td>B.2</td>
<td>Project Schedule PSM II</td>
</tr>
<tr>
<td>C</td>
<td>GANTT CHART</td>
</tr>
<tr>
<td>C.1</td>
<td>Gantt Chart</td>
</tr>
<tr>
<td>D</td>
<td>ACTIVITY DIAGRAM OF CURRENT SYSTEM</td>
</tr>
<tr>
<td>D.1</td>
<td>Activity Diagram for As-Is System</td>
</tr>
<tr>
<td>E</td>
<td>ACTIVITY DIAGRAM OF TO-BE SYSTEM</td>
</tr>
<tr>
<td>E.1</td>
<td>Activity Diagram of User Login</td>
</tr>
<tr>
<td>E.2</td>
<td>Activity Diagram of Preventive Maintenance</td>
</tr>
<tr>
<td>E.3</td>
<td>Activity Diagram of Work Order</td>
</tr>
<tr>
<td>E.4</td>
<td>Activity Diagram of Data Analysis</td>
</tr>
<tr>
<td>E.5</td>
<td>Activity Diagram of Print</td>
</tr>
<tr>
<td>E.6</td>
<td>Activity Diagram of Search</td>
</tr>
</tbody>
</table>
USE CASE DIAGRAM OF TO-BE SYSTEM

E.1 Use Case Diagram of To-be System

INTERACTION DIAGRAM

G.1 User Login (Basic Flow)
G.2 User Login (E1- Invalid Input)
G.3 Preventive Maintenance (Basic Flow)
G.4 Preventive Maintenance (A1- View Yearly PM)
G.5 Preventive Maintenance (A2- View Monthly PM)
G.6 Preventive Maintenance (A3- Create New PM)
G.7 Preventive Maintenance (A4- Edit PM)
G.8 Preventive Maintenance (A5- Delete PM)
G.9 Preventive Maintenance (A6- Print PM)
G.10 Preventive Maintenance (A7- Generate WO)
G.11 Preventive Maintenance (E2- Invalid Input)
G.12 Work Order (Basic Flow)
G.13 Work Order (A1- Inspection WO)
G.14 Work Order (A2- Breakdown WO)
G.15 Work Order (A3- Create New WO)
G.16 Work Order (A4- Edit WO)
G.17 Work Order (A5- Delete WO)
G.18 Work Order (A6- Print WO)
G.19 Work Order (A7- Search WO)
G.20 Work Order (E1- Invalid Input)
G.21 Data Analysis (Basic Flow)
G.22 Data Analysis (A1- Quit Analysis and Print)

CLASS DIAGRAM

H.1 Class Diagram of PMMDS System

NAVIGATION DESIGN
I.1 Navigation Design of PMMDS System

J

INPUT DESIGN
J.1 Input Design of PMMDS System

K

OUTPUT DESIGN
K.1 Output Design of PMMDS System

L

PROTOTYPE INTERFACE
L.1 User Login
L.2 Preventive Schedule List
L.3 Preventive Maintenance List
L.4 Single Preventive Maintenance
L.5 Inspection Work Order
L.6 Breakdown Work Order
L.7 Data Analysis

M

ENTITY RELATIONSHIP DIAGRAM- ERD
M.1 ERD of PMMDS System

N

DEPLOYMENT DIAGRAM
N.1 Deployment Diagram of PMMDS System

O

PHYSICAL DATABASE DESIGN
O.1 User Login
O.2 Staff
O.3 Single PM
O.4 Machine
O.5 Section
O.6 Group
O.7 Part
O.8 Work Order
O.9 History
O.10 Effect

P VERSION CONTROL PROCEDURE

Q IMPLEMENTATION STATUS PMMDSS

R UNIT TEST CASE FORM

S SYSTEM TESTING FORM

T USER ACCEPTANCE TESTING

U TEST DATA

V TEST CASE RESULT
# LIST OF ABBREVIATION

<table>
<thead>
<tr>
<th>NO</th>
<th>ABBREVIATION</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BDE</td>
<td>Borland Database Engine</td>
</tr>
<tr>
<td>2</td>
<td>CMMS</td>
<td>Computerized Maintenance Management System</td>
</tr>
<tr>
<td>3</td>
<td>CSCI</td>
<td>Computer Software Configuration Item</td>
</tr>
<tr>
<td>4</td>
<td>DSS</td>
<td>Decision Support System</td>
</tr>
<tr>
<td>5</td>
<td>FMECA</td>
<td>Failure Mode and Effect Critical Analysis</td>
</tr>
<tr>
<td>6</td>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>7</td>
<td>MySQL</td>
<td>My Structured Query Language</td>
</tr>
<tr>
<td>8</td>
<td>ODBC</td>
<td>Microsoft® Open Database Connectivity</td>
</tr>
<tr>
<td>9</td>
<td>PM</td>
<td>Preventive Maintenance</td>
</tr>
<tr>
<td>10</td>
<td>PMMDSS</td>
<td>Preventive Maintenance Management Decision Support System</td>
</tr>
<tr>
<td>11</td>
<td>PSM</td>
<td>Projek Sarjana Muda</td>
</tr>
<tr>
<td>12</td>
<td>RUP</td>
<td>Rational Unified Process</td>
</tr>
<tr>
<td>13</td>
<td>WO</td>
<td>Work Order</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

1.1 Project Background

The system that will be developed for the Project Sarjana Muda is Preventive Maintenance Management Decision Support (PMMDS) System for Palm Oil Mill. This system is used to manage maintenance the machines in computerized. It can use for any manufacturing machines. This is because the objectives and principles of preventive maintenance programmes (PMP) are the same for any processing industry within an industry. The proposed system can divide to four modules which are user login, preventive maintenance, work order, and data analysis maintenance.

Firstly, in the module user login, the to-be system will request the user to enter their user ID and password before login into the PMMDS system. The purpose of this module is to prevent the PMMDS system only accessible by the authorized user only. Beside that, the administrator also allow to add the new user meanwhile the user can only edit own password.

In module PM, user can prepare the single preventive maintenance task and view the scheduled PM list. This module also allows user to generate the work order and operate as well as scheduled.

During the module work order, the user allows to prepare the inspection work order, generate the inspection task. However, we also need to consider preparing the work order during the machine breakdown uncertainly. Then, all the records will be updated. All the report for work order allowed printing.
At last, PMMDS system provides function data analysis for the user to achieve the details data from the PM schedule and work order which has been. The result diagnosis of the root cause and solution will be provided.

1.2 Problem Statement

In this section, the problem statements will be discussed which found in the current system. After analyzing the existing system, there have a lot of weaknesses that we should look into. There have briefly described the problem statements that occur in the real environment and below are the details of each problem:

1.2.1 PM is unduly costly

This logic dictates that it would cost more for regularly scheduled downtime and maintenance than it would normally cost to operate equipment until repair is absolutely necessary. This may be true for some components; however, without preventive maintenance, for example, costs for lost production time from unscheduled equipment breakdown will be incurred.

1.2.2 PM as a secondary core business

Nowadays, with profit margins decreasing, the need for a good maintenance planning and control system is obvious. However, often maintenance is a secondary process in companies that have production as their core business. The result is that maintenance does not receive enough management attention. So then, the effort that put
into the maintenance without provide an effective way to control the equipments management.

1.2.3 Paper-driven maintenance system

For some industrial organizations, maintenance managers still use a traditional, paper-driven maintenance system that cannot effectively track the hundreds of work orders crossing desks each week. Still, each work order contains information that will affect labor hours, inventory, purchasing, and (ultimately) production. A paper-driven maintenance system will affect the efficiency of maintenance management and cause the loss of data.

1.2.4 Current CMMS do not easily facilitate the process of planning and scheduling

Currently, most CMMS do not easily facilitate this process, and as a result, much of this work is performed using manual log books and worksheets. Some CMMS have the facility to perform some of these functions, but often the biggest gap is the capability to collect data and analyses it with regard to Weekly Schedule completion.

1.3 Objective

The objectives to develop this PMMDSS are:

- To increase mechanization and automation of the process Preventive Maintenance management.
• To adequate planning of maintenance operations so that the needed spare parts and materials are on hand.

• To analyze the maintenance operation through reports and data analysis.

• To act as a human decision support tools.

1.4 Scopes

The Preventive Maintenance Management System that will be developed can divide to four main modules which are user login, preventive maintenance, work order, and data analysis. The PMMDS system is suitable for most of the industrial organizations which need an effectively preventive maintenance system.

1.4.1 In the module user login

• This module will allow the user to enter their user ID and password. Then validate check the status accessible of that user. This module can then decide the accessible links of that particular user login. This is to prevent the unauthorized user login the system and alter the essential data.

• It also include the function new user registration which allow the administrator to add new user or edit the user data.

1.4.2 In the module preventive maintenance