

**CONFIGURATION AND IMPLEMENTATION OF “CALEMEAM” FOR  
ONLINE CONDITION MONITORING FOR MAINTENANCE OF  
IT SYSTEM**

by

DEBORA FRANSISKA

1-1211-081

BACHELOR’S DEGREE

in

INDUSTRIAL ENGINEERING

FACULTY OF ENGINEERING AND INFORMATION TECHNOLOGY

SWISS GERMAN UNIVERSITY



SWISS GERMAN UNIVERSITY

EduTown BSD City

Tangerang 15339

Indonesia

Revision after Thesis Defense on August 4<sup>th</sup> 2015

### STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains neither material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

Debora Fransiska

Student

Date

Approved by:

Aditya T. Pratama, S.Si., MT.

Thesis Advisor

Date

Ir. Invanos Tertiana, MBA

Thesis Co-Advisor

Date

Dr. Ir. Gembong Baskoro, M.Sc.

Dean

Date

---

Debora Fransiska

## ABSTRACT

### CONFIGURATION AND IMPLEMENTATION OF “CALEMEAM” FOR ONLINE CONDITION MONITORING FOR MAINTENANCE OF IT SYSTEM

by

Debora Fransiska

Aditya T. Pratama, S.Si.,MT, Advisor

Ir. Invanos Tertiana, MBA, Co-Advisor

SWISS GERMAN UNIVERSITY

The role of IT system assets in supporting enterprise to achieve their objectives becomes more critical. Considering the IT system, which becomes based of every business, leads to the raise of management asset of IT system. Therefore, ISO 20000 provided a guideline to maintain the information technology assets, so it can deliver the business objective. Based on Information Technology Infrastructure Library (ITIL), framework this study focused on service support by configuring an open source application of maintenance named CalemEAM. Due to this application was not able yet for online condition monitoring and make it not effective in monitoring the assets condition. Proof of concept and Rapid Application Development methodology was used as methodologies. The results showed that having online condition monitoring system is necessary to control the critical asset such as IT System, due to the ability to give the real time data that very beneficial to analyze the condition in order to extend asset lifecycle and increase accuracy. Moreover CalemEAM completed with the four pillars of maintenance which are asset, user, inventory and scheduling.

*Keywords: Asset Management, Asset Lifecycle, Maintenance, Online Condition Monitoring, ISO 20000, ITIL.*



## DEDICATION

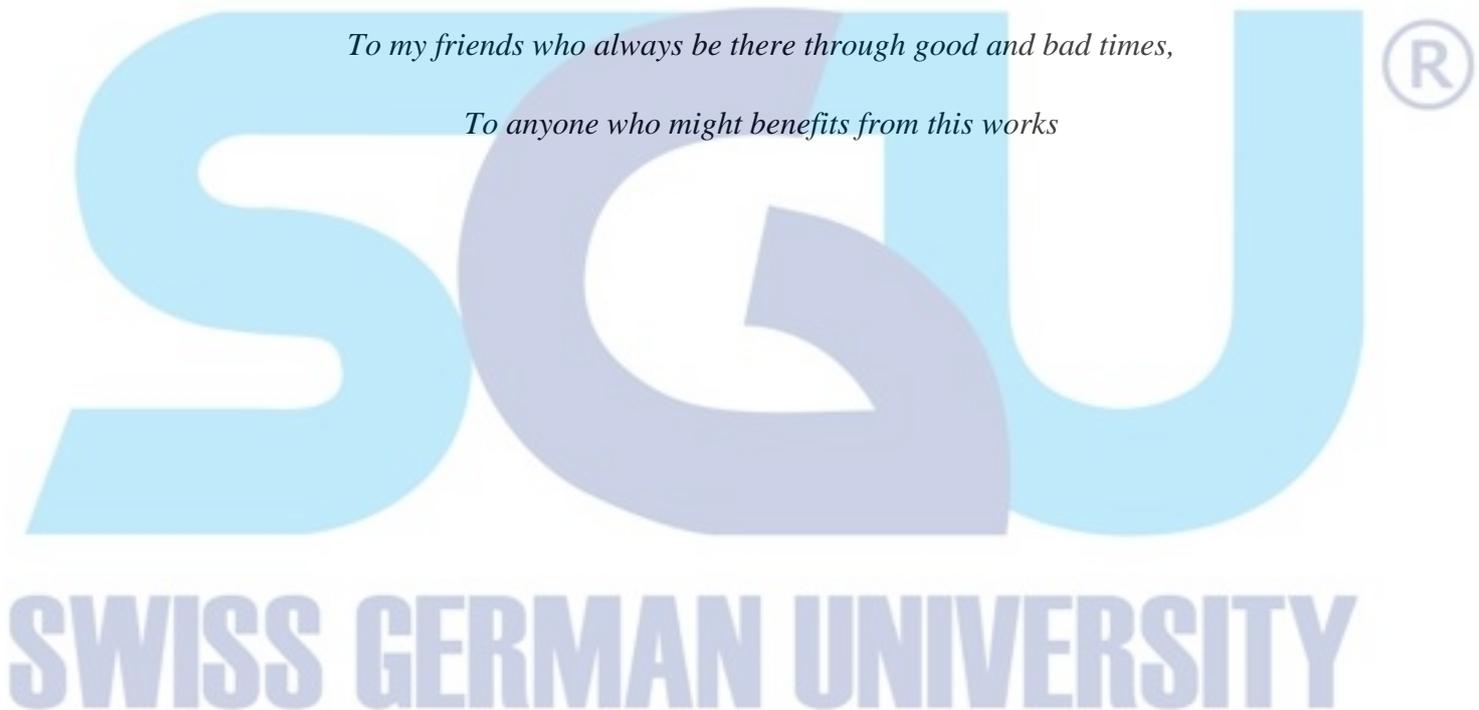
*I dedicate this works*

*To my beloved family who always support me and encourage me,*

*To my lecturers for all the advices and guidance,*

*To my friends who always be there through good and bad times,*

*To anyone who might benefits from this works*



## ACKNOWLEDGEMENTS

First of all I would like to express my gratitude to The Almighty God for giving me strength and helping me to accomplish this thesis.

Immeasurable appreciation and thankful to my beloved parents, sisters and brothers for the endless support, encouragement, prayers and unconditional love that help me throughout the completion of this works. Not to forget to my lovely nephews and niece, who always cheers me up.

I would also like to thank Mr. Aditya T. Pratama, S.Si, MT. as my advisor and Mr. Ir. Invanos Tertiana, MBA as my co-advisor during this project. Besides that I also thankful to Mr. Dr. Ir. Prianggada Indra Tanaya, MME, who also helped me in programming. I am very grateful to have advisor, co-advisor and lecture like them for the endless support, guidance and lesson for me to learn.

I am also grateful to Mr. Agung Handoko as an ITO Manager in LKPP that have spared his precious time for me to conduct the research in this company and additional knowledge you thought me.

I would also like to my closest friends : Junita Martini, Timothy Soerianto, Monica Nilam, Josshua Virgianto, Kevin Aurey and Raezita Dinar who always been there for me through ups and down. Moreover, to all SGU's friends and other friends for the kindness and support until the end of this project.

## TABLE OF CONTENTS

	Page
STATEMENT BY THE AUTHOR.....	2
ABSTRACT.....	3
DEDICATION.....	5
ACKNOWLEDGEMENTS.....	6
TABLE OF CONTENTS.....	7
LIST OF FIGURES.....	11
LIST OF TABLES.....	14
CHAPTER 1 – INTRODUCTION.....	15
1.1. Background.....	15
1.2. Research Problems.....	16
1.3. Research Objectives.....	16
1.4. Significance of Study.....	16
1.5. Research Questions.....	16
1.6. Hypothesis.....	17
1.7. Scope & Limitation.....	17
CHAPTER 2 – LITERATURE REVIEW.....	18
2.1. Asset Management.....	21
2.2. Maintenance.....	22
2.2.1. Condition Monitoring.....	23
2.3. CalemEAM.....	25
2.3.1. Asset Meter.....	27
2.3.2. amCharts.....	29
2.3.3. MySQL Database.....	30
2.4. Online Asset Meter.....	30
2.4.1. JavaScript.....	31
2.4.2. Java Programming.....	31
2.4.3. SNMP.....	31

2.4.4. Cronjob .....	34
2.5. Information Technology Service Management (ITSM).....	35
2.5.1. Information Technology Infrastructure Library (ITIL) .....	36
2.5.2. Parameter of IT System .....	37
2.6. Rapid Application Development (RAD).....	39
CHAPTER 3 – research methodology.....	40
3.1. Exploratory Research .....	42
3.1.1. Proof of concept (POC) .....	42
3.2. Application.....	42
3.2.1. Requirement Planning.....	42
3.2.2. User Design (Functional Design Stage).....	43
3.2.3. Construction.....	44
3.2.4. Implementation in CalemEAM.....	44
3.2.5. Approval .....	45
3.2.6. Implementation in LKPP .....	45
CHAPTER 4 – results and discussion .....	46
4.1. Introduction .....	46
4.2. Proof of Concept .....	46
4.3. Steps 1 of RAD: Requirement Planning .....	47
4.3.1. SNMP Configuration .....	47
4.3.2. Internet Protocol Address Setting .....	48
4.3.3. Prepare Database for CalemEAM (MySQL DB) .....	49
4.3.4. CalemEAM Application Preparation.....	52
4.3.5. Programming Preparation .....	53
4.3.6. Result and Analysis.....	54
4.4. Steps 2 of RAD: User Design .....	54
4.4.1. Result and Analysis.....	57
4.5. Step 3 of RAD: Construction .....	57
4.5.1. Get and Capture Data.....	57
4.5.2. Scheduling the Data Taken .....	58
4.5.3. Parse and Storing Data.....	59
4.5.4. Preparing the Online Condition Monitoring Module.....	60

4.6.	Step 4 of RAD: Implementation in CalemEAM .....	61
4.6.1.	Approval .....	65
4.6.2.	Implementation .....	65
<b>CHAPTER 5 – Conclusion and recommendation .....</b>		<b>66</b>
5.1.	Conclusion.....	66
5.1.1.	OCM module increase the effectivity of CalemEAM .....	66
5.1.2.	Real Time Data Provides Better Analysis for Maintenance .....	66
5.1.3.	OCM module could be configured in CalemEAM .....	66
5.1.4.	CalemEAM is a user friendly application.....	66
5.1.5.	CalemEAM can be used in managing IT assets.....	67
5.2.	Recommendations .....	67
GLOSSARY .....		69
REFERENCES .....		71
APPENDICES .....		78
APPENDIX A.....		79
LIST OF FIGURES .....		80
SECTION A1. – INTRODUCTION.....		81
A1.1.	Background .....	81
A1.2.	Objectives .....	81
A1.3.	Scope.....	81
SECTION A2. – USE CASE .....		82
A2.1.	Problem to Address .....	82
A2.2.	Requirements .....	82
A2.3.	Source Code .....	90
SECTION A3. – CONCLUSION .....		92
A3.1.	Conclusion.....	92
GLOSSARY .....		93
REFERENCES .....		93
APPENDIX B.....		94
LIST OF FIGURES .....		95
LIST OF TABLES .....		96
SECTION B1. – INTRODUCTION.....		97

B1.1. Background .....	97
B1.2. Objectives .....	97
B1.3. Scope.....	97
SECTION B2. – PREREQUISITES .....	98
B2.1. Requirements .....	98
B2.2. Components Used .....	98
SECTION B3. – CONFIGURATION .....	100
B3.1. Network Diagram.....	100
B3.2. Configuration of SNMP .....	102
B3.3. Java Programming for Data Recording.....	109
B3.4. Online Condition Monitoring (OCM) Module Configuration.....	127
B3.5. Data Presentation .....	134
SECTION B4. – CONCLUSION .....	141
GLOSSARY .....	142
REFERENCES .....	143
APPENDIX C.....	145
SECTION C1. - INTRODUCTION.....	146
C1.1. Background .....	146
C1.2. Purpose.....	146
C1.3. Scope.....	146
SECTION C2. - FINDINGS .....	148
C2.1. Mail Relay.....	148
C2.2. Applied Mail Relay to CalemEAM .....	149
C2.3. Result & Analysis .....	150
C2.4. Findings Conclusion .....	164
SECTION C3. - CONCLUSION .....	165
APPENDIX D.....	166
APPENDIX E .....	167
CURRICULUM VITAE.....	169