



Sekolah Siswazah
(Graduate School)
Universiti Utara Malaysia

PERAKUAN KERJA KERTAS PROJEK
(*Certification of Project Paper*)

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

HENG CHENG BU

calon untuk Ijazah _____
(*candidate for the degree of*) Sarjana Sains (Teknologi Maklumat)

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

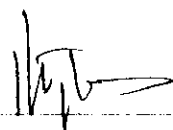
MACHINE MAINTENANCE MANAGEMENT SYSTEM

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

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

Nama Penyelia
(*Name of Supervisor*) : Prof. Madya Nazib Nordin

Tandatangan
(*Signature*)

: 

Tarikh
(*Date*)

: 9th May 2001

MACHINE MAINTENANCE MANAGEMENT SYSTEM

A thesis submitted to the Graduate School in partial

fulfillment of the requirements for the degree

Master of Science (Information Technology)

University Utara Malaysia

by

Heng Cheng Bu

© Heng Cheng Bu, 2001. All rights reserved.

PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a post graduate degree from University Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for scholarly purpose may be granted by my supervisor or, in his absence, by the Dean of Graduate School. It is understood that any copying or publication or use of this thesis or parts thereof financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to University Utara Malaysia for any scholarly use which may be made of any material from my thesis.

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

Dean of Graduate School

Universiti Utara Malaysia

06010 UUM Sintok

Kedah Darul Aman

ABSTRACT (BAHASA MALAYSIA)

Projek ini dihasilkan dengan tujuan untuk membangunkan sistem sokongan pemutusan mesin industri. Sistem ini adalah penting terutamanya dalam bidang industri yang berteknologi tinggi, di mana mesin-mesin yang berkos tinggi digunakan dalam operasi pembuatan untuk mencapai tahap kualiti dan output yang diinginkan. Justeru ini, ia adalah amat penting untuk menguruskan mesin-mesin ini dengan cara yang berkesan demi mempertingkatkan pencapaian mesin, di samping mengurangkan kos operasi.

Rational Unified Modeling Process telah digunakan untuk membangunkan sistem model analisis dan rekabentuk dalam “*Machine Maintenance Management System*”. Aplikasi berasaskan web (PWS) serta *Microsoft Visual Basic* diintegrasikan untuk membangunkan sistem antaramuka. *Microsoft Access* digunakan untuk membangunkan database.

Dalam proses sistem prototaip, sistem ini telah dicubakan di MKPI (Matsushita Kotobuki Peripheral Indonesia). Pengubahsuaian perisian mesin dan pembagunan rangkaian setempat antara komputer di pejabat dan talian pengeluaran boleh dilakukan untuk mengimplementasikan fungsi-fungsi sistem ini dengan sepenuhnya.

ABSTRACT (ENGLISH)

This project develops a machine maintenance management system to be used in high technology manufacturing industries. Machine performance influences the entire manufacturing operation, from product quality to on-time delivery. Thus, machine maintenance management system is essential to improve machine performance while reducing production costs immensely.

Rational Unified Modeling Process is used to develop the analysis and design models of the machine maintenance management system. An integration of Web-based application (PWS) and Microsoft Visual Basic 6.0 is used to develop the system interface. Microsoft Access is used to develop the system database.

Upon the system prototyping process, the system has been tested in MKPI (Matsushita Kotobuki Peripheral Indonesia). Further work, such as modification of machine software and set-up of networking between computer production line and office could be done to materialize the full implementation of the system functionality.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Associate Professor Nazib Nordin for his guidance, suggestion and support throughout the development of this project. Special thanks to my course mates, Woon Ching and Kok Thye for their supports.

This project is dedicated to my parents and my master in life, Daisaku Ikeda.

TABLE OF CONTENT

	Page
PERMISSION TO USE	i
ABSTRACT (BAHASA MALAYSIA)	ii
ABSTRACT (ENGLISH)	iii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF ACRONYMS	xiii
CHAPTER 1: INTRODUCTION	
1.1 Background	1
1.2 MKPI Manufacturing	2
1.3 Problem Statement	5
1.4 Objective	6
1.5 Project Scope	6

1.6 Software and Hardware Requirements	7
1.6.1 Hardware Requirement	7
1.6.2 Software Requirement	7
1.7 Summary	8
CHAPTER 2: STATE OF TECHNOLOGY	
2.1 Current Maintenance Management System	9
2.1.1 AMS Maintenance Management System	10
2.1.1.1 Maintenance Planning	10
2.1.1.2 Development Strategy	12
2.1.1.3 Reliability Centered Maintenance (RCM) Approach	15
2.1.1.3 Maintenance Development Model	19
2.1.2 COGZ Maintenance Management System	21
2.1.2.1 Feature of COGZ Maintenance Management System	23
2.2 Comments	25
2.3 Summary	26
CHAPTER 3: THE DEVELOPMENT METHODOLOGY	
3.1 Methodology	28

3.2 Process Modeling	32
3.3 Specification Language	33
3.3.1 Unified Modeling Language (UML)	33
3.3.2 UML Concepts	34
3.3.3 Building Blocks of UML	35
3.3.4 Development Project Artifact	37
3.3.4.1 Use Case Diagram	37
3.3.4.2 Sequence Diagram	39
3.3.4.3 Class Diagram	39
3.4 Summary	41
CHAPTER 4: MACHINE MAINTENANCE MANAGEMENT SYSTEM	
4.1 Requirement Model	42
4.1.1 Scenario of the machine maintenance management system (Business model)	42
4.1.2 System Architecture	46
4.1.3 Definition of the Actor	47
4.1.4 Use Case	49

4.1.5 Use case diagram	49
4.2 Design Model of Machine maintenance management System	67
4.2.1 Sequence diagram	67
4.2.1.1 Sequence diagram for create PM request	67
4.2.1.2 Sequence diagram for generate checklist	68
4.2.1.3 Sequence diagram for generate work order	69
4.2.1.4 Sequence diagram for issue spare part	70
4.2.1.5 Sequence diagram for perform maintenance	71
4.2.1.6 Sequence diagram for machine verification	72
4.2.1.7 Sequence diagram for perform machine qualification	73
4.2.1.8 Sequence diagram for process qualification analysis	74
4.2.1.9 Sequence diagram for perform production	75
4.2.1.10 Sequence diagram for management making decision	76
4.2.2 Class Diagram (System Design)	77
4.2.2.1 Main class diagram for process engineering UI Package	79
4.2.2.2 Main class diagram for the maintenance personnel UI package	81

4.2.2.3 Main class diagram for the production UI package	83
4.2.2.4 Main class diagram for the management UI package	85
4.2.2.5 Main class diagram for the database package	86
4.2.2.6 Web based for the management Interface	88
CHAPTER 5: EVALUATION	
5.1 System Functionality	92
5.2 System portability test	96
5.3 Results and Discussion	97
CHAPTER 6: CONCLUSION AND RECOMMENDATION	
6.1 Review of the Overall Project Development	99
6.2 Problem and Limitation	100
6.3 Recommendation of the project	102
6.4 Summary	103
BIBLIOGRAPHY	104
APPENDIX A:User Manual	108
APPENDIX B: Coding for User Interface In Visual Basic	121

LIST OF TABLE

Table 2.1	The basic logic flow of strategic business planning versus maintenance planning	12
Table 2.2	The maintenance development model	22
Table 2.3	The difference between bad and well managed Maintenance	24
Table 2.4	Comprehensive maintenance profile	25
Table 5.1	System functionality test and evaluation	94
Table 5.2	System portability test and evaluation	98
Table 5.3	Summary of testing and evaluation results	100

LIST OF FIGURE

Figure 1.1	The overview of MKPI slider fabrication	6
Figure 3.1	The base phases of RUP	31
Figure 3.2	Methodology of Project Phases	33
Figure 3.3	Iterative and incremented model	35
Figure 4.1	Business model of MMMS	47
Figure 4.2	System architecture for MMMS	48
Figure 4.3	Use case diagram – process engineering	52
Figure 4.4	Use case diagram – maintenance	58
Figure 4.5	Use case diagram – production	64
Figure 4.6	Sequence diagram – create PM request	69
Figure 4.7	Sequence diagram – generate checklist	70
Figure 4.8	Sequence diagram – generate work order	71
Figure 4.9	Sequence diagram – issue spare part	72
Figure 4.10	Sequence diagram – perform maintenance	73
Figure 4.11	Sequence diagram – machine verification	74
Figure 4.12	Sequence diagram – machine qual	75
Figure 4.13	Sequence diagram – Process qual	76
Figure 4.14	Sequence diagram – perform production	77
Figure 4.15	Sequence diagram – decision making	78

Figure 4.16	Main class diagram	80
Figure 4.17	Class diagram -- process engineering	82
Figure 4.18	Class diagram -- maintenance	84
Figure 4.19	Class diagram -- production	86
Figure 4.20	Class diagram -- decision making	87
Figure 4.21	Class diagram -- database	89
Figure 4.22	Main class diagram for web-based Management UI	91
Figure 4.23	Class diagram for web-based searching	92
Figure 4.24	Class diagram for web-based retrieving	93

LIST OF ACRONYMS

MKPI	Matsushita Kotobuki Peripheral Indonesia
MMMS	Machine Maintenance Management System
PWS	Personal Web Server
IMETS	Ion Milling Etching Tracking System
PDR	Plasma Design Rail
STS	Surface Technology System
CVD	Chemical Vapour Deposition
UTS	Ultratech Stepper
UML	Unified Modeling Language
AMS	American Maintenance System
RCM	Reliability Centered Maintenance
CMMS	Computer Maintenance Management System
PM	Preventive Maintenance
FMEA	Failure Mode Effect Analysis
RUP	Rational Unified Process

Chapter 1

INTRODUCTION

The use of computer system to control and manage the machines is increasingly important in manufacturing. These machines need to be managed properly and effectively as it will affect the company's operating-costs. This chapter gives an overview of machine maintenance management system in PT Matsushita Kotobuki Electronics Peripherals Indonesia (MKPI).

The problem statement, objectives, project scope, hardware and software requirements of this project are discussed in this chapter.

1.1 Background

Computer system control is getting important in high technology industries in controlling and managing of their machine performance. For instance, Seagate Penang had implemented a system called IMETS to control their ion milling

The contents of
the thesis is for
internal user
only

Bibliography

American Maintenance System (2000). "Maintenance planning and strategy development". URL : http://www.strategiccorp.com/rcm_turbo_detail.htm

ATS Inc. (2000). "Maximizing Maintenance Management Service". URL : <http://www.atstechnical.com/>

Booch, Grady & Rumbaugh, James & Jacobson, Ivar (1999). "The Unified Modeling Language User Guide". Rational Software Corp. Addison-Wesley, An imprint of Addison-Wesley Longman Inc.

COGZ Maintenance Management Software Corp. (1998). "The COGZ Design Philosophy". URL : <http://www.cogz.com/ov2phy.htm>

COGZ Maintenance Management Software Corp. (1998). "Totally Automated Preventive Maintenance". URL : http://www.cogz.com/automated_pm.htm

Cornell, Gary (1998). "Visual Basic 6 from the Ground up." Osborne, McGraw-Hill.

Davison Software (2000). "Featuring the Davison Maintenance System".
URL: <http://www.davisonsoftware.com/>

Dr Mobley, Keith (2000). "Factors to be Considered in the Selection and Implementation of a CMMS". Presentation, Plant Performance Group, Integrated System, Inc. <http://www.plant-maintenance>

Jim Conallen (1999). "Modeling Web Application with UML", Whitepaper, Conallen Incorp.

Lai Maintenance System, Inc. "Increasing Plant Capacity Through Equipment Reliability" URL : <http://www.lai-tpm.com/>

Parnas, D.L. and Clements, P.C. (Feb 1986). "A Rational Design Process : How and Why to Fake It." IEEE Trans. On Software Engineering, SE-12(2), pp 251 – 257.

Philippe Kruchten (1998). "A Rational Unified Process". Whitepaper, Rational Software Corp.

Philippe Kruchten (1999). "Rational Unified Process – An Introduction". Addison Wesley.

Rigau, Juan J. and Association (2000). "Factors to be Considered in the Selection and Implementation of a CMMS". Whitepaper, Association Inc.
http://www.plant-maintenance.com/articles/CMMS_systems.shtml

Sturm, Jake (1999). "VB6 UML Design and Development." Wrox Press, Wrox Press Ltd.

Weir, Bryan (1999). "Computerized Maintenance Management System – An Impartial View of CMMS function, selection and implementation. Polaroid (UK) Ltd. URL:
<http://www.maintenanceresources.com/ReferenceLibrary/CMMS/Index.htm>

Zaheer, Naveed (2001). " Building a Sample Web Site based on .NET Frame
Part 1". The ASP Today Article (Apr. 2001). URL :
<http://www.asptoday.com/content/articles/20010411.asp?>