

**DEVELOPING ACHUSI SYSTEM AS
A BUSINESS SYSTEM SOLUTION FOR C.V. X: HUMAN
RESOURCE, COST, BONUS, AND UTILITY SUBSYSTEM**

THESIS

Prepared by:

Willy Suryadi
0700722642

Approved by:

Supervisor

Erwien Nurwihatman, M.Kom.

Lecture Code: L1119

**BINUS INTERNATIONAL
UNIVERSITAS BINA NUSANTARA
JAKARTA
2007**

BINUS INTERNATIONAL

UNIVERSITAS BINA NUSANTARA

Major Computer Science

Stream Multimedia

Sarjana Komputer Thesis

Semester [Even] Year 2006/2007

**DEVELOPING ACHUSI SYSTEM AS BUSINESS SYSTEM SOLUTION
FOR C.V. X: HUMAN RESOURCE, COST, BONUS, AND UTILITY
SUBSYSTEM**

Willy Suryadi (0700722642)

Abstract

This thesis discusses about the design and development of new business system, which is named ACHUSI. The new business system contains a set of subsystem, but the main focus of this thesis will be about Human Resource, Utility, Cost, and Bonus subsystems. Not only focusing on the software side, this thesis also includes the proposed hardware specification that can support the new business system. At present, the business processes in CV. X are done with paper based system, which requires a lot of human efforts to be done. The paper based system also makes the process of tracking, analyzing, and recording data difficult.

ACHUSI is developed by following the customized Waterfall software development life cycle (SDLC) principles. The Human Resource subsystem can be used to handle the payroll payment. Cost and Bonus subsystems are developed to handle the expensed cost and received bonus of the company. The Utility subsystem is developed to handle several things in ACHUSI, such as: add/update/delete business data, the new business system's authorization access, and so forth. Moreover, all of those subsystems are developed based on the user requirement gathered in one phase of Waterfall SDLC.

The Human Resource, Cost, and Bonus subsystems could help to automate the process of payroll calculation, payroll data entry, cost data entry, and bonus data entry. Those data can be recorded and tracked easily for analyzing purpose. Moreover, the Utility subsystem could give useful features for ACHUSI so that the user can be more convenient when using ACHUSI.

By implementing ACHUSI business system with the proposed hardware specification, the company's business processes can be done more efficiently and effectively.

Keywords

Customized Waterfall Software Development Life Cycle, Human Resource Subsystem, Bonus Subsystem, Cost Subsystem, and Utility Subsystem.

PREFACE

To begin with, the author is grateful to God that allows the author to complete this thesis within schedule and with the expected result. This thesis is completed as the final requirement before receiving Sarjana Komputer Degree majoring in Computer Science from Bina Nusantara University. Moreover, this thesis also gives chance for the author to implement the study subjects that has been learned from Bina Nusantara University.

In this opportunity, I would also like to appreciate and convey my gratitude for everyone that helped me in the process of completing this thesis:

- University of Bina Nusantara, for providing facilities in which could significantly assist me in completing my thesis.
- Erwien Nurwihatman, M.Kom as my thesis supervisor, who always give me guidance and support from the beginning until the end of this thesis.
- Ir. Tri A. Budiono. M.I.T., as Head of School of Computer Science, Binus International, Universitas Bina Nusantara.
- Mr. Kiki Purwanto as my project sponsor, who shares his time, effort, and patience in the development process of this thesis.
- Mr. Raymondus Kosala, Phd., Mr. Yahya H., Msc., Mr. Adrianus Haryo, MSCS, Mr. Totok Soefijanto, Phd., Mr. Abubakar Siddiq, MIT, and all other lecturers who have assisted and shared their knowledge with the author.
- All the staff of University of Bina Nusantara who have supported me within the thesis period.
- My family who always support me throughout the thesis period.

- My group members, for their support and teamwork so that this thesis can be completed within specified schedule and with expected result.
- All of my friends who have always supported and helped me during the thesis period.
- Many others that I have not mentioned in this chance but have significantly help in the process of completing thesis as well.

This thesis is dedicated for the company itself in order to increase the efficiency and effectiveness of their business process and for those who are willing to develop similar or more complex business system with the implementation of Waterfall SDLC principles.

Jakarta, July 20th, 2007

Author

TABLE OF CONTENT

CERTIFICATE OF APPROVAL	ii
Abstract	iv
PREFACE	v
TABLE OF CONTENT	vii
LIST OF FIGURES	x
LIST OF TABLES	xiii
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Scope	2
1.3 Aims and Benefit.....	4
1.4 Structures.....	6
CHAPTER 2 THEORETICAL FOUNDATION & FRAMEWORK	8
2.1 Theoretical Foundation	8
2.1.1 Data, Information, and Knowledge in Information System.....	8
2.1.1.1 Data	8
2.1.1.2 Information.....	8
2.1.1.3 Knowledge	9
2.1.2 Information System.....	9
2.1.3 Database Systems	11
2.1.3.1 Database (DB).....	12
2.1.3.1.1 The Database Environment Components	15
2.1.3.2 Relational Database Model	16
2.1.3.2.1 Relation in Relational Database Model.....	18
2.1.3.2.2 Relations Properties.....	19
2.1.3.2.3 Relational Keys	20
2.1.3.2.4 Integrity Constraints in Relational Database Model	21
2.1.3.3 Database Management Systems (DBMS).....	22
2.1.3.3.1 Relational Database Management Systems (RDBMS)	23
2.1.3.3.2 Level of Abstractions in RDBMS	23
2.1.3.4 Data Modeling.....	26
2.1.3.4.1 Entity Relationship Diagram (ERD)	26
2.1.3.4.2 ERD Notation.....	27
2.1.3.4.3 Entity.....	27
2.1.3.4.4 Attribute	28
2.1.3.4.5 Relationships	29
2.1.3.5 Normalization.....	31
2.1.3.6 Structured Query Language (SQL).....	32
2.1.3.7 Database Backup and Recovery.....	33
2.1.4 System Analyst and Design.....	33
2.1.4.1 Class Diagram	34
2.1.4.2 Data Flow Diagram (DFD)	35
2.1.4.3 Flow Chart.....	36
2.1.4.4 Use Case Diagrams	37
2.1.4.5 Microsoft Office Visio Professional	38

2.1.5 Programming and Technologies.....	38
2.1.5.1 Microsoft .NET Framework	39
2.1.5.2 C# Programming Language	40
2.1.5.3 Microsoft Visual Studio .NET	41
2.1.5.4 ADO (Active Data Object) .NET	42
2.1.5.5 Microsoft SQL Server Express	43
2.1.6 Local Area Network (LAN).....	43
2.1.7 Client and Server	44
2.1.7.1 Client	44
2.1.7.2 Server	44
2.1.7.3 Client/Server Architecture.....	44
2.1.8 Overview of Business System.....	46
2.1.8.1 Human Resource System	46
2.1.8.2 Cost and Bonus Systems	46
2.1.8.3 Report.....	47
2.1.9 Security.....	47
2.1.9.1 Secure Hash Algorithm (SHA)	47
2.2 Theoretical Framework	49
2.2.1 Waterfall.....	49
2.2.1.1 Communication Phase.....	50
2.2.1.2 Planning Phase	51
2.2.1.3 Requirement Analysis Phase.....	52
2.2.1.4 Design Phase	53
2.2.1.5 Construction Phase	54
2.2.1.6 Testing Phase.....	55
CHAPTER 3 ANALYSIS ON THE EXISTING SYSTEM	57
3.1 Company History	57
3.2 Company Organizational Structure	60
3.3 Company Policies and Procedures	61
3.4 Existing Data.....	63
3.5 Data Flow Diagram (DFD)	64
3.5.1 Context Diagram	64
3.5.2 Level 0 DFD.....	65
3.5.3 Level 1 DFD.....	66
3.5.3.1 Inventory System Level 1 DFD	66
3.5.3.2 Sales System Level 1 DFD.....	68
3.5.3.3 Payment System Level 1 DFD.....	70
3.5.3.4 Purchasing System Level 1 DFD.....	72
3.5.4 System Flow Chart.....	73
3.5.4.1 Taking Order (TO) Selling Flow Chart.....	73
3.5.4.2 On Place (OP) Selling Flow Chart	75
3.5.4.3 Delivering for TO and Product Return Flow Chart.....	77
3.5.4.4 Payment Flow Chart.....	79
3.6 Existing Problems	80
3.7 Alternative Solutions for the Problems	82
CHAPTER 4 DESIGN OF THE PROPOSED SYSTEM	85
4.1 The Proposed Policy and Procedures.....	85

4.2 The New Company Organizational Structure	86
4.3 Data Flow Diagram (DFD)	90
4.3.1 Context Diagram	90
4.3.2 Detailed Data Flow Diagram.....	91
4.3.2.1 Master Data Flow Diagram.....	91
4.3.2.2 Cost Data Flow Diagram.....	92
4.3.2.3 Cost Report Data Flow Diagram.....	93
4.3.2.4 Bonus Data Flow Diagram.....	94
4.3.2.5 Bonus Report Data Flow Diagram.....	95
4.3.2.6 Payroll Data Flow Diagram.....	96
4.3.2.7 Payroll Report Data Flow Diagram.....	97
4.4 System Flow Chart.....	98
4.4.1 Cost Flow Chart	98
4.4.2 Bonus Flow Chart.....	100
4.4.3 Payroll Flow Chart.....	102
4.5 System Data.....	103
4.5.1 Data Dictionary.....	103
4.5.2 Data Normalization.....	119
4.5.3 File Specification.....	121
4.5.4 Entity Relationship Diagram.....	130
4.6 Class Diagram	131
4.7 Use Case Diagram.....	134
4.8 State Transition Diagram	139
4.9 Development System.....	142
4.10 Architecture Design.....	144
4.10.1 Hardware Specification.....	144
4.10.2 Software Specification	145
4.10.3 System Topology.....	146
4.11 User Interface Design.....	146
CHAPTER 5 SOLUTION DESIGN	155
5.1 Testing Strategy.....	155
5.2 Operational Procedures	156
5.3 Module Testing	157
5.4 System Integration Testing.....	176
CHAPTER 6 EVALUATION.....	179
6.1 System Evaluation.....	179
6.1.1 Internal Respondent	180
6.1.2 External Respondent	187
6.2 Evaluation Conclusion	195
CHAPTER 7 CONCLUSION AND RECOMMENDATION.....	199
7.1 Conclusion.....	199
7.2 Recommendation.....	200
REFERENCES	202
APPENDICES	A

LIST OF FIGURES

Figure 2.1 Transaction viewed as a system [2]	9
Figure 2.2 Information System Cycle [2].....	10
Figure 2.3 Simplified View of Database System.....	12
Figure 2.4 Hierarchical Database Model [7]	14
Figure 2.5 Network Database Model [7].....	14
Figure 2.6 Relational Database Model [7]	14
Figure 2.7 Database Environment Components [7].....	16
Figure 2.8 Field, Record, and File in Student Table	17
Figure 2.9 Relation Schema [4].....	18
Figure 2.10 Relation Instance.....	19
Figure 2.11 Conceptual Schema of University Database [4].....	24
Figure 2.12 An example of View [4]	25
Figure 2.13 Three Levels of Abstraction in DBMS [4]	25
Figure 2.14 Example of an ERD	27
Figure 2.16 Creating a Table	32
Figure 2.17 Querying Data	33
Figure 2.18 Class Diagram Notations	35
Figure 2.19 Gane and Sarson DFD Notation	36
Figure 2.20 Flow Chart Notations.....	37
Figure 2.21 Use Case Diagram Notations	38
Figure 2.22 The Customized Waterfall Phases	50
Figure 2.23 Communication Phase	51
Figure 2.24 Planning Phase	52
Figure 2.25 Requirement Analysis Phase	53
Figure 2.26 Design Phase.....	54
Figure 2.27 Constructing Phase	55
Figure 2.28 Testing Phase	56
Figure 3.1 CV. X Organizational Structure.....	60
Figure 3.2 Context Diagram.....	64
Figure 3.3 Level 0 DFD	65
Figure 3.4 Inventory System Level 1 DFD.....	66
Figure 3.5 Sales System Level 1 DFD	68
Figure 3.6 Payment System Level 1 DFD.....	70
Figure 3.7 Purchasing System Level 1 DFD.....	72
Figure 3.8 TO Selling Flow Chart.....	73
Figure 3.9 OP Selling Flow Chart.....	75
Figure 3.10 Delivering and Product Return Flow Chart	77
Figure 3.11 Payment Flow Chart	79
Figure 4.1 New Organizational Structure	86
Figure 4.2 Context Diagram of Proposed System.....	90
Figure 4.3 Master Data Flow Diagram.....	91
Figure 4.4 Cost Data Flow Diagram	92
Figure 4.5 Cost Report Data Flow Diagram	93

Figure 4.6 Bonus Data Flow Diagram	94
Figure 4.7 Bonus Report Data Flow Diagram.....	95
Figure 4.8 Payroll Data Flow Diagram.....	96
Figure 4.9 Payroll Report Data Flow Diagram	97
Figure 4.10 Cost Flow Chart.....	98
Figure 4.11 Bonus Flow Chart	100
Figure 4.12 Payroll Flow Chart.....	102
Figure 4.13 Entity Relationship Diagram	130
Figure 4.14 Class Diagram (Part 1 of 3)	131
Figure 4.15 Class Diagram (Part 2 of 3)	132
Figure 4.16 Class Diagram (Part 3 of 3)	133
Figure 4.17 Cost, Bonus, and Payroll Use Case.....	134
Figure 4.18 Utility Use Case	134
Figure 4.19 Master Building Use Case	135
Figure 4.20 Master Customer Use Case.....	135
Figure 4.21 Master Product Use Case	136
Figure 4.22 Master Warehouse Stock Use Case	136
Figure 4.23 Master Supplier Use Case.....	137
Figure 4.24 Master Employee Stock Use Case	138
Figure 4.25 Master Login Use Case.....	138
Figure 4.26 Login, Unlock Login, and Main Menu State Transition Diagram.....	139
Figure 4.27 File Menu State Transition Diagram	139
Figure 4.28 Master Menu State Transition Diagram.....	139
Figure 4.29 Inventory Menu State Transition Diagram.....	140
Figure 4.30 Transaction Menu State Transition Diagram.....	140
Figure 4.31 Accounting Menu State Transition Diagram.....	140
Figure 4.32 Account Receivable Menu State Transition Diagram	141
Figure 4.33 Account Payable Menu State Transition Diagram	141
Figure 4.34 Accounting Reports Menu State Transition Diagram (Part 1 of 2)	141
Figure 4.35 Accounting Reports Menu State Transition Diagram (Part 2 of 2)	141
Figure 4.36 Analysis Menu State Transition Diagram.....	142
Figure 4.37 Utility Menu State Transition Diagram	142
Figure 4.38 System Topology	146
Figure 4.39 Login and Change Password User Interface Design	149
Figure 4.40 Unlock Login User Interface Design	149
Figure 4.41 Main Menu User Interface Design.....	150
Figure 4.42 Backup Data and Restore Data User Interface Design	150
Figure 4.43 Master Product, Warehouse Stock, Customer, Supplier, and Employee User Interface Design	151
Figure 4.44 Master Building and Login User Interface Design.....	152
Figure 4.45 Bonus and Cost User Interface Design	153
Figure 4.46 Payroll User Interface Design.....	153
Figure 4.47 Cost, Bonus, and Payroll Reports User Interface Design	154
Figure 5.1 Testing Phase	155
Figure 6.1 System Layout Diagram (Internal Respondent)	180
Figure 6.2 System Content Awareness Diagram (Internal Respondent)	181
Figure 6.3 System Aesthetics Diagram (Internal Respondent).....	182

Figure 6.4 System User Experience Diagram (Internal Respondent) 182

Figure 6.5 System Consistency Diagram (Internal Respondent) 183

Figure 6.6 System Minimal User Effort Diagram (Internal Respondent)..... 184

Figure 6.7 System Readable Diagram (Internal Respondent)..... 185

Figure 6.8 System Satisfaction Diagram (Internal Respondent) 185

Figure 6.9 System Menu Classification Diagram (Internal Respondent) 186

Figure 6.10 System Usefulness Diagram (Internal Respondent) 187

Figure 6.11 System Layout Diagram (External Repondent)..... 188

Figure 6.12 System Content Awareness Diagram (External Repondent)..... 189

Figure 6.13 System Aesthetics Diagram (External Repondent) 189

Figure 6.14 System User Experience Diagram (External Repondent)..... 190

Figure 6.15 System Consistency Diagram (External Repondent)..... 191

Figure 6.16 System Minimal User Effort Diagram (External Repondent)..... 191

Figure 6.17 System Readable Diagram (External Repondent)..... 192

Figure 6.18 System Satisfaction Diagram (External Repondent) 193

Figure 6.19 System Menu Classification Diagram (External Repondent)..... 193

Figure 6.20 System Usefulness Diagram (External Repondent)..... 194

Figure 6.21 Evaluation Conclusion Diagram for Internal Respondent 195

Figure 6.22 Evaluation Conclusion Diagram for External Respondent..... 196

Figure 6.23 Evaluation Conclusion Diagram for All Respondents..... 197

LIST OF TABLES

Table 2.1 Comparison of All SHA Variant [21]	48
Table 3.1 Salesman Daily Schedule	59
Table 4.1 Bonuses Entity	103
Table 4.2 Building Entity.....	104
Table 4.3 Cost Entity.....	105
Table 4.4 Customer Entity	106
Table 4.5 Employee Entity.....	107
Table 4.6 Login Entity	108
Table 4.7 Payroll Entity	109
Table 4.8 Product Entity.....	110
Table 4.9 Purchase_Invoice Entity.....	112
Table 4.10 Purchase_Invoice_Detail Entity.....	113
Table 4.11 Sales_Invoice Entity.....	114
Table 4.12 Sales_Invoice_Detail Entity.....	114
Table 4.13 Stored_In Entity	115
Table 4.14 Supplier Entity	116
Table 4.15 Supplier_Has_Product Entity.....	116
Table 4.16 Stock_Mutation Entity	117
Table 4.17 Stock_Opname Entity	118
Table 4.18 Top_Urgent Entity	119
Table 4.19 Bonuses Attribute.....	121
Table 4.20 Building Attribute	122
Table 4.21 Cost Attribute	122
Table 4.22 Customer Attribute.....	123
Table 4.23 Employee Attribute	123
Table 4.24 Login Attribute	124
Table 4.25 Payroll Attribute	124
Table 4.26 Product Attribute	125
Table 4.27 Purchase_Invoice Attribute	125
Table 4.28 Purchase_Invoice_Detail Attribute	126
Table 4.29 Sales_Invoice Attribute	126
Table 4.30 Sales_Invoice_Detail Attribute	127
Table 4.31 Stored_In Attribute.....	127
Table 4.32 Supplier Attribute	128
Table 4.33 Supplier_Has_Product Attribute	128
Table 4.34 Stock_Mutation Attribute.....	128
Table 4.35 Stock_Opname Attribute.....	129
Table 4.36 Top_Urgent Attribute	129
Table 4.37 Hardware Development System Specifications	143
Table 4.38 Software Development System Specifications	143
Table 4.39 Hardware Specification.....	145
Table 5.1 Login Test Plan.....	157
Table 5.2 Master Product Test Plan.....	160

Table 5.3 Master Warehouse Stock Test Plan.....	160
Table 5.4 Master Customer Test Plan.....	162
Table 5.5 Master Supplier Test Plan.....	163
Table 5.6 Master Employee Test Plan.....	166
Table 5.7 Master Building Test Plan.....	167
Table 5.8 Master Login Test Plan.....	168
Table 5.9 Cost Test Plan.....	169
Table 5.10 Bonus Test Plan.....	170
Table 5.11 Payroll Test Plan.....	171
Table 5.12 Cost Report Test Plan.....	171
Table 5.13 Bonus Report Test Plan.....	172
Table 5.14 Payroll Report Test Plan.....	173
Table 5.15 Change Login Password Test Plan.....	173
Table 5.16 Backup Data Test Plan.....	174
Table 5.17 Restore Data Test Plan.....	175
Table 5.18 Unlock Login Status Test Plan.....	176
Table 5.19 ACHUSI System Integration Testing.....	178
Table 6.1 System Layout Table (Internal Respondent).....	180
Table 6.2 System Content Awareness Table (Internal Respondent).....	181
Table 6.3 System Aesthetics Table (Internal Respondent).....	181
Table 6.4 System User Experience Table (Internal Respondent).....	182
Table 6.5 System Consistency Table (Internal Respondent).....	183
Table 6.6 System Minimal User Effort Table (Internal Respondent).....	184
Table 6.7 System Readable Table (Internal Respondent).....	184
Table 6.8 System Satisfaction Table (Internal Respondent).....	185
Table 6.9 System Menu Classification Table (Internal Respondent).....	186
Table 6.10 System Usefulness Table (Internal Respondent).....	187
Table 6.11 System Layout Table (External Repondent).....	188
Table 6.12 System Content Awareness Table (External Repondent).....	188
Table 6.13 System Aesthetics Table (External Repondent).....	189
Table 6.14 System User Experience Table (External Repondent).....	190
Table 6.15 System Consistency Table (External Repondent).....	190
Table 6.16 System Minimal User Effort Table (External Repondent).....	191
Table 6.17 System Readable Table (External Repondent).....	192
Table 6.18 System Satisfaction Table (External Repondent).....	192
Table 6.19 System Menu Classification Table (External Repondent).....	193
Table 6.20 System Usefulness Table (External Repondent).....	194
Table 6.21 Evaluation Conclusion Table for Internal Respondent.....	195
Table 6.22 Evaluation Conclusion Table for External Respondent.....	196
Table 6.23 Evaluation Conclusion Table for All Respondents.....	196