

## TABLE OF CONTENTS

APPROVAL PAGE.....	II
STATEMENT .....	II
FOREWORD.....	II
TABLE OF CONTENTS .....	V
LIST OF TABLES .....	VIII
LIST OF FIGURES .....	X
LIST OF APPENDIXES .....	XII
ABSTRACT .....	XIV
CHAPTER I INTRODUCTION .....	1
1.1 Research Background.....	1
1.2 Research Problems .....	4
1.3 Research Scope.....	5
1.4 Research Objectives .....	6
1.5 Research Benefits .....	6
1.6 Research Methodology .....	7
1.7 Writing Systematics.....	8
CHAPTER II LITERATURE REVIEW .....	10
CHAPTER III THEORITICAL FRAMEWORK .....	22
3.1 Design Thinking Methodology.....	22
3.2 Evolved Double-Diamond Framework .....	23
3.3 User Experience (UX) .....	25
3.4 User Interface (UI).....	26
3.5 In-Depth Interview .....	27
3.6 Empathy Map .....	29
3.7 The Four W's Questions.....	30
3.8 Problem Statement.....	30

3.9 How Might We Questions .....	31
3.10 User Persona .....	31
3.11 User Journey Map.....	32
3.12 Product Flowchart .....	33
3.13 Information Architecture .....	33
3.14 Wireframe.....	34
3.15 High-Fidelity Prototype.....	34
3.16 Usability Testing .....	35
3.17 Usability Metrics .....	36
3.18 User Experience Questionnaire .....	37
3.19 System Usability Scale .....	40
3.20 Data Mining.....	41
3.21 Decision Tree.....	43
3.22 C4.5 Algorithm.....	44
3.23 Thesis System.....	46
CHAPTER IV ANALYSIS AND PLANNING.....	48
4.1 Data Collection and Analysis .....	48
4.1.1 Preliminary Questionnaire .....	48
4.1.2 In-depth Interview .....	50
4.1.3 1 <sup>st</sup> User Experience Questionnaire .....	59
4.1.4 1 <sup>st</sup> System Usability Scale Questionnaire.....	62
4.1.5 C4.5 Decision Tree Algorithm .....	65
4.1.6 1 <sup>st</sup> Satisfaction Measurement.....	68
4.2 Empathy Map .....	74
4.3 The Four W's Questions.....	83
4.4 Problem Statement.....	85
4.5 How Might We Questions .....	86

4.6	User Persona .....	88
4.7	User Journey Map.....	92
4.8	Usability Testing Plan .....	104
CHAPTER V IMPLEMENTATION .....		108
5.1	Hardware and Software Specifications.....	108
5.2	Product Flowchart .....	108
5.3	Information Architecture .....	110
5.4	Wireframe.....	112
CHAPTER VI RESULTS AND TESTING .....		125
6.1	High Fidelity Prototype Results .....	125
6.2	Usability Testing Results.....	141
6.2.1	Efficiency Measurement.....	142
6.2.2	Effectiveness Measurement .....	145
6.2.3	2 <sup>nd</sup> User Experience Questionnaire.....	146
6.2.4	2 <sup>nd</sup> System Usability Scale Questionnaire .....	149
6.2.5	2 <sup>nd</sup> Satisfaction Measurement.....	152
6.2.6	User Feedback .....	156
CHAPTER VII CONCLUSION AND SUGGESTION .....		161
7.1	Conclusion .....	161
7.2	Suggestions.....	162
REFERENCES .....		163
APPENDIX .....		168

## LIST OF TABLES

Table 2.1 Literature Comparison Table.....	16
Table 3.1 Benchmark Intervals for The UEQ Scales (Schrepp, et al. 2017).....	39
Table 4.1 Preliminary Questionnaire Answer .....	49
Table 4.2 Introduction Stage Respondents Answer.....	51
Table 4.3 Ice Breaking Stage Respondents Answer.....	53
Table 4.4 General Questions Stage Respondents Answer.....	55
Table 4.5 Questions About the Product Stage Respondents Answer .....	57
Table 4.6 1 <sup>st</sup> UEQ Scale Means per Person.....	60
Table 4.7 1 <sup>st</sup> SUS Questionnaire Processed Score .....	63
Table 4.8 Entropy and Gain Calculation of Existing Thesis System .....	69
Table 4.9 Calculation of Entropy and Gain on node 1.1 .....	71
Table 4.10 Calculation of Entropy and Gain on Node 1.2 .....	73
Table 4.11 Empathy Map “Says” Section .....	75
Table 4.12 Empathy Map “Feels” Section .....	77
Table 4.13 Empathy Map “Does” Section.....	79
Table 4.14 Empathy Map “Think” Section .....	81
Table 4.15 4 W’s Questions List .....	84
Table 4.16 Problems Occurs in Existing Thesis System .....	86
Table 4.17 How Might We Questions? .....	87
Table 4.18 User Persona 1 .....	89
Table 4.19 User Persona 2 .....	90
Table 4.20 User Journey Map 1.....	94
Table 4.21 User Journey Map 2.....	99
Table 4.22 Usability Testing Plan .....	106
Table 5.1 Product Flowchart Results List .....	109
Table 5.2 Information Architecture (IA) Results List .....	111

Table 6.1 Expert User Tij and Respondents Tij Time Threshold.....	143
Table 6.2 Nij and Tij Values for Each Respondent (Scenario 1-4) .....	144
Table 6.3 Nij and Tij Values for Each Respondent (Scenario 5-9) .....	144
Table 6.4 Completion Rate Identification and Calculation .....	145
Table 6.5 2 <sup>nd</sup> UEQ Scale Means per Person .....	147
Table 6.6 2 <sup>nd</sup> SUS Questionnaire Processed Score.....	150
Table 6.7 Entropy and Gain Calculation of New Thesis System Prototype.....	152
Table 6.8 Calculation of Entropy and Gain on Node 1.1 .....	154
Table 6.9 Question 1 Respondent's Answer .....	156
Table 6.10 Question 2 Respondent's Answer .....	157
Table 6.11 Question 3 Respondent's Answer .....	158
Table 6.12 Question 4 Respondent's Answer .....	159
Table 6.13 Question 5 Respondent's Answer .....	160

## LIST OF FIGURES

Figure 3.1 Double-Diamond Framework (British Design Council, 2005).....	24
Figure 3.2 Empathy Map Illustration .....	29
Figure 3.3 Acceptability Ranges of SUS scores (Bangor, et al. 2009).....	41
Figure 3.4 Data Mining Stage (Wang et al., 2019).....	42
Figure 3.5 Decision Tree Stage Process (Supriyadi & Safitri 2020).....	43
Figure 3.6 DCSE Thesis System Login Page .....	47
Figure 3.7 DCSE Thesis System Dashboard .....	47
Figure 4.1 The Pseudo Code for C4.5 Decision Tree Algorithm .....	67
Figure 4.2 Decision Tree on Node 1 .....	71
Figure 4.3 Decision Tree on Node 1.1 .....	72
Figure 4.4 Decision Tree of the Existing Thesis System .....	74
Figure 5.1 Log-in Page Wireframe .....	112
Figure 5.2 Homepage Wireframe .....	113
Figure 5.3 “Propose Supervisor” Feature Wireframe.....	114
Figure 5.4 “Find Lecturer” Feature Wireframe .....	114
Figure 5.5 “My Supervisor” Feature Wireframe .....	115
Figure 5.6 “Propose New Exam” Feature Wireframe .....	116
Figure 5.7 “Current Supervisor” Feature Wireframe .....	116
Figure 5.8 “My Exam” Feature Wireframe .....	117
Figure 5.9 “Revision Stage Exam” Feature Wireframe .....	118
Figure 5.10 “Thesis System Calendar” Feature Wireframe .....	119
Figure 5.11 “Thesis Messenger” Feature Wireframe .....	120
Figure 5.12 “Need Help?” Feature Wireframe .....	121
Figure 5.13 “My Account” Feature Wireframe.....	122
Figure 5.14 “Notification” Feature Wireframe.....	123
Figure 5.15 “Help Center” Feature Wireframe .....	124

Figure 6.1 Design System: Main Color .....	125
Figure 6.2 Design System: Secondary Color.....	125
Figure 6.3 Design System: Typography .....	126
Figure 6.4 Login Page .....	127
Figure 6.5 Homepage .....	128
Figure 6.6 “Create New Supervisor Proposal” Feature .....	129
Figure 6.7 “Propose Supervisor” Feature .....	129
Figure 6.8 “Find Lecturer” Feature .....	130
Figure 6.9 “My Supervisor” Feature .....	131
Figure 6.10 “Propose Exam” Feature .....	131
Figure 6.11 “Propose New Exam” Feature .....	132
Figure 6.12 “Current Supervisor” Feature.....	132
Figure 6.13 “My Exam” Feature .....	133
Figure 6.14 “Revision Stage Exam” Feature.....	134
Figure 6.15 “Thesis System Calendar” Feature.....	135
Figure 6.16 “Thesis Messenger” Feature .....	136
Figure 6.17 “Need Help?” Feature .....	137
Figure 6.18 “My Account” Feature .....	138
Figure 6.19 “Notification” Feature .....	139
Figure 6.20 “Help Center” Feature.....	140
Figure 6.21 Completion Rate Percentage per Scenario .....	146
Figure 6.22 Decision Tree on Node 1.....	154
Figure 6.23 Decision Tree of the New Prototype of Thesis System .....	155

## LIST OF APPENDIXES

Appendix 1 User Experience Questionnaire Questions List .....	168
Appendix 2 System Usability Scale (SUS) Question List.....	168
Appendix 3 Preliminary Questionnaire Questions List.....	169
Appendix 4 In-Depth Interview and Qualitative Usability Testing Respondents Data ...	170
Appendix 5 In-Depth Interview Questions List .....	170
Appendix 6 UEQ and SUS Questionnaire Respondents Data.....	172
Appendix 7 1 <sup>st</sup> UEQ Answer .....	173
Appendix 8 1 <sup>st</sup> UEQ Answer (Transformed).....	176
Appendix 9 1 <sup>st</sup> SUS Questionnaire Answer .....	178
Appendix 10 1 <sup>st</sup> UEQ and SUS Questionnaire Benchmark Border Results .....	180
Appendix 11 Flowchart for Login Page .....	182
Appendix 12 Flowchart for Dashboard .....	182
Appendix 13 Flowchart for “Create New Supervisor Proposal” feature.....	183
Appendix 14 Flowchart for “My Supervisor” feature .....	183
Appendix 15 Flowchart for “Propose Exam” feature.....	184
Appendix 16 Flowchart for “My Exam” feature .....	184
Appendix 17 Flowchart for “Thesis System Calendar” feature .....	185
Appendix 18 Flowchart for “Thesis Messenger” feature .....	185
Appendix 19 Flowchart for “Need Help” feature.....	186
Appendix 20 Flowchart for “My Account” feature.....	186
Appendix 21 Flowchart for “Help Center” & “Notification” features .....	187
Appendix 22 Information Architecture for Login Page .....	188
Appendix 23 Information Architecture for Dashboard .....	188
Appendix 24 Information Architecture for “Create New Supervisor Proposal”.....	189
Appendix 25 Information Architecture for “My Supervisor” .....	189
Appendix 26 Information Architecture for “Propose Exam” .....	190



Appendix 27 Information Architecture for “My Exam” .....	190
Appendix 28 Information Architecture for Thesis System Calendar .....	191
Appendix 29 Information Architecture for Thesis Messenger .....	191
Appendix 30 Information Architecture for “Need Help” features .....	192
Appendix 31 Information Architecture for “My Account” Page .....	192
Appendix 32 Information Architecture for Notification Page.....	193
Appendix 33 Information Architecture for Help Center Page .....	193
Appendix 34 2 <sup>nd</sup> UEQ Answer .....	194
Appendix 35 2 <sup>nd</sup> UEQ Answer (Transformed).....	196
Appendix 36 2 <sup>nd</sup> SUS Questionnaire Answer .....	198
Appendix 37 2 <sup>nd</sup> UEQ and SUS Questionnaire Benchmark Border Results.....	199