

HEALTHCARE INTEGRATED SYSTEM ADMINISTRATION



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS TESIS*JUDUL: HEALTHCARE INTEGRATED SYSTEM ADMINISTRATIONSESI PENGAJIAN: 2016/2017Saya ARDHI SURYA IBRAHIM

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

1. Tesis dan projek adalah hakmilik Universiti Teknikal Malaysia Melaka.
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

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

_____ TERHAD

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

_____ TIDAK TERHAD

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

(TANDATANGAN PENULIS)

Alamat tetap: NO 99, JALAN TAKH
14, TAMAN AYER KEROH HEIGHTS
1, 75450 AYER KEROH, MELAKA,
MALAYSIA

(TANDATANGAN PENYELIA)

PROFESOR DR. MOHD KHANAPI
BIN ABD GHANI

Tarikh: 14 OGOS 2017

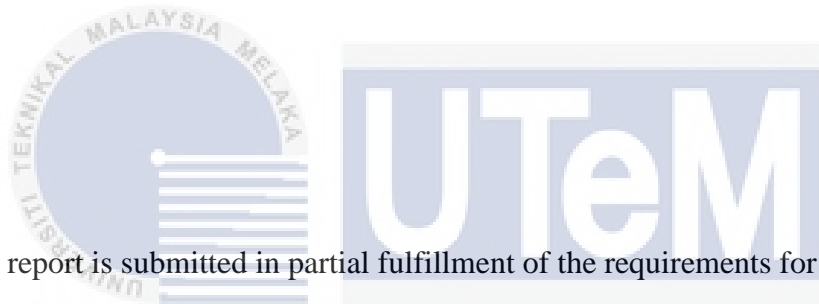
Tarikh: _____

CATATAN: * Tesis dimaksudkan sebagai Laporan Akhir Projek Sarjana Muda (PSM)

** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa

HEALTHCARE INTEGRATED SYSTEM ADMINISTRATION

ARDHI SURYA IBRAHIM



This report is submitted in partial fulfillment of the requirements for the award of

Bachelor of Computer Science (Software Development)
اوتیور سینی بیگنیسکل ملیسیا ملاک

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

UNIVERSITY TEKNIKAL MALAYSIA MELAKA

2017

DECLARATION

I hereby declare that this project report entitled
HEALTHCARE INTEGRATED SYSTEM ADMINISTRATION

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

STUDENT : _____ Date: _____
(ARDHI SURYA IBRAHIM)

I hereby declare that I have read this project report and found this project report is
sufficient in term of the scope and quality for the award of

Bachelor of Computer Science (Software Development) With Honours.

SUPERVISOR : _____ Date: _____
(PROF. DR MOHD KHANAPI ABD GHANI)

DEDICATION

I dedicate this project to Allah the Almighty God my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this semester.

I also dedicate this work to my beloved parents; Muhammad Suryanata and Gusti Fitriani who have encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. Thank you for always supporting me in all possible ways that you both have could.

To my supervisor and lecturers, thank you for all of the knowledge, guidance, patience, and encouragement that you have given to me which have kept me in high spirit in finishing this project.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

To my dear friends, thank you for always being around and ready to help me whenever I need it.

ACKNOWLEDGMENT

Praised to Allah The Almighty God who has blessed us with strength and patience throughout the semester which have kept us going in completing this project. Without His mercy, this project might have failed miserably.

Millions thanks to our beloved parents who have never stop mentioning our success and bright future in their prayers. Without them, we are not even have the chance to be here today and collaborate with others in this project. We want the readers to know that we love you so much. So much that words cannot describe it.

Also thanks to our supervisor, Prof. Dr. Mohd Khanapi Abd Ghani, the key factor in achieving success for this project. He is the one who has gave us step-by-step guidance starting from a scratch of an idea into a production of a real health information web app. Thank you for your motivational words that have kept us up whenever we were feeling down at the lowest point in our life. A lot of problems we have faced and not a single one that we could solve without your advice. Thank you for lending your helping hand whenever we were in need.

Finally, thank you to all parties that have directly or indirectly contribute to the success of this project, especially the iHIS project team.

ABSTARCT

iHIS is an acronym which stands for “Integrated Health Information System”. iHIS is a web-based application which covers billing, clinical and operational requirements of any healthcare facility in Malaysia. Having various integrated modules like pharmacy, laboratory, radiology, consultation, appointment, patient management, system administration, data analysis and financial accounting, it has everything needed to manage the business process of a healthcare facility. As mentioned, iHIS is a big system which contains many sub-systems or modules. The problem in integration occur if each module fails to communicate with other modules. In other words, how to enable data-sharing across multiple modules? To create a successful inter-module communication, we must ensure that those modules communicate using the same language. It simply means all data, terms and codes used in the healthcare system must correspond to the latest valid standard. This is where Healthcare Integrated System Administration (HISA) plays a vital role. Therefore, development of HISA is to help administrators to do their jobs to make sure all data entry, terms and codes used are standard using a computerized system. Those terms or codes will be referred later by other modules as a lookup or dictionary to ensure data integrity throughout iHIS. Our next concern is about data confidentiality. We have various levels and types of personnel with different authority in a healthcare facility. Of course there is some rules or restriction of what data can be disclosed to which user. Therefore, HISA also allow the administrators to manage users by defining the users’ role and access level into the system. Thus, data confidentiality and data privacy are guaranteed as users can only access certain functions and see certain information according to their authority. Since healthcare domain is not easy to understand, agile methodology is used to develop HISA in order to identify expectation mismatches early between users and developer. Through this method, requirements get clearer every iteration and finally, a product that meets user’s requirements can be produced. iHIS will be used by users from different health facilities. Therefore, HISA is significant to make sure each user does not interfere other users.

ABSTRAK

iHIS adalah aplikasi berasaskan web yang mempunyai pelbagai modul bersepadu seperti farmasi, makmal, radiologi, perundingan, pelantikan, pengurusan pesakit, pentadbiran sistem, analisis data dan perakaunan kewangan, ia mempunyai semua yang diperlukan untuk menguruskan proses perniagaan di kemudahan penjagaan kesihatan. Seperti yang dinyatakan, iHIS adalah satu sistem yang besar yang mengandungi banyak sub-sistem atau modul. Masalah dalam integrasi berlaku jika setiap modul gagal untuk berkomunikasi dengan modul lain. Dalam erti kata lain, bagaimana untuk membolehkan perkongsian data merentasi pelbagai modul? Ia bermakna semua data, terma dan kod yang digunakan dalam sistem penjagaan kesihatan perlu sesuai dengan standard yang sah. Ini adalah di mana Sistem Pentadbiran Kesihatan Bersepadu (HISA) memainkan peranan penting. Oleh itu, pembangunan HISA adalah untuk membantu pentadbir untuk menjalankan tugas mereka untuk memastikan semua kemasukan data, istilah dan kod yang digunakan adalah standard menggunakan sistem berkomputer. Istilah atau kod akan dirujuk oleh modul lain sebagai pencarian atau kamus untuk memastikan integriti data di iHIS. Kebimbangan yang seterusnya adalah mengenai kerahsiaan data. Kami mempunyai pelbagai peringkat dan jenis kakitangan yang mempunyai kuasa yang berbeza di kemudahan penjagaan kesihatan. Sudah tentu terdapat beberapa peraturan atau sekatan tentang data yang boleh didedahkan kepada pengguna. Oleh itu, HISA juga membolehkan pentadbir untuk menentukan peranan dan peringkat akses pengguna ke dalam sistem. Oleh itu, kerahsiaan data dan privasi data terjamin kerana pengguna hanya boleh mengakses fungsi-fungsi tertentu dan melihat maklumat tertentu mengikut kuasa mereka. Disebabkan domain penjagaan kesihatan tidak mudah untuk difahami, metodologi tangkas digunakan untuk membangunkan HISA untuk mengenal pasti ketidakpadanan jangkaan antara pengguna dan pembangun sistem secepatnya. Melalui kaedah ini, keperluan menjadi lebih jelas dalam setiap kitaran dan akhirnya, produk yang memenuhi keperluan pengguna boleh dihasilkan. iHIS akan digunakan oleh pengguna daripada kemudahan kesihatan yang berbeza. Oleh itu, HISA adalah penting untuk memastikan setiap pengguna tidak mengganggu pengguna lain.

CONTENTS

BORANG PENGESAHAN STATUS TESIS*	I
DECLARATION	III
DEDICATION	IV
ACKNOWLEDGMENT	V
ABSTARCT	VI
ABSTRAK	VII
LIST OF FIGURES	XIII
LIST OF TABLES	XVI
CHAPTER I	1
INTRODUCTION	1
1.1 INTRODUCTION.....	1
1.2 PROBLEM STATEMENTS.....	2
1.3 OBJECTIVE	3
1.4 SCOPE.....	3
1.5 PROJECT SIGNIFICANCE.....	5
1.6 EXPECTED OUTPUT	6
1.7 CONCLUSION	6
CHAPTER II	7
LITERATURE REVIEW AND PROJECT METHODOLOGY	7
2.1 INTRODUCTION.....	7
2.2 FACTS AND FINDINGS	7
2.2.1 <i>Domain</i>	7
2.3 PROJECT METHODOLOGY	10
2.3.1 <i>First iteration</i>	11
2.3.2 <i>Final iteration</i>	14
2.4 PROJECT REQUIREMENTS	16
2.4.1 <i>Software requirement</i>	16

2.4.2 <i>Hardware requirements</i>	17
2.4.3 <i>Other requirements</i>	17
2.5 PROJECT SCHEDULE AND MILESTONES	18
2.6 CONCLUSION	21
CHAPTER III	22
ANALYSIS	22
3.1 INTRODUCTION.....	22
3.2 PROBLEM ANALYSIS	22
3.3 REQUIREMENT ANALYSIS.....	23
3.3.1 <i>Data requirement</i>	24
3.3.2 <i>Functional requirement</i>	24
3.2.1 <i>Use case description</i>	25
3.3.3 <i>Non-functional requirement</i>	59
3.4 CONCLUSION	60
CHAPTER IV.....	61
DESIGN	61
4.1 INTRODUCTION.....	61
4.2 HIGH-LEVEL DESIGN	61
4.2.1 <i>System Architecture</i>	61
4.2.2 <i>User Interface Design</i>	63
4.2.3 <i>Database Design</i>	74
4.3 DETAIL DESIGN	83
4.3.1 PROGRAM STRUCTURE FOR MANAGE LOOKUP MASTER.....	84
4.4 CONCLUSION	85
CHAPTER V	86
IMPLEMENTATION	86
5.1 INTRODUCTION.....	86
5.2 SOFTWARE DEVELOPMENT ENVIRONMENT SETUP	86
5.3 SOFTWARE CONFIGURATION MANAGEMENT.....	89
5.3.1 <i>Configuration environment setup</i>	89
5.3.2 <i>Version control procedure</i>	91

5.4 IMPLEMENTATION STATUS	92
5.5 CONCLUSION	94
CHAPTER VI.....	95
TESTING.....	95
6.1 INTRODUCTION.....	95
6.2 TEST PLAN	96
6.2.1 Test Organization.....	96
6.2.2 Test environment	97
6.2.3 Test Schedule.....	98
6.3 TEST STRATEGY	99
6.3.1 Unit testing.....	99
6.3.2 Integration testing	99
6.3.3 System testing	99
6.3.4 User acceptance testing	100
6.4 TEST DESIGN.....	100
6.4.1 Test description.....	100
6.4.2 Test data.....	100
6.4.3 Quick reference	101
6.5 TEST RESULT AND ANALYSIS	101
6.6 CONCLUSION.....	105
CHAPTER VII	106
CONCLUSION.....	106
7.1 OBSERVATION ON WEAKNESSES AND STRENGTHS	106
7.2 PROPOSITIONS FOR IMPROVEMENT	106
7.3 PROJECT CONTRIBUTION	107
7.4 CONCLUSION	108
REFERENCES.....	109
BIBLIOGRAPHY	110
APPENDICES	111
APPENDIX A: PROGRAM STRUCTURE OF HISA	111

4.3.1 Program structure for manage lookup master.....	112
4.3.2 Program structure for manage lookup detail.....	113
4.3.3 Program Structure for manage user	114
4.3.4 Program structure for manage role	116
4.3.5 Program structure for manage role-user assignment.....	117
4.3.6 Program structure for manage page-role assignment.....	118
4.3.7 Program structure for manage health facility	119
4.3.8 Program structure for manage discipline	120
4.3.9 Program structure for manage subdiscipline	121
4.3.10 Program structure for manage hfc-discipline assignment.....	123
4.3.11 Program structure for manage CIS setting.....	124
4.3.12 Program structure for manage PMS setting	125
4.3.13 Program structure for manage system code	126
4.3.14 Program structure for manage module code	127
4.3.15 Program structure for manage transaction code.....	128
4.3.16 Program structure for manage page code	129
APPENDIX B: TEST CASE AND TEST DATA	130
Iteration 1.....	131
Test Case 1000.....	131
Test Data 1000.....	135
Test Case 2000.....	136
Test Data 2000.....	141
Test Case 3000.....	142
Test Data 3000.....	145
Iteration 2.....	146
Test Case 1000.....	146
Test Data 1000.....	150
Test Case 2000.....	151
Test Data 2000.....	156
Test Case 3000.....	157
Test Data 3000.....	160
Test Case 4000.....	161
Test Data 4000.....	170

<i>Test Case 5000</i>	172
<i>Test Data 5000</i>	183
<i>Test Case 6000</i>	185
<i>Test Data 6000</i>	187
APPENDIX C: QUICK REFERENCE.....	188
LIST OF FIGURES	IV
HISA QUICK REFERENCE	7
1.1 HISA TRANSACTION	7



LIST OF FIGURES

Figure 3.1: HISA Use Case Diagram.....	24
Figure 3.2: Maintain health facility page.....	31
Figure 3.3: Maintain discipline page.....	38
Figure 3.4: Maintain subdiscipline page.....	39
Figure 3.5: Discipline/subdiscipline assignment page.....	39
Figure 3.6: Maintain system page.....	46
Figure 3.7: Maintain module page.....	46
Figure 3.8: Maintain page page.....	46
Figure 3.9: Create staff details page.....	53
Figure 3.10: Assign role to user page.....	53
Figure 3.11: Maintain lookup master page.....	58
Figure 3.12: Maintain lookup detail page.....	59
Figure 4.1: HISA system architecture.....	62
Figure 4.1.1: HISA internal view of system architecture.....	62
Figure 4.2: Login page.....	63
Figure 4.3: Maintain lookup master page.....	63
Figure 4.4: Maintain lookup detail page.....	64
Figure 4.5: Maintain health facility page.....	64
Figure 4.6: Maintain discipline page.....	65
Figure 4.7: Maintain subdiscipline page.....	65
Figure 4.8: Assign discipline to health facility page.....	66
Figure 4.9: Maintain user page.....	67
Figure 4.10: Maintain role page.....	68
Figure 4.11: Maintain user-role assignment page.....	69

Figure 4.12: Maintain role-module assignment page.....	70
Figure 4.13: Maintain queue page.....	71
Figure 4.14: Maintain system code page.....	71
Figure 4.15: Maintain module code	72
Figure 4.16: Maintain page code.....	72
Figure 4.17: Maintain transaction code.....	73
Figure 4.18: ERD of HISA.....	74
Figure 4.1: Table notation in program specification diagram.....	83
Figure 4.2: Manage lookup master program structure	84
Figure 5.1: Development environment layout	87
Figure 6.1: Test organization structure	96
Figure 6.2: Test environment structure	97
Figure 6.3: Summary of point 15	103
Figure 6.4: Iteration 1 test result	104
Figure 6.5: Iteration 2 test result	104
Figure 4.1: Manage lookup master program structure.....	112
Figure 4.2: Program structure for manage lookup detail	113
Figure 4.3: Program Structure for manage user	114
Figure 4.4: Program structure for manage role	116
Figure 4.5: Program structure for manage role-user assignment	117
Figure 4.6: Program structure for manage page-role assignment	118
Figure 4.7: Program structure for manage health facility	119
Figure 4.8: Program structure for manage discipline.....	120
Figure 4.9: Program structure for manage subdiscipline	121
Figure 4.10: Program structure for manage hfc-discipline assignment	123
Figure 4.11: Program structure for manage CIS setting	124

Figure 4.12: Program structure for manage PMS setting.....	125
Figure 4.13: Program structure for manage system code.....	126
Figure 4.14: Program structure for manage module code.....	127
Figure 4.15: Program structure for manage transaction code	128
Figure 4.16: Program structure for manage page code	129



LIST OF TABLES

Table 1.1: Users' job scope description	3
Table 2.1: Software Specification	16
Table 2.2: Hardware Specification.....	17
Table 2.3: Project milestones	18
Table 2.4: Gantt-chart of HISA.....	21
Table 3.1: Non-functional requirement of HISA	59
Table 4.1: Structure for table adm_discipline	75
Table 4.2: Structure for table adm_health_facility	75
Table 4.3: Structure for table adm_hfc_discipline.....	76
Table 4.4: Structure for table adm_lookup_detail.....	77
Table 4.5: Structure for table adm_lookup_master.....	77
Table 4.6: Structure for table adm_module.....	78
Table 4.7: Structure for table adm_page.....	78
Table 4.8: Structure for table adm_responsibility.....	78
Table 4.9: Structure for table adm_role	79
Table 4.10: Structure for table adm_subdiscipline	79
Table 4.11: Structure for table adm_system	80
Table 4.12: Structure for table adm_txn_code.....	80
Table 4.13: Structure for table adm_users	80
Table 4.14: Structure for table adm_user_access_role	82
Table 5.1: Development server specification.....	87
Table 5.2: Development machine specification.....	89
Table 5.3: Implementation status of HISA	92

Table 6.1: Test schedule.....	98
Table 6.2: Questionnaire and Result	102
Table 1.1: Module transactions	7



CHAPTER I

INTRODUCTION

1.1 Introduction

Accurate recording of the care given to a patient (usually diagnostic and procedure information) using clinical terms entered into the electronic record, leads to better quality information within the healthcare information system and enables sharing of data across multiple systems more effectively. It enables more effective searching of clinical records to support patient care, patient monitoring and risk management as well as the subsequent classification of data for administrative purposes and statistical analysis. The provision of better quality information for authorized health professionals helps improve the overall quality of patient care.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

So how to achieve accurate data recording? How can we enable data sharing across multiple systems? These could be achieved by ensuring that those systems communicate using the same language. It simply means all data, terms and codes used in the healthcare system must correspond to the latest valid standard.

Therefore, development of HISA is to help administrators to do their jobs to make sure all data entry, terms and codes used are standard using a computerized system. Those terms will be used by doctors later on during patients' consultation session to record the complaints and diagnosis. So the doctors can just select the existing terms using the system. Besides, this system also allow the administrators to manage users by defining the users' role and access level into the system. Thus, data

confidentiality and data integrity are guaranteed as users can only access certain functions according to their authority.

1.2 Problem Statements

System integration is a big challenge in software development. There are a lot of modules or systems lie under iHIS project. To make integration of those modules possible, the data used by all modules must be uniform or standard. Therefore, those modules need to have something to look up to as a reference or dictionary such that all forms of data are standardized across all modules.

Many people from different facilities and different roles and authority levels are involved in everyday healthcare business process. If iHIS is to be introduced to those people, then users' role and access level must be clearly defined so that users cannot access the system beyond their authority.

Difficulty in maintaining both administrative and clinical terms and codes are also issues that need to be solved. Thus, we need a computerize system to aid in managing those codes rather than using traditional paper based files.

1.3 Objective

This project has objectives as listed below:

1. To create a web application of healthcare system administration.
2. To assists administrators of healthcare facilities in managing administrative codes, clinical codes and user authentication using computerize system.
3. To create paperless healthcare records keeping.
4. To manage patient queue.

1.4 Scope

HISA is developed mainly to assist the system admin of any healthcare facility registered to iHIS. This system basically allow only two types of system admin user which are project system admin and local system admin. The following table described the list of users and their job scopes.

Table 1.1: Users' job scope description

User	Job Scope
Project system administrator	<ul style="list-style-type: none"> ➤ Have full access to iHIS's modules across all registered healthcare facilities. ➤ Manage iHIS's module codes. <ul style="list-style-type: none"> • Create, update and delete module codes. ➤ Manage lookup codes <ul style="list-style-type: none"> • Create, update and delete lookup codes of all health facilities. ➤ Manage health facility

	<ul style="list-style-type: none"> • Register new health facility. • Update and delete existing health facility information. ➤ Manage discipline and subdiscipline <ul style="list-style-type: none"> • Create, update and delete discipline and subdiscipline of all health facilities. ➤ Manage role <ul style="list-style-type: none"> • Create, update and delete role of all health facilities. ➤ Manage role access level <ul style="list-style-type: none"> • Assign accesible module to role of all health facilities. • Revoke module from role of all health facilities. ➤ Manage user <ul style="list-style-type: none"> • Create, update and delete user of all health facilities. ➤ Manage user's role <ul style="list-style-type: none"> • Assign role to user of all health facilities. • Revoke role from user of all health facilities. ➤ Manage queue <ul style="list-style-type: none"> • Create, update and delete queue of all health facilities.
Local system administrator	<ul style="list-style-type: none"> ➤ Have full access to iHIS's modules across his/her healthcare facility. ➤ Manage lookup codes <ul style="list-style-type: none"> • Create, update and delete lookup codes of his/her health facility. ➤ Manage health facility <ul style="list-style-type: none"> • Update and delete his/her health facility information. ➤ Manage discipline and subdiscipline <ul style="list-style-type: none"> • Create, update and delete discipline and subdiscipline of his/her health facility.

	<ul style="list-style-type: none"> ➤ Manage role <ul style="list-style-type: none"> • Create, update and delete role of his/her health facility. ➤ Manage role access level <ul style="list-style-type: none"> • Assign accessible module to role of his/her health facility. • Revoke module from role of his/her health facility. ➤ Manage user <ul style="list-style-type: none"> • Create, update and delete user of his/her health facility. ➤ Manage user's role <ul style="list-style-type: none"> • Assign role to user of his/her health facility. • Revoke role from user of his/her health facility. ➤ Manage queue <ul style="list-style-type: none"> • Create, update and delete queue of his/her health facility.
--	--

1.5 Project Significance

This project is significant to iHIS. HISA is one of the key towards integration of all modules under iHIS project. Integration means interoperability among all modules in iHIS. This is HISA plays a vital role. Therefore, development of HISA is to help administrators to do their jobs to make sure all data entry, terms and codes used are standard using a computerized system. Those terms or codes will be referred later by other modules as a lookup or dictionary to ensure data integrity throughout iHIS. Thus, system integration of iHIS is achievable.

iHIS is a web-based application which will have a lot of users from different health facilities. Therefore, data partitioning is a great concern in order to maintain

data privacy and confidentiality. HISA is also used to define that partition clearly so that data are only available to the right users.

1.6 Expected Output

The expected outcomes of this project is a fully developed Healthcare Integrated System Administration (HISA) that achieved all mentioned objectives. I hope this system can be a starting step to make standard usage as a culture in healthcare system in order to achieve long term of standard data representation and integration.

1.7 Conclusion

This chapter has discussed the purpose of this project. What and why this project is developed is clearly stated in this chapter. This chapter is the first area readers will refer when looking into this project. It is also show the process of the project as a whole to make it easy to refer. Next chapter will discuss in detail about the project methodology and also the literature review.