

CEAT Smart Library Management System

An Undergraduate Thesis Presented to the Faculty of Computer Engineering
College of Engineering, Architecture and Technology
De La Salle University – Dasmariñas
Dasmariñas City, Cavite

In Partial Fulfillment of the Requirements for the Degree of
Bachelor of Science in Computer Engineering

Arvin J. de Castro
Jason Josef S. De Leon
Jerome G. Jusi

April 2019



ABSTRACT

Research and engineering books are beneficial and important for people who brainstorm for making new ideas and creations. These materials can be found in the University library while some of these materials can only be found in the CEAT faculty department. The problem lies on the lack of logging the track record of people who borrow the material, and of digitalized catalogue. The lack of digital preservation of the materials leads to missing or destroyed books. This study aims to develop a management system that will monitor the security, proper position, location, and availability of the valuable researches and theses in the CEAT department using LED dot matrix and virtual map for directions, PC Kiosk, RFID scanner, and student ID for logging borrowers; and a web application that will assist and minimize the conflict of looking books and allow book search anywhere including a preview of the abstract for the thesis manuscript. The result of this study will provide the CEAT department with an independent research paper catalogue that stores the most frequently used books in the department. This will also aid the students to conveniently brainstorm new ideas for research in the future. The results presented in this study will also aid for future improvement of this system.



TABLE OF CONTENTS

Chapter 1: Introduction..... 1

1.1 Background of the Study1

1.2 Objectives of the Study.....3

1.3 Significance of the Study4

1.4 Scope and Limitation4

1.5 Conceptual Framework5

1.6 Definition of Terms.....6

Chapter 2: Review of Related Literature 8

2.1 Foreign Literature8

2.1.1 Library Definition8

2.1.2 Smart Library Definition8

2.1.3 OPAC Definition9

2.2 Local Literature.....9

2.2.1 Philippine Library Trends in 21st century.....10

2.2.2 Design, Development, and Evaluation of Passive RFID10

2.2.3 Modernization of National Library of the Philippines10

2.3 Foreign Study11

2.3.1 Impact of RFID Technology in the Industry.....11

2.3.2 Smart Library Management System using RFID11

2.3.3 Implementation of Smart Library Systems using IoT12

2.4 Local Study.....12

2.4.1 RFID Local Study.....12

2.4.2 RFID Inventory System13

2.5 Relevance to the Present Study13

Chapter 3: Methodology 15

3.1 Methodological Framework15

3.2 Data Gathering Procedure17

3.3 Research Design17

3.4 Research Instrument.....18

3.4.1 Interviews.....18



3.4.2 Surveys.....	19
3.4.3 Forms	19
3.5 Testing Methodology	19
3.6 System Process and Design	21
3.6.1 Block Diagram	21
3.6.2 Flowchart	22
3.6.3 Architecture	29
3.7 System Components.....	29
3.7.1 Hardware Components	30
3.7.2 Software Components.....	32
3.8 System Designs	34
3.8.1 Software Design	34
3.8.2 Hardware Design.....	37
3.9 Budget Plan.....	40
Chapter 4: Results and Discussion.....	41
4.1 System Development.....	41
4.1.1 Software Description.....	42
4.1.2 Hardware Description	43
4.2 Prototype Design	44
4.2.1 Hardware Specification	44
4.2.2 Software Development.....	53
4.2.3 Database Design	67
4.3 Validation	75
4.3.1 System Testing.....	76
4.3.2 Functional Testing	77
4.3.3 Performance Test	86
4.3.4 Interview Results.....	86
4.3.5 Security and Backup	87
4.3.6 Implementation of Proposed System.....	88
4.3.7 Comparative Analysis.....	88
4.3.8 Feedback from expert test	89



4.3.9 Feedback from end user89

Chapter 5: Conclusion and Recommendation 95

5.1 Conclusion.....95

5.2 Recommendation96

Bibliography 97

Appendices 100

Appendix A: Sample Blank Form 100

Appendix B: Gantt Chart 101

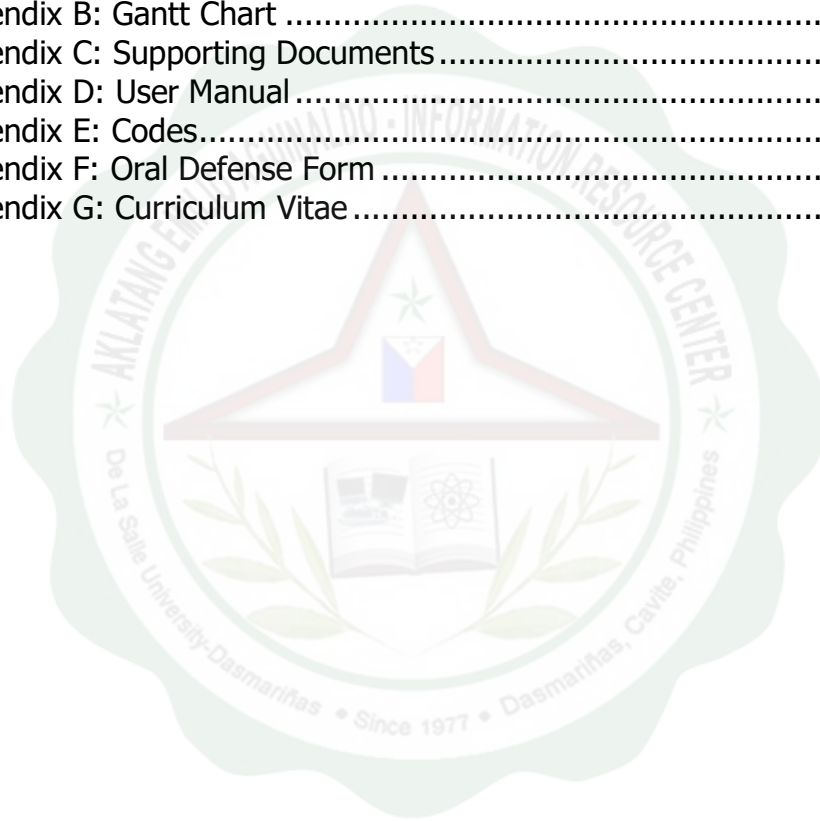
Appendix C: Supporting Documents 103

Appendix D: User Manual 104

Appendix E: Codes.....127

Appendix F: Oral Defense Form 179

Appendix G: Curriculum Vitae 183





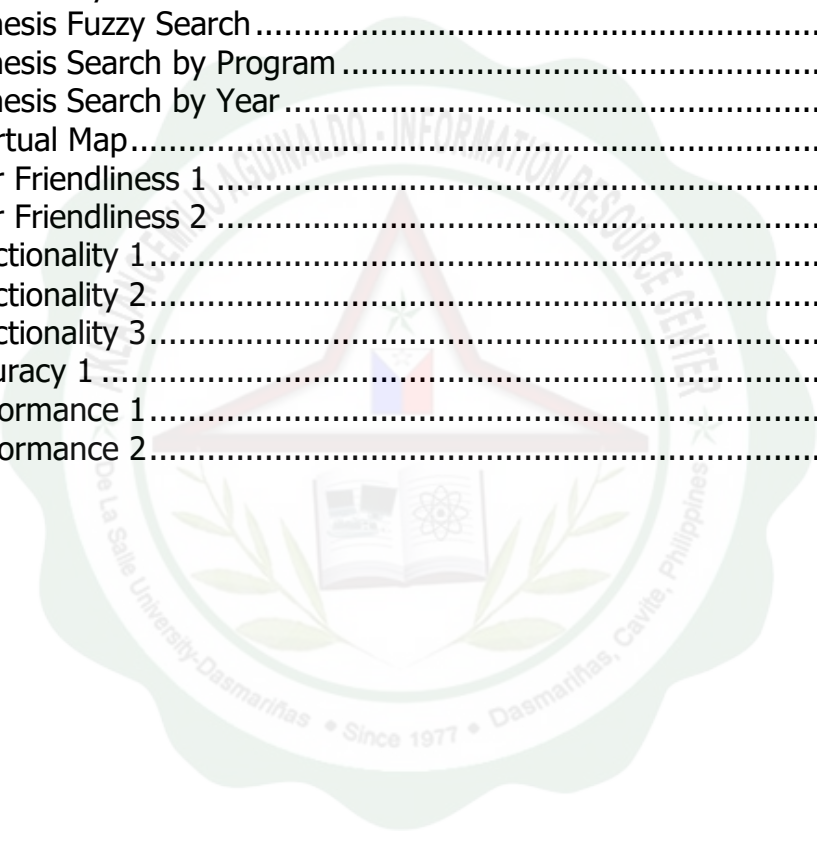
List of Figures

Figure

1.5.1 Conceptual Framework	5
3.1 Methodological Framework	15
3.6.1.1 Block Diagram	21
3.6.2.1 System Flow Chart.....	22
3.6.2.2 Online Search Flow Chart	23
3.6.2.3 Kiosk Search Flow Chart.....	24
3.6.2.4 Borrowing Library Materials Flowchart.....	25
3.6.2.5 Librarian/Admin Interface.....	26
3.6.3.1 System Architecture.....	29
3.7.1.1 Raspberry Pi.....	30
3.7.1.2 Dotmatrix Display	31
3.7.1.3 RC522 RFID reader.....	31
3.8.1.1 Search Page for Online Search	34
3.8.1.2 Login Page for Website	35
3.8.1.3 Registration Page	36
3.8.2.1 RFID Scanner for books and ID	37
3.8.2.2 Bookshelf	38
3.8.2.3 Front view of the bookshelf	39
4.1.1 Block Diagram	41
4.2.1.1 Bookshelf location assistant module schematic and circuit layout.....	44
4.2.1.2 LED matrix schematic diagram	45
4.2.1.3 RFID schematic diagram	46
4.2.3.1 Bookshelf LED	47
4.2.3.2 Library Kiosk	48
4.2.2.1.1 Login Page	53
4.2.2.1.2 Registration Page.....	53
4.2.2.1.3 Administrator Login.....	54
4.2.2.1.4 Administrator Dashboard.....	55
4.2.2.1.5 Admin Thesis Database	55
4.2.2.1.6 Admin Books Database.....	56
4.2.2.1.7 Admin Enrolled Student Database	56
4.2.2.1.2 Admin Student User Database	57
4.2.2.1.9 Admin Borrow Book Page	57
4.2.2.1.10 Admin Return Book Page.....	58
4.2.2.1.11 Admin Penalty Monitor	58
4.2.2.1.12 Admin Reset Student Password.....	59
4.2.2.1.13 User Homepage	59
4.2.2.1.14 User Thesis Search.....	60



4.2.2.1.15 User Book Search.....	61
4.2.2.1.17 User Change Password.....	62
4.2.3.1 Database Relationship.....	67
4.3.1.1 Admin and User Interface Testing.....	76
4.3.1.2 LED bookshelf testing	77
4.3.2.1.1 Book Fuzzy Search.....	78
4.3.2.1.2 Search by Department	79
4.3.2.1.3 Search by Program	80
4.3.2.1.4 Search by Year	81
4.3.2.2.1 Thesis Fuzzy Search.....	82
4.3.2.2.2 Thesis Search by Program	83
4.3.2.2.3 Thesis Search by Year.....	84
4.3.2.3.1 Virtual Map.....	85
4.3.8.1 User Friendliness 1	90
4.3.8.2 User Friendliness 2	91
4.3.8.3 Functionality 1.....	91
4.3.8.4 Functionality 2.....	92
4.3.8.5 Functionality 3.....	92
4.3.8.6 Accuracy 1	93
4.3.8.7 Performance 1.....	93
4.3.8.8 Performance 2.....	94





List of Tables

Table

3.9.1 Cost of Materials..... 40

4.4 RFID Specifications..... 49

4.2.1.6 Raspberry pi Specifications..... 49

4.2.1.7 Dot Matrix Specifications 50

4.2.1.9 Hardware Cost..... 51

4.2.2.1 System Requirement..... 64

4.2.2.2 Browser Configuration..... 65

4.2.2.4.1 Web Application Specifications..... 65

4.2.2.4.2 Database Server Specifications 66

4.2.1 Admin Database 68

4.2.2 Users Table 68

4.2.3 Student Table..... 69

4.2.4 Book Table..... 69

4.2.5 Thesis Table..... 70

4.2.8 Borrow transactions Table..... 73

4.2.9 Return transactions Table 74

4.2.10 Pay transactions Table 74