



ANALYSIS, DESIGN AND IMPLEMENTATION OF A DIGITAL
LIBRARY CARD SYSTEM, E-KARTELA

GRADUATION PROJECT

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**ANALYSIS, DESIGN AND IMPLEMENTATION OF A DIGITAL
LIBRARY CARD SYSTEM, E-KARTELA**

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ANALYSIS, DESIGN AND IMPLEMENTATION OF A DIGITAL LIBRARY CARD SYSTEM, E-KARTELA

ABSTRACT

e-Kartela is an innovative solution to a challenging problem that the National Library of Albania currently faces. Designed as an information system that will keep the digitalized records of every user of the National Library, e-Kartela will serve as a digital library card that can be accessed at any time through Internet-connected devices. This system will facilitate the registration of new users by keeping their personal records secure and private on a large database that will be available only to the system administrator. Furthermore, the users of the National Library will be able to view their own profiles that will show historical records of their current and past book loans, overdue book loans and an option to reserve books for future borrowing among other features. As for now, every step regarding the overall process starting from the user registration to the book loaning, is done manually through standard library cards and any other information is kept in a voluminous registry that is edited by the secretaries manually. Considering that the data is divided between the registry and Excel spreadsheets, the aim of this thesis is to provide the National Library of Albania with a centralized management system that will organize user and loaning records, by giving a detailed analysis, design and implementation of e-Kartela information system. A successful implementation of e-Kartela will be beneficial to the users of the Library by making the book loaning process less time-consuming as well as by simplifying and effectively improving the record-keeping work done manually by librarians.

Keywords: information system, digital card, digital library

ABSTRAKT

e-Kartela është një zgjidhje inovative e një problemi sfidues që Biblioteka Kombëtare Shqiptare has momentalisht. I projektuar si një sistem informacioni që do të ruajë të dhënat e digjitalizuara të çdo përdoruesi të Bibliotekës Kombëtare, e-Kartela do të shërbejë si një kartelë digjitale e bibliotekës e cila mund të aksesohet në çdo kohë përmes pajisjeve elektronike të lidhura me Internet. Ky sistem do të lehtësojë regjistrimin e përdoruesve të rinj duke mbajtur të dhënat e tyre personale të sigurta dhe private në një bazë të madhe të dhënash, e cila do të jetë e aksesueshme vetëm nga administratori i sistemit. Gjithashtu, përdoruesit e Bibliotekës Kombëtare do të kenë mundësinë të shohin profilin personal, në të cilin do të shfaqen të dhënat historike për huazimet e tanishme apo të kaluara të librave, huazimet me afat të tejkalluar si dhe një opsion për rezervimin e librave për një huazim në të ardhmen, përveç mundësive të tjera. Momentalisht, çdo hap përpara i përket procesit që fillon me regjistrimin e përdoruesve deri te huazimi i librave, kryhet manualisht përmes kartelave standarde të bibliotekës dhe çdo informacion tjetër ruhet në regjistra voluminoz që ndryshohen manualisht nga sekretaret. Duke marrë parasysh që të dhënat janë të ndara midis regjistrave dhe tabelave të Excel-it, qëllimi i kësaj teze është t'i ofrojë Bibliotekës Kombëtare Shqiptare një sistem të centralizuar të menaxhimit të informacionit, i cili do të organizojë të dhënat e përdoruesve dhe huazimeve, duke dhënë një analizë të detajuar, projektimin dhe implementimin e sistemit e-Kartela. Një zbatim i suksesshëm i e-Kartela do të jetë i dobishëm për përdoruesit e Bibliotekës duke e bërë procesin e huamarrjes së librave më pak të zgjatur si dhe do të thjeshtësojë dhe do të përmirësojë efektivisht mbajtjen e të dhënave që kryhet manualisht nga sekretaret.

Fjalë kyçe: sistem informacioni, kartelë digjitale, bibliotekë digjitale

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DECLARATION

I hereby declare that this Graduation Project ‘Analysis, Design and Implementation of a Digital Library Card System, e-Kartela’, is based on my original work except quotations and citations which have been duly acknowledged. I also declare that this thesis has not been previously or concurrently submitted for the award of any degree, at Epoka University, any other university or institution.

Sara Makishti

24 June 2019

DEDICATION

To my family and my siblings, Viola and Ares

TABLE OF CONTENTS

APPROVAL	i
ABSTRACT	ii
ABSTRAKT	iii
ACKNOWLEDGEMENTS	iv
DECLARATION	v
DEDICATION	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF APPENDICES	xi
LIST OF ABBREVIATIONS	xii
CHAPTER 1	
1 INTRODUCTION	1
1.1 Motivation	1
1.2 e-Kartela	2
1.3 QR code	3
CHAPTER 2	
2 LITERATURE REVIEW	5
2.1 Technology and Literacy	5
2.2 World Reading Habits	6
2.3 Evolution of libraries.....	7
2.3.1 The history of libraries	7
2.3.2 Digital libraries	8
2.4 An Overview on Library Cards.....	9

2.4.1	History of library cards	9
2.4.2	Evolution of library cards	10
2.5	Digitalized Library Cards by Countries	11
2.5.1	Harris County Public Library, United States	11
2.5.2	Shanghai Public Library, China	12
2.5.3	Russian State Library for Young Adults, Russia	13
 CHAPTER 3		
3	SOFTWARE ANALYSIS AND DESIGN	15
3.1	System Requirements	15
3.1.1	Functional Requirements	16
3.1.2	Non-functional Requirements	19
3.1.2.1	Product Requirements	19
3.1.2.2	Organizational Requirements	20
3.1.2.3	External Requirements	21
3.1.3	User Scenarios.....	21
3.2	System Design & Modelling: UML Diagrams.....	23
3.2.1	Behavioral Diagrams.....	23
3.2.2	Interaction Diagrams.....	27
3.2.3	Structural Diagrams	29
 CHAPTER 4		
4	IMPLEMENTATION	32
4.1	Technologies Used	32
4.2	Database	33
4.3	Mobile App.....	34
4.4	Software Demonstration.....	35
 CHAPTER 5		
5	CONCLUSION AND FUTURE WORK	37
 REFERENCES		39
 APPENDICES		42

LIST OF TABLES

Table 1.1	INSTAT - Cultural Statistics: NLA	2
Table 3.1	User Scenarios	23

LIST OF FIGURES

Figure 1.1	QR code example	4
Figure 2.1	Circulation of library materials in US public libraries from 1993 – 2012...	9
Figure 2.2	Circulation of library materials in US academic libraries from 1997- 2011	10
Figure 3.1	General Use Case	24
Figure 3.2	Activity Diagram – Registration Process	25
Figure 3.3	Activity Diagram – Reserving a Book Process	26
Figure 3.4	Sequence Diagram – Reserving a Book Process	27
Figure 3.5	Sequence Diagram – Registration Process	28
Figure 3.6	Class Diagram	29
Figure 3.7	Component Diagram	30
Figure 3.8	Deployment Diagram	31
Figure 4.1	Software Demonstration - 1	35
Figure 4.2	Software Demonstration - 2	36
Figure A	Activity Diagram – Return Book	42
Figure B	Activity Diagram – Renew Book	43

LIST OF APPENDICES

Appendix A: Activity Diagrams	42
Appendix B: Code Fragments	44

LIST OF ABBREVIATIONS

API	Application Programming Interface
APP	Application
CRUD	Create/Read/Update/Delete functionalities
CSS	Cascading Style Sheet
HTML	Hypertext Markup Language
HTTP	Hyper Text Transfer Protocol
INSTAT	Institute of Statistics in Albania
ISBN	International Standard Book Number
JS	Javascript
MySQL	My Structured Query Language
NLA	National Library of Albania
PHP	Hypertext Preprocessor
QR	Quick Response
UI	User Interface

CHAPTER 1

INTRODUCTION

The concept of libraries has been part of our historical advancements since the 7th century B.C, which records the world's oldest library, the Library of Ashurbanipal, located in modern day Iraq. Housing more than thousands of cuneiform scripts, religious incantations, scholarly texts and the 4000 year-old 'Epic of Gilgamesh' [1], the world's oldest library shows the importance that ancient civilizations put into the preservation of cultural, religious and historical documents. This 'tradition' of collecting documents and works of art by establishing what we may call as ancient learning centers, continued with the renowned Library of Alexandria and Library of Pergamum with the former speculated to having collected thousands works of literature, science and mathematics and being known as the intellectual center of the ancient world.[1] Since then, humanity has recognized and maintained the necessity of reading and sharing cultural information by building public libraries for communities throughout the years. Although public library institutions in Albania are relatively new, the tradition of preservation of valuable literature texts is much older and dates back to the Middle Ages. [2] The National Library of Albania (also known as NLA) was founded on July 1920 [3] and today its archive comprises a total of nearly 1 million books, periodicals, maps, atlases, microfilms and other library materials.

1.1 Motivation

The National Library has become a central location for students to explore reading materials, for the elderly to find older texts and for researchers to look into specific collections not found in local public libraries in Albania. Only during the first quarter of 2019, the number of people using library materials and being offered services within the

National Library was 30,669, which is a 64,3% increase from a year before. Also, there were 6,574 new publications being added to the National Library during the first quarter of 2019, which is also an increase of 55,7% from the previous year. [4] The following table published by INSTAT shows these figures and makes a comparison:

Treguesit	Tr.1-2018	Tr.1-2019	Ndryshimi tremujor në %
Shërbimi i njësive bibliotekare (njësi)	19.728	19.971	1,2
Frekuentimi	18.662	30.669	64,3
Veprimtari Kulturore dhe Shkencore	62	35	-43,5
Numri i botimeve	4.222	6.574	55,7
Numri i titujve të rinj gjatë vitit	815	1.233	51,3
Numri i ekzemplarëve të rinj gjatë vitit	3.407	5.341	56,8

Table 1.1 INSTAT – Cultural Statistics: NLA

Considering this increase in the popularity of the National Library, a centralized management system is needed to organize and effectively handle the services and requests of the library users. Currently, the Library grants membership only to residents in Tirana through simple library cards that hold their personal information, such as: first name, last name, address and a personal photo. When library users loan a book, the book's information is written on the back of the library card. These library cards follow a standard that is used in all the public libraries worldwide, however they are prone to damages or being lost if not handled properly. Also, user registration details are kept in Excel spreadsheets by the librarians, which can be time-consuming to edit and may be badly organized. As a result, a centralized system will keep together all the records regarding users' personal information and book loans, making it easier to manage, edit and get meaningful statistics to help the decision-making bodies of the National Library of Albania.

1.2 e-Kartela

e-Kartela is a web-based management system which will bring together in the same platform librarians, administrators and users of the National Library of Albania. Users need to fulfill the following requirements [5] to be able to gain membership to the Nation

Library: personal identification document, 2 personal photos and a document that validates their residential status in Tirana. As these documents are a must for registering, e-Kartela will allow citizens to obtain these documents through the governmental system e-Albania. By uploading the personal ID, photos and requesting the residential document via e-Albania, the users can cut off the tedious process of waiting in long lines at their respective municipal units. Once the request for registration is sent through the e-Albania platform, the librarians can review the documents and accept or decline the user's request to join. Once the user is accepted, he is given a unique username and a randomly generated password to use as credentials for logging in the e-Kartela system.

The user can update his/her personal information on their own profiles and will have access to all of the materials that the library owns and available for reserving. The reservation of library materials will also take place through the e-Kartela system. Once the user places a reservation, the librarian is responsible for reviewing the reservation details and accepting or declining the request. If the request is accepted, the book will be ready to withdraw from the National Library within 3 days from the moment of acceptance. The loaning history of the user will be automatically updated in the personal profile and a graphical representation will inform users on the remaining time they have until the book is returned. Users can place requests on books that are not yet available and will be notified once the book is available for lending and also can search and mark certain library materials under 'Favorites'.

On the other hand, the librarians and the administrators will have access on all the database regarding users' and library materials information. They will be the main responsible users on maintaining citizens' data and updating book information. e-Kartela will provide a connection to the already existing digital searching option, Adlib, that is being currently used by the National Library. By connecting users' profiles to Adlib, they can easily search books and make the respective reservations, while updates and addition made by librarians and/or administrators of the system will be automatically reflected into the Adlib searching tool. The librarian will keep track of loaning requests and notify users when a book needs to be returned. Administrators will be able to overview the whole system and will gain meaningful statistics such as the number of registered users, new books added and the pattern on the reservation of books based on category or authors.

1.3 QR code

Another part that will be analyzed and implemented further into Chapter 5 is the QR code generation. e-Kartela as a web-based system will change how traditional library cards are handled. Rather than having a library card with the personal information of the user and the loaning history on the back, the QR code implementation will equip users with a simple card with a unique QR code that is linked to their personal accounts. These cards will be designed as laminated papers with the unique QR code printed on top of it. The QR code will help librarians identify user profiles and accept their loaning requests for book materials. The QR code will hide the personal information that is easily visible on the traditional library cards and even if it is lost can be regenerated and printed quickly from the user profile. The implementation of the library card as a QR code will simplify the identification and book loaning process as the manual task of entering book details will be replaced with a simple scanning by the librarians. The figure below shows a simple representation of a QR code that links to the main website of the National Library of Albania.



Fig 1.1 QR code example

CHAPTER 2

LITERATURE REVIEW

This chapter will analyze in detail the relationship between technology and literacy as researched by modern scholars as well as the evolution of libraries as digital libraries and the future of library cards. During this analysis, different examples from worldwide application and innovative solutions being implemented will be described, concluding the chapter on the advantages of applying e-Kartela management system in Albania.

2.1 Technology and Literacy

As stated in the study of Ritchie & Bates, 2013, reading is the foundation of learning and processing new information, a skill which is taught from the early childhood and can be a good predictor of achievement and success later in life, as children having reading and mathematical fluency by the age of seven, will have a higher-income job and better social and economic status [6]. Considering the growing influence of technology not only in our daily lives but also in learning environments such as schools, universities or libraries, it is important for individuals to possess technological literacy skills above everything else. Technology literacy represents the aptitude to use media, such as the internet to access and interact with information (Golian-Lui & Westenkirchner, 2011) [7].

Nowadays literacy includes the creation, analysis and evaluation of multimedia texts and gaining this proficiency through technological tools. As our society is moving to being paperless and relying on smart devices to transmit information, there has been a rise of online and offline platforms offering e-learning services such as e-books, audiobooks, digital archives etc.

The e-learning market is already evaluated to billions of US dollars and it is anticipated to be a \$37.6 billion market by 2020. [8] This shows how technology is shaping the learning process and making information easily accessible under a few clicks on a PC or mobile device.

2.2 World Reading Habits

A study conducted by World Culture Score Index in 2017, to measure the amount of time individuals around the world spent reading in a weekly basis, showed that the three countries reading the most were India, Thailand and China. These three countries reported spending 8 hours [9] or more per week reading materials either in printed or electronic formats. Another factor that may drive the interest in reading is the number of public libraries that operate in a certain country. According to a report, [10] the country with the largest number of public libraries was China, followed by Russia and then India. In Albania there are around 83 public libraries [11] operating as governmental-owned libraries or universities' libraries. Considering that Albania's population in 2017 was around 2.873 million, as researched by INSTAT, there is an estimated 1 publicly accessed library for around 34,600 citizens. [12]

Public libraries are an important asset to a country's cultural advancement, because the rich collections of books and journals will also play a vital role in the advancement of knowledge. There seems to be a slight correlation on the countries that spend most hours reading and the number of public libraries owned. However, as both China and India also have a large population, this factor may be determinant in driving up the numbers. When analyzing reading habits, it is interesting to note that the age group known as Millennials, are the most avid readers among other generations.

According to studies, 92% of Millennials read to research something they like. In fact, Millennials read more than their parents or any other age groups. The average Millennial reads around 5 books per year [13] and uses public libraries more than Generation X or Baby Boomers Generation. The study focuses on how and what Millennials engage in reading, bringing down common stereotypes of a social media obsessed generation. Although this particular generation was raised and experienced the growth of technological

advancements since childhood, it was reported that around 92% of college age students prefer printed book materials over e-books as a reading choice.

Also, it is important to note that they were more willing to research particular topics online out of curiosity and be well-informed, [13] compared to 66% of individuals in the older generations.

2.3 Evolution of Libraries

2.3.1 The history of libraries

By definition, libraries have been serving their purpose as an organization of a large collection of documents since the beginning of modern civilization. Although many collections from the ancient world unfortunately have been destroyed, the culture of organizing and tracking historical texts by organizing them into a single record room or location has preserved.

During the widespread of European monasteries in the era of Middle Ages, books were considered essential to the spiritual life. St. Benedict, an Italian monk that was renowned during this era laid out a set of rules under his name, known as the Benedictine Rule. [14] Under this set of rules, certain emphasis was put under the integration of studying and reading for having a well-rounded daily routine. The concept of libraries as areas of study and book lending under a supervisor was mentioned as well, differentiating it from Scriptoria [15] which were places specialized in the copying of important manuscripts as a way of preserving them.

During the Middle Ages, books were expensive and collecting them, soon became a hobby for monarchs to show off their wealthy lifestyle, or they were available only through the monastic libraries. However, by the 17th and 18th century, book collecting became more widespread, mostly as an expression of genuine love for scholarship. But by the 19th century, there were evident problems for proper library management. As the libraries had now increased rapidly in size, their growth was faced with poor administration and low standards on service and cataloguing.

Sir Anthony Panizzi, a political refugee from Italy, was the leading figure of the transformation of library service, [16] once he started working as a principal librarian for the British Museum from 1856 to 1866. He saw the importance of proper cataloguing and elaborated on a complete code of rules for cataloguers to follow. His ideas on administration and library management continued to be well-founded and effective as they were put into use on other public libraries for the years to come, especially in the Library of Congress in Washington, DC.

2.3.2 Digital libraries

The shift we are currently observing from traditional to the digital libraries is not merely a technological novelty, but it requires a change in the pattern by which people access and interact with information. [17] Traditional libraries have certain characteristics such as: the emphasis on physical preservation of written texts and documents, the high level of cataloguing and the proximity with related reading materials on nearby shelves. On the other hand, a digital library puts more emphasis on the digitalization of materials and storing them electronically rather than physically and the browsing is done through keywords or hyperlinks which also eliminates the need for users to visit a library because they can simply access materials online.

Twenty years ago, researchers came by a term known as hybrid libraries or integrated library system, as the halfway step towards achieving the fully digital library (Oppenheim & Smithson, 1999). The research analyses the development of the Electronic Libraries Programme (eLib) [18] and brings up the discussion of the evolution of hybrid libraries. As we can see now, a fully digital library is not impossible and has been achieved worldwide many times already, peaking with a massive project [19] of the U.S Library of Congress and United Nations Educational, Cultural and Scientific Organization (UNESCO) as the World Digital Library. This project aims to provide significant documents from different countries and make them accessible to any individual with an Internet connection. They are partnering with libraries, archives, museums and other cultural institutions to expand their collection of valuable documents from the contributions.

Through a digital library, everything is storable: legislative materials, music, theatrical performances, speeches etc., altering a little the concept of a traditional library. The total

number of books distributed in the world since they were firstly printed can be stored in a disk storage of a few petabytes and copies of each of them could be made in few seconds. This becomes a concern and raises the question if libraries can still be relevant in the age of Internet. We tend to romanticize libraries as places of storing ancient knowledge and old documents. However, the Internet has not destroyed their purpose yet, actually technology has helped transforming libraries to make them relevant in the digital age, as public libraries took proactive steps in the early 2000s. Digital libraries which were only in the realm of hypothesis around twenty years ago, have now become a reality, only by translating records into new digitalized formats and creating networks of catalogues which resulted in an exponential expansion of the materials a common user could access. By introducing e-books and wiring up their spaces with PCs and Wi-Fi services, public libraries managed to gather people into a safe and inexpensive learning and discovering atmosphere that benefits everyone from children to adults. A surprising trend was noticed in U.S public libraries during a study from 1993 to 2012, which evaluated the circulation of materials from public libraries and number of visits, as shown on the chart below. [20]

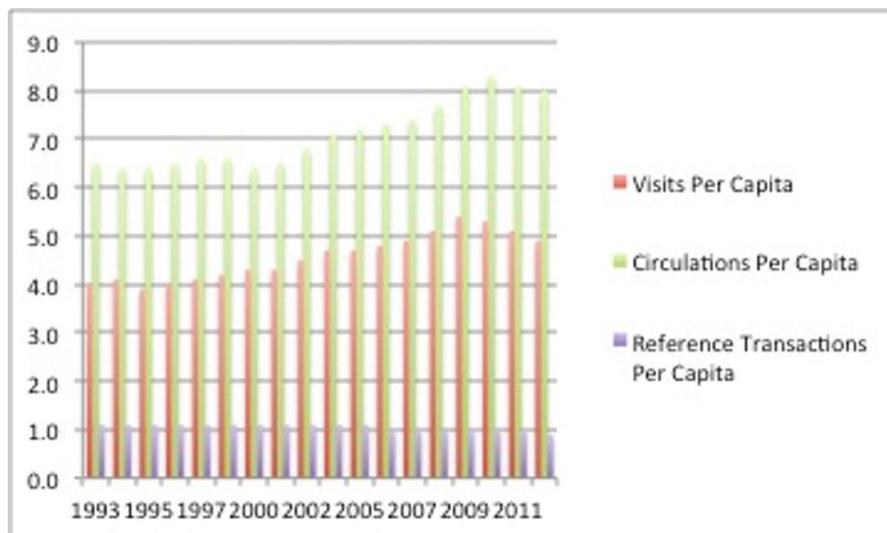


Figure 2.1 Circulation of library materials in US public libraries from 1993 – 2012

According to this study, [21] the number of books and other items borrowed from U.S. public libraries increased from 6.5 items per capita in 1993 to 8.0 items per capita in 2012 (up 23 percent). Over the same time span, the number of visits to U.S. public libraries rose 22.5 percent. The one major public library usage measure that did decrease was the number of times library users asked questions of reference librarians, dropping 18 percent from

1993 to 2012. U.S public libraries are still popular and commonly used, even more than before, despite the transformation of how we gather and read information.

Contrary to public libraries, [22] academic libraries have experienced the greatest loss of usage and material circulation. The cause of this phenomenon is the ubiquity of e-books and electronic journals. More specifically in the U.S, the circulation of items in academic libraries has sharply declined from 1997 to 2011, as shown on a particular study.

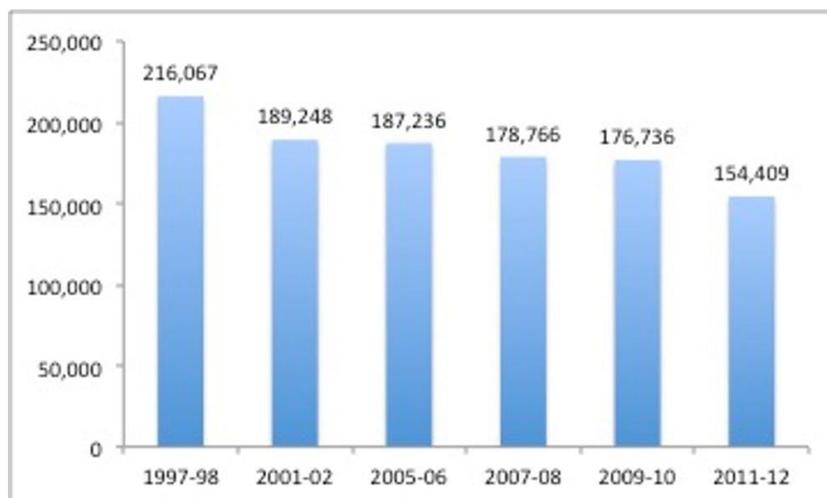


Figure 2.2 Circulation of library materials in US academic libraries from 1997 - 2011

It doesn't come as a surprise that less books are being loaned through academic libraries, considering the subscriptions these libraries make to electronic scientific journals or by applying the JSTOR interface for researching articles. Only in 2012, all the existing academic libraries in U.S held a collection of 252,599,161 e-books. [23] This number shows that for around a decade, [23] U.S. academic libraries have acquired e-books equal to about one-fourth the total number of physical books, bound volumes of old journals, government documents and other paper materials acquired by those same libraries since 1638.

2.4 An Overview on Library Cards

2.4.1 History of library cards

As we concluded by the statistics above, public libraries haven't lost their purpose in the era of digitalization. How to use and become a member of the public library in your region

or neighborhood is also fairly easy through what are commonly known as library cards. Nevertheless, old libraries were non-circulating libraries, which means that they didn't loan books to users and therefore didn't supply users with membership cards in order to identify them. During this time, only some particular libraries like YMCA and Sunday schools offered membership cards, which also served as library cards.

When the public library movement took place in the 19th century, it was crucial for public libraries to register users and keep record of the books they borrowed. Originally this was done with burdensome ledger systems, where each page on the ledger represented a borrower and the books that were borrowed and returned in a list. Libraries tried a number of systems, as documented by Leila H. Kirkwood, in *Charging Systems* (New Brunswick, N.J.: Graduate School of Library Services, 1961.) [24] As Helen Thornton Geer explains in her book, *Charging Systems* (Chicago: ALA, 1955), in about 1900, (though Kirkwood cites 1896), John Cotton Dana, then director of the Newark (N.J.) Public Library, devised a system using a borrower's card and a book card. These early borrower's cards were not the simple identification cards of today, but rather a card with space to enter the date borrowed, date due, and date returned for each book circulated. As such they did fill up and the "Detroit system" of an identity card was developed by Ralph Ulveling in 1929. In 1932, Gaylord Brothers introduced an electrically operated book-charging machine, using the basic two-card system devised by Dana. This system used a borrower card with a metal plate with an embossed number to register the borrower's identity onto the book card, which was filed by call number. [24]

In the years that followed, more sophisticated systems were developed and became a vital part of ILS (integrated library systems) as we know today. In most societies today, the metal plate has been replaced with a simple barcode or chip embedded card, similar to credit cards.

2.4.2 The evolution of library cards

The digital age we are currently living in, considers widespread information the basis of gaining meaningful knowledge by extracting important data. Almost all public libraries can be regarded as bodies of knowledge, having numerous records on an extensive range of collective human history and human thought that has been preserved through the centuries.

A library card has become a powerful tool of unlimited access of this broad information more quickly and easier than ever before. The library cards have evolved from a mere slip of paper engraved with the name and surname of the user to a technological novelty that allows for much more access to resources and faster identification of the bearer of the card. The director of the American Library Association's Center for the Future of Libraries, Miguel Figueroa, shows his belief that physical library cards will continue to persist.

“It's really one of those things that I don't think is going to go away any time soon,” he says. “It's like a shopping bag; it's just a very effective tool for managing what we want.” [25]

However, digitalization will continue to efficiently improve existing technologies and library cards will also be affected. Figueroa also dwells on the idea of creating what he names as 'keychain' cards, which are a simplified form of the existing library cards. The future of library cards seems to align with the integration of the library system into larger system with collaborative communities. Figueroa mentions how library services have become similar to the basic applications' usage on mobile phones and expresses the need for libraries to start coordinating their services with the public through real applications for simplicity. Randy Maxey, director of sales at Boopsie, a company that builds mobile apps for libraries, says library cards are “certainly becoming more and more digitized.” Maxey envisions apps as the ultimate key to the library.

“We'll see continual digitization, not just of the electronic collection but of the physical collection.” [25]

Maxey cites a possible future in which an app can find, scan, and check out a book within a library, all from a patron's phone. Library cards shouldn't be ditched forever, but libraries must keep track of the latest technological trends and apply the best of these trends to the digital evolution of library cards.

Rather than inventing the wheel and redoing the whole card processing services, [25] Figueroa calls for an adoption of the trends and adjusting these trends to the existing library systems.

2.5 Digitalized library cards by countries

2.5.1 Harris County Public Library (HCPL), United States

The public library in the largest county in Texas by population but also the third-largest county in all of the US, unveiled on September 2015 the iKnow Digital Access Card. [26] This novelty allows the county residents to apply and receive a library card completely online and have unlimited access to the library's broad database of digital materials such as e-books, audiobooks and streaming movie services. Not only you can obtain this card for free, without paying any kind of fee, but also residents can print it by themselves to use it in person on the library's premises. According to Edward Melton, [26] the library's director, this allows residents that cannot visit the physical building to have unlimited free online access to all the collections within the library for lifelong learning.

The new library card, iKnow, does not replace the existing library card and the residents with a regular library card can still access the digital content. The difference is that with the new card, not only the content is accessible online 24 hours every day but children can also gain one effortlessly by simply having their parents confirm through the registration email. A new feature that was introduced for this library card was the upgrade function. The iKnow card will serve residents only in the premises of the Harris County Public Library. However, the card can be upgraded to the Knowledge card that is used at the county's all 26 branch libraries. Reducing the waiting time and offering to residents, information access through the website and mobile phone, the iKnow has seen incremental usage by the county in Texas. It works well with the elderly and the children who may not be able to physically visit the library on their own for the 2.5 million items that the library has a collection of. [27]

Another thing that is worth mentioning, is the partnership of the Harris County Public Library with the Overdrive app, the digital distribution service for libraries or schools. Through the Overdrive application, [28] the library shows the available e-books, audiobooks, magazines etc to borrow and links users to their personal accounts by signing in with their respective library card number to make the request and have the material ready to them in just a few minutes.

2.5.2 Shanghai Public Library, China

China is listed among the countries with the largest number of public libraries and as we mentioned before at the start of this chapter, the Chinese are among the most well-read people in the world by country. It is no surprise that given a population already surpassing 1,3 billion residents, China is investing in its local public libraries to improve their services to millions of people and efficiently reduce costs and waiting times. For this reason, the Shanghai Public Library, one of the largest public libraries in the country, is changing the way we view library cards.

On 2015, [29] the library management announced through their official website on a new service initiative to be deployed by the public library. This initiative is a technology novelty on the library cards that combines the QR code technology with the user's personal identification information to create a 'mobile reader card'. The new library card has the same functionalities as a regular card but with added innovative features. The readers can access the multiple reading rooms by scanning the card with the unique QR code printed on it. Also, the scanning feature will allow readers to borrow or renew books by scanning them through the Shanghai Library app that was launched for iOS devices on the App Store for free.

In order to gain a unique mobile reader card, readers can apply online through the official library website or through the app from the mobile phones. This innovation on the library services, [29] has permitted Chinese libraries to improve book circulation, by reducing the traditional problems that were related to borrowing books such as lack of convenience and lack of efficiency among others.

By partnering with WeChat and AliPay, the Shanghai Public Library can make the new digital library card part of the City Services and extend its usage to a wider network of public libraries within the country. The mobile reader card has been incredibly effective and has shown to better protect the user's personal information than a regular card. Furthermore, the new library card avoids common issues with regular library cards such as forgetting or losing them, fraudulent use or using fake library cards to gain access to the library's large database collection.

2.5.3 Russian State Library for Young Adults, Russia

Russia also implements a unique way of handling library cards to its users. Russian State Library for Young Adults is the largest public library dedicated to young adults, encompassing over 900,00 materials as books, magazines, audiobooks, CD, DVDs, musical scores and vinyl records. The State Library for Young Adults has improved its technological aspect to reach younger people easily on the Internet and offer library services online.

Any citizen of Russia aged 14 or older can become a member of the public library by showing personal identification documents to the registration desk of the respective library. The library card is not free but it is rather cheap and is also linked to an online account, where users can see a list of all borrowed materials. Russia, different from the other two countries analyzed above, follows the registration steps the traditional way by requiring users of the library services to apply for membership in person with valid identification documents.

After the registration has been successful, the library staff supplies the reader an activation code that is entered to the website for online access to the history of borrowed materials and making online reservations for new books. Registered users are also able to work with e-library resources from home only by getting the activation code in the library to use it for online learning services available to Russia such as IPRbooks, Bibliorossika, Znanium, University Library on-line, and LitRes Biblioteka systems. [30]

The library cards are embedded with RFID (Radio Frequency Identification) technology, which makes the borrowing material process much easier and efficient. As stated on their official website [30], the State Library also has established self-service systems, which are available 24/7 for young readers to return books anytime near the entrance of the library.

CHAPTER 3

SOFTWARE ANALYSIS AND DESIGN

In this chapter, I will provide a thorough analysis on the implementation of e-Kartela, by giving a properly and detailed explanation and documentation of the intended software that is described as a digital library card system. The chapter is comprised of two main parts: The software analysis and the design analysis. The software analysis will document all the requirements of the software, both functional and non-functional requirements, while the design analysis will focus more on the description of the most important operations that the system will implement through the use of behavioral, interaction and structural diagrams.

3.1 System Requirements

e-Kartela management system is designed as an interactive system between the reader and the library staff. Every citizen of Albania aged 15 or older can apply to become a member of the National Library of Albania. The required documents are personal identification document (passport or ID card), two small recently taken photos and a document that validates the user's residency. As e-Kartela will be a public system offered for all the citizens, it will collaborate with the services of e-Albania, the governmental online platform, to allow users to obtain the required documents online and send them directly to the e-Kartela system. This collaboration will enhance privacy and validation on personal information as e-Albania authenticates users based on the personal number of the ID cards.

Furthermore, e-Kartela will also be linked to the existing digital library database of the NLA, Adlib, where all the available library materials are listed to be viewed online. To make all this happen, this management system will have three main user accounts as

below: Member, Secretary and Administrator. Functional requirements for each user will be elaborated on the following section.

3.1.1 Functional Requirements

Account type: Administrator

The administrator (admin) account will be the main user that will oversee the whole system and will have all the privileges to make changes on the data of the program's objects. The administrator account is able to log in through a username and password. Once the log in is successful, the admin will be redirected to the main dashboard, which will have the latest notifications shown in the top of the page. The admin account has the enabled responsibility to approve new user requests by reviewing the documents submitted to the e-Albania portal. When validating the membership of new users, the admin account will automatically send a randomly generated password to the personal email that the user has provided, which can be used for the logging in the system. The admin account is the only account responsible for adding new books and/or other materials, which will be also updated to the Adlib digital library.

Other features that the admin account is eligible to view are reservations made on library materials and the user list. Through the user list, the admin account will have access to all the database of registered members, and also to the list of registered staff known as a Secretary account. The admin account can activate or deactivate Secretary accounts, as well as oversee their personal information. Other than user requests, admin account will be able to approve or dismiss book requests and/or card requests made by members. Book requests consist of reading materials that are already missing from the library collection and based on demand can be later added to the library.

Card requests deal with lost or damaged membership cards that can be renewed based on user request. A scan function will be added to allow the admin account to scan the QR code on a member's card or the barcode on the library material for a quick information.

Based on the activity of all the users within the system, the admin account is eligible to view reports in the form of pie charts and statistics which can be used on decision-making. The main admin functionalities will be summarized on the list below:

- Views users
- Approves membership requests
- Adds a new employee
- Adds new book
- View all reservations made
- Views all book requests
- Views all card requests
- Views all reports

Account type: Secretary

The secretary account is similar to the admin account but with reduced privileges. The secretary account will have more interaction with the member account as it will be directly responsible for approving or declining requests. The secretary account will also be able to be logged in through a username and password. As not all users are technology-friendly, the secretary will have the option to manually add a new member by filling out a certain form with the required information. Other than approving membership requests, this account will also be able to view the members' information in a tabular view. The information displayed will be limited as to ensure the privacy of the members. Once a member has made a book reservation, a notification will be visible to the secretary account. This will be the same for renewal requests and card requests in case users have lost or damaged their library card. Secretary account will be able to view book requests too although this feature will help in generating reports and no action will be done. The scanning feature will be available again to help scan QR code on library cards or the barcode on the library material in order to display a quick and summarized information. The secretary will also be shown reports in the form of pie charts and statistics to deduct on the recent trends on user activity and book borrowings. The main secretary functionalities will be summarized on the list below:

- Views users
- Approves membership requests

- Adds a new user
- View and approve/decline all reservations made
- Views and approve/decline all book renewal requests
- Views all card requests
- Views all reports

Account type: Member

The member account type will be accessible by the registered readers of the NLA and will have the opportunity to request services of the library through the system online. Once the member's request from e-Albania has been approved by either the administrator account or the secretary account, a randomly generated password will let the user to be logged in the system, along with a username. Once the log in is successful, the member is displayed the main dashboard which will show the automatically generated personal information as submitted to the documents for the registration.

The member can change the personal password or view his library card. In case the library card is lost or forgotten, the member can request a new one. On the member dashboard, a reader can view all the historical data on past and/or current book reservations, can reserve to borrow a new book or renew an existing reservation. The member will be linked to the Adlib library to view more books as well as is able to request a new reading material by filling out a form with the required details.

A new feature that will be available to member's profile is the Favorites, in which certain library materials that are liked by the members can be stored for future reference. The reader will receive notifications from the secretary or the admin in case certain requests have been approved or declined. The scan function will help members to only scan barcodes on library materials in order to view a summarized information. Furthermore, the user can view his personal activity on the system by recording the library check-ins and check-outs as well as borrowings and returns. The main member functionalities will be summarized on the list below:

- Views profile
- Makes a reservation

- Makes a request
- Renews book
- Search book
- Add book to favorites

3.1.2 Non-Functional Requirements

Non-functional requirements specify certain criteria which are used to validate the system's operations. The non-functional requirements are different from functional requirements which are used to define specific behavior or functions.

3.1.2.1 Product Requirements

User Interface Requirements

e-Kartela is going to be a web-based application, which can be seen at any browser including Google, Mozilla, Safari, Internet Explorer. The system must be usable without reading a printed guide. Therefore, the system should not have complex interfaces for any type of user. There would be different system modules in order to structure, simplify and ease the efficiency of the system.

Usability Requirements

The system will be available only through a stable Internet connection, therefore it can be accessed only if the user is connected to internet via Wi-Fi, mobile network etc. The system is built using a simple and understandable template that will help users navigate easily through it. The web-app would be very efficient, meaning that each user can accomplish every task easily, quickly and with few or no user errors.

Efficiency Requirements

The performance of the e-Kartela management system is strongly determined by the user's internet connection strength, server hardware performance, the algorithm's efficiency on fetching the necessary data from the database, the number of active users that are accessing the web at the same time and on the operating system that is installed in the server. The e-Kartela system will be web – based, meaning that it will require a capable server with

strong connection on internet access. This server must also include a powerful CPU along with high-speed internet connection in order to handle multiple users at the same time.

Storage space is also included into the requirements as a feature of good performance. If the storage space is high it means that it can handle more users and includes bigger storage space per user, improving the overall performance.

Dependability Requirements

The application should be available 24/7, therefore users can access it any time and in any geographical area that allows for a stable Internet access. In case of a system crash, the server should redirect the user experiencing the crash into an error page showing the Error 404 standard response code. During a crash, the system should restart as soon as the problem occurs by re-configuring the server.

Security Requirements

As the system will store sensitive and personal information on citizens, high security measures should be enforced. The database with the members' information will be fully available only to the administrator account of the system and partly visible to the secretary account. Member accounts will have access only to their own personal information. The password credential that is used for logging into the system will be saved into encrypted format into the database and will require specific validation whenever it is changed.

3.1.2.2 Organizational Requirements

Environmental Requirements

e-Kartela management system will be compatible with the existing organizational structure in which the current management of the National Library of Albania operates. The modules of the system will link 2 main management areas of NLA: the administration unit and the secretary unit with the citizens.

Operational Requirements

e-Kartela management system will be a web-based platform that will facilitate for faster and more efficient services already offered by the National Library of Albania. The introduction of a digital library card which can be scanned in order to access reading rooms

and/or viewing library materials will allow the administration unit to view and keep track of real-time data on the activity of users inside the library's premises.

Development Requirements

The e-Kartela management system will be developed using the latest and most reliable technologies for both client-side and server-side programming. Extended description on the implementation technologies used for the development of this system will be discussed on Chapter 4: Implementation.

3.1.2.3 External Requirements

Regulatory Requirements

e-Kartela management system will operate under a domain that is licensed for use only to the National Library of Albania. As most entities on the Internet, the IP address of every visiting user will help to identify problems on the system and diagnose how the site is used. IP addresses are not linked to identifiable information and will not be tracked outside the login session for the users of the system.

Legislative Requirements

Personal information of every user of this system will be subject to protection by the according regulations and legislative rules that are already being applied within the Albanian territory. The Commission for Personal Data Protection, which is operating in Albania, grants institutions, organizations and/or businesses to a license that allows them to handle personal and sensitive information regarding the users of an information system. As e-Kartela will operate under the domain of National Library of Albania, it will be included in this regulation. According to the legislation No.9887, dated 10.03.2008, amended with law No.48/2012, "On the Protection of Personal Data", the personal information on each user should be private and possible to be accessed only by the specified actors.

3.1.3 User Scenarios

The main user scenarios that are implemented into the system are as shown on the table below:

Nr	User Scenario	Description
1	Log in	The users of the system must log in by validating credentials so they can gain access into the e-Kartela system.
2	Reserve a book	The member account can borrow a book by reserving it online through the system. The reservation will show the status of the book and the remaining time before returning.
3	Renew book	The member account can renew an existing reservation of a book by sending a request to the secretary.
4	Register	A new member of the NLA can request registration via the e-Albania government portal. Through an online request for registration, the user can wait for the approval response in order to gain access into the system.
5	Checkout book	The member account can cancel the reservation made for a certain book beforehand, or return in within the time limit that is identified by the NLA standards.
6	View Reservations	Member account will be able to view the historical data on the reservations made for previously borrowed books. Admin and secretary accounts will view the reservations made by the users of the system and will be eligible to grant approval on the reservation request of the member.
7	View Statistics	Both admin and secretary accounts will have the option to view statistics on member activity ranked by books borrowed and an overall report on the circulation of materials in a chosen period of time.
8	Register User	The admin account will only be able to add a new employee as secretary while the secretary account can add members to the system.
9	Search book	The members are linked to the Adlib digital database of NLA to search a certain book by title, author, publication date etc.
10	Approve Requests	Both the admin and secretary accounts are responsible for approving or declining the incoming requests on books, registration or library card requests.

Table 3.1 User Scenarios

3.2 System Design and Modelling: UML Diagrams

3.2.1 Behavioral Diagrams

Use Cases

Use Case diagrams are representative diagrams showing the interaction between a user, identified as an actor, and the system itself through different use cases in which the user is part of.

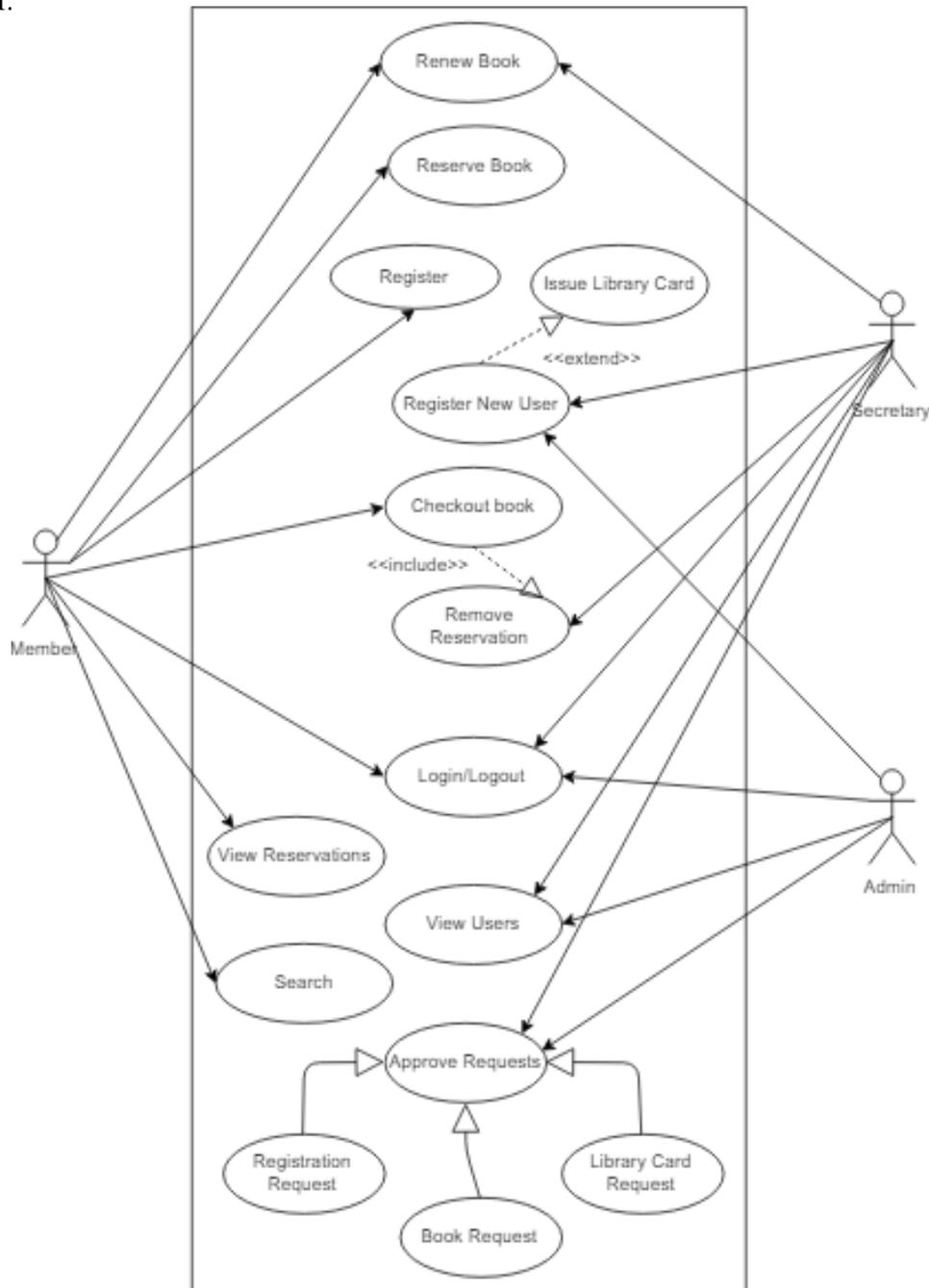


Figure 3.1 General Use Case

As the general use case shows, the e-Kartela management system will have into its domain three main actors that will be interacting with each other. This use case diagram depicts the most important activities and operations that each actor can perform within the e-Kartela system.

Activity Diagrams

Activity diagrams are used as a graphical depiction of the workflow and the basic or alternative actions that need to be completed for a certain activity to happen within a system.

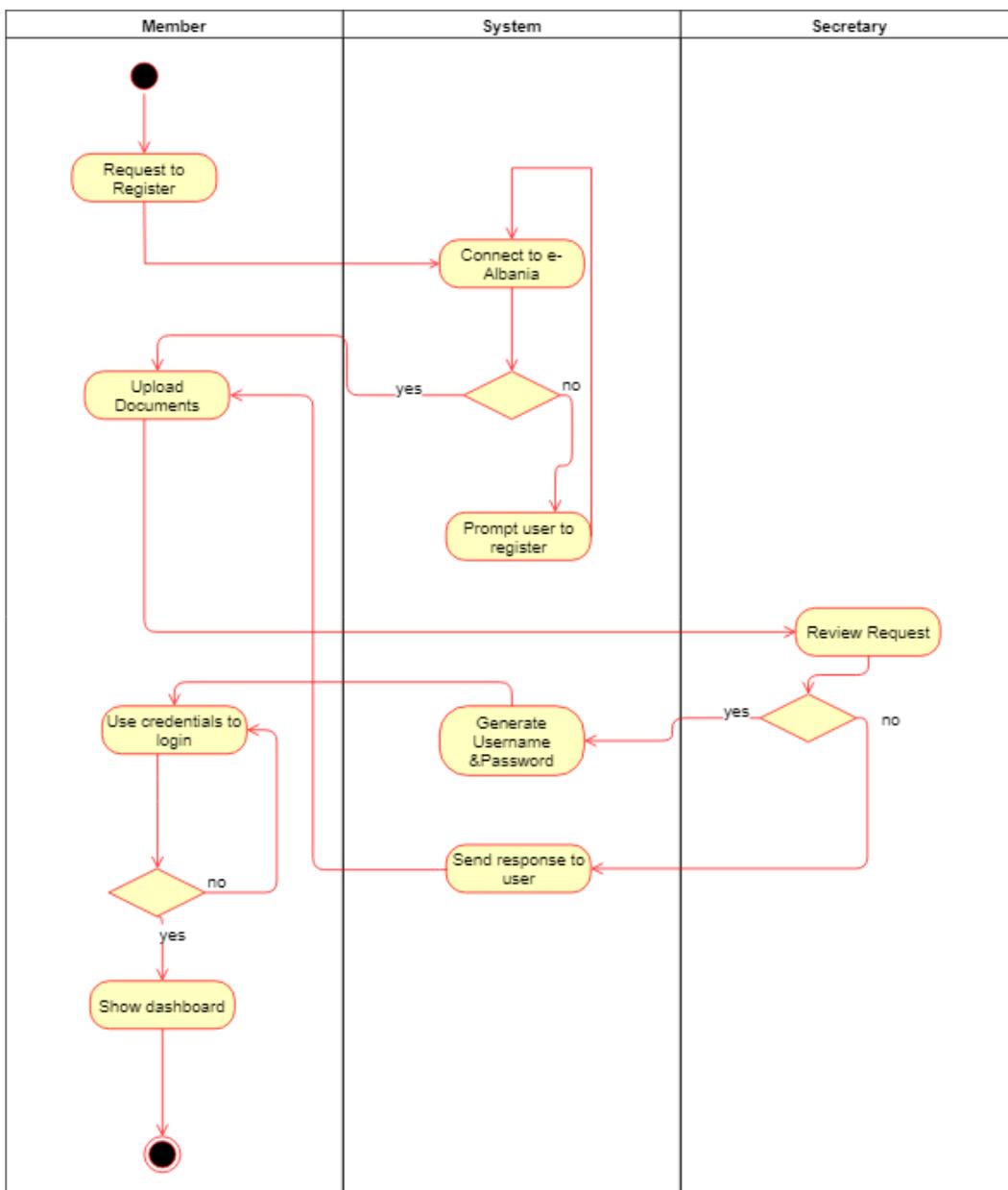


Figure 3.2 Activity Diagram – Registration Process

During the registration process, there is high interaction between the user and either the secretary or the admin account. Based on the requirements stated above, the secretary or the administrator of the system needs to verify the validity of the documents submitted to e-Albania before accepting a request for registration. If any of the documents is invalid, an automatic email response will be sent to the user to inform him that the request for registration has been declined and the user needs to resubmit the documents again. In the case of a successful and valid submission of personal documents, the user receives an automatically generated username and password to use as credentials for logging into the system. Once the user has provided valid credentials for logging in, the registered member is now redirected to the dashboard where the personal profile with all the details will be displayed.

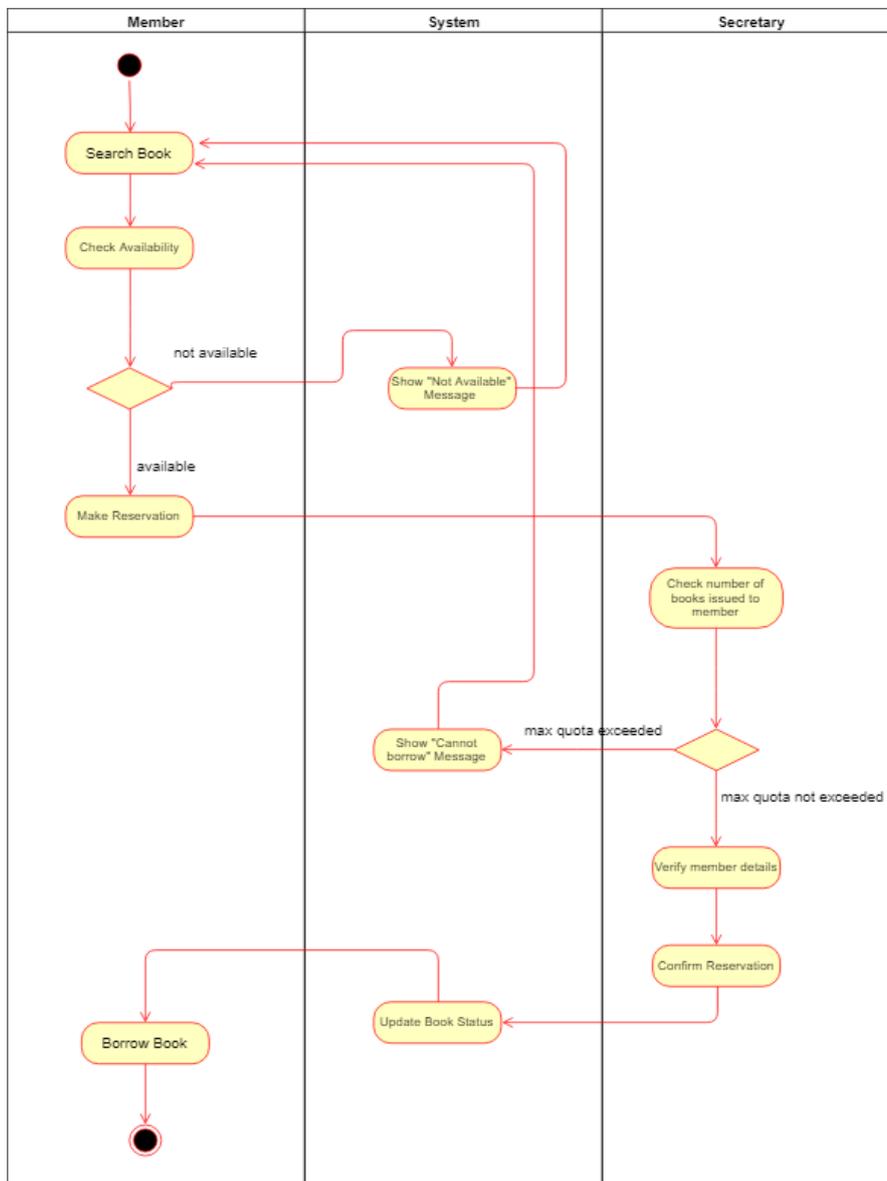


Figure 3.3 Activity Diagram – Reserving a Book Process

The same as the registration process, the borrowing process needs the interaction of the registered member with the library's secretary. After checking the availability of a certain library material, i.e. book, the member can place a reservation request which will be checked for approval from the secretary. As the National Library has a maximum quota on the library materials you can check out at the same time, this requirement is validated before approving the reservation made. If the member has exceeded the quota allowed for borrowing books at the same time, a message will be shown to let the user know that he cannot make a reservation for the moment. If the quota has not been exceeded, then the reservation is approved and the book status is updated to show that it is unavailable to other users, once it is reserved.

3.2.2 Interaction Diagrams

Sequence Diagrams

Sequence diagrams depict the interactions among objects arranged in a timely sequence. It shows all the objects and classes involved in a particular user scenario and the sequence of operations that are exchanged between them in order to carry out the functionality of that particular scenario.

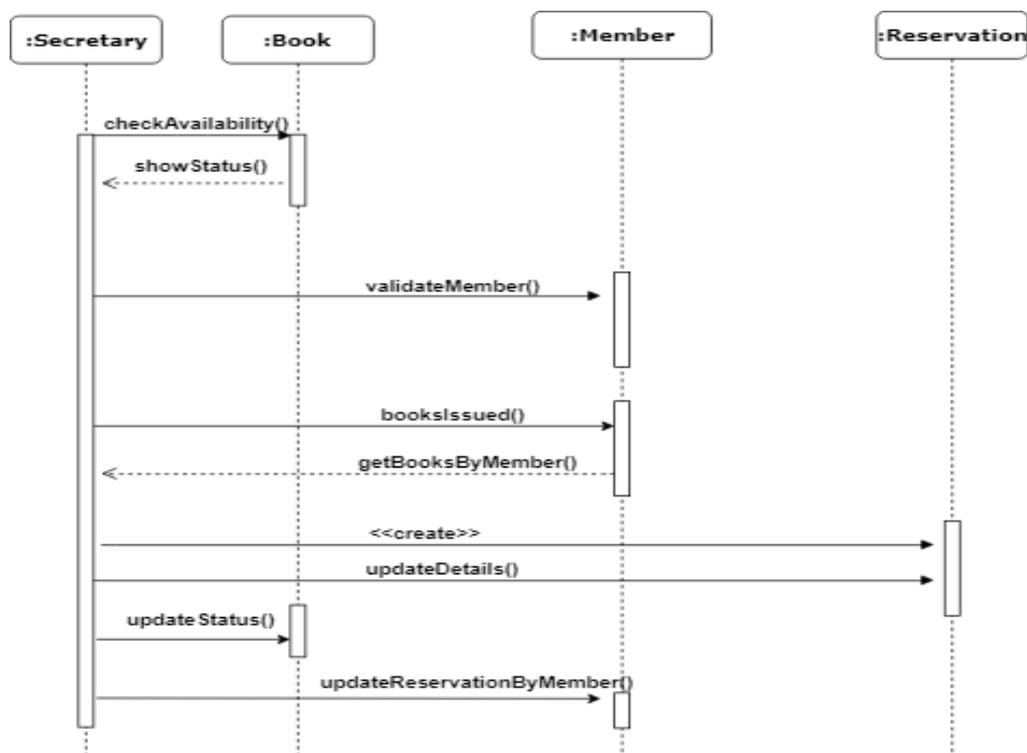


Figure 3.4 Sequence Diagram – Reserving a Book Process

In the sequence diagram of reserving a book, the interaction between the main object of the system is depicted along with the methods of interactions or otherwise known as operations. The secretary object interacts with the book object in order to check availability of books before interacting with the member object in order to check for member details validation and the quota on the books issued. Once these validations are made and a positive confirmation is received, the secretary creates a transaction process that is called reservations. In this transactions, the member details are updated to show the book that is reserved and the book status is updated to show the availability.

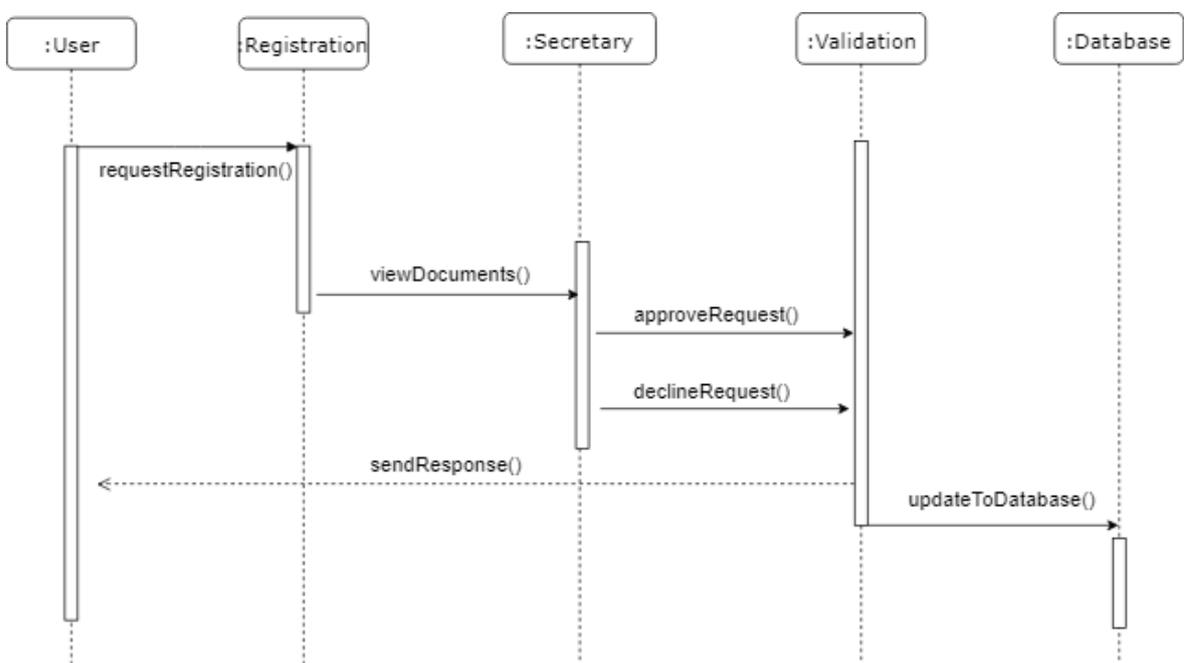


Figure 3.5 Sequence Diagram – Registration Process

The registration process for the user requires the cooperation between the e-Albania portal and the secretary in the NLA. Once a registration request has been placed, by connecting to the e-Albania portal, the secretary can review the documents needed in order to approve or decline the request for registration. In either case, a response is sent back to the user’s email account notifying him on the procedures that need to be followed based on the response received by the NLA. If the documents are valid, the user information is added into the database and a randomly generated username and password is sent via the email account. If the request has been declined, an email informing the user will be sent so that he can re-upload the documents or obtain the valid ones.

3.2.3 Structural Diagrams

Class Diagram

Class diagram is the most important static structural diagram that describes the structure of a system by showing the system's classes, their attributes, operations, and the relationships among objects.

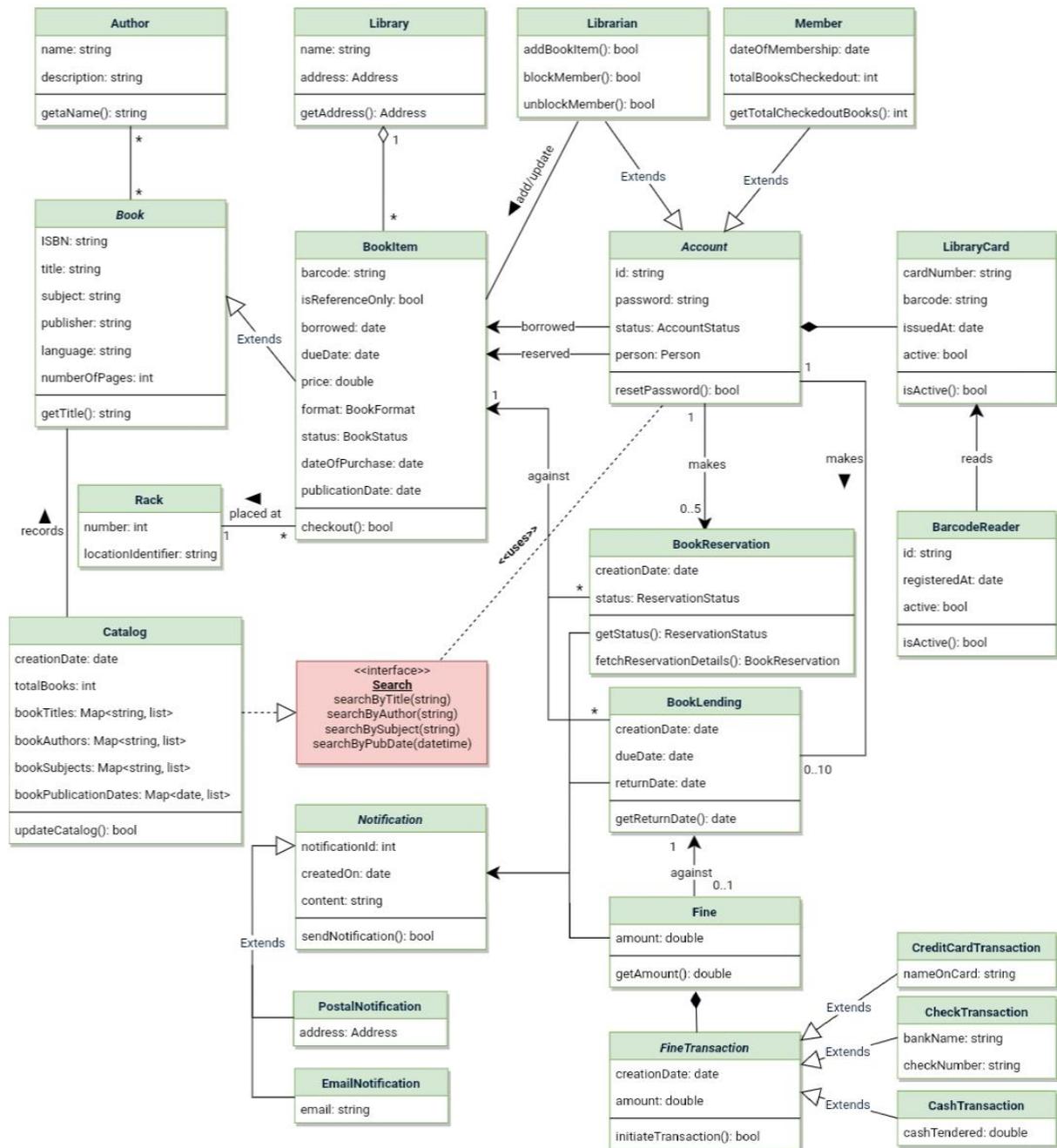


Figure 3.6 Class Diagram

In this class diagram, the relationships among the tables of the database are shown as above. Apart from the getter and setter functions that are standard for almost all the entities, the diagram displays the most important methods of the system. A member of the library extends the parent class of Account and inherits the attributes of password, membership status and the reset password method. The member class can borrow books and the operation will be automatically uploaded by the method that calculates the total checked out books. Each Account also has a library card, which read from the BarcodeReader. In the case of e-Kartela, the barcode is synonymous for the QR code technology. The Account class extends the Search interface which is the integrated Adlib digital searching platform that the NLA currently uses.

Component Diagram

A component diagram describes the organization the physical components in a system. This diagrams shows a simplified model of the implementation details.

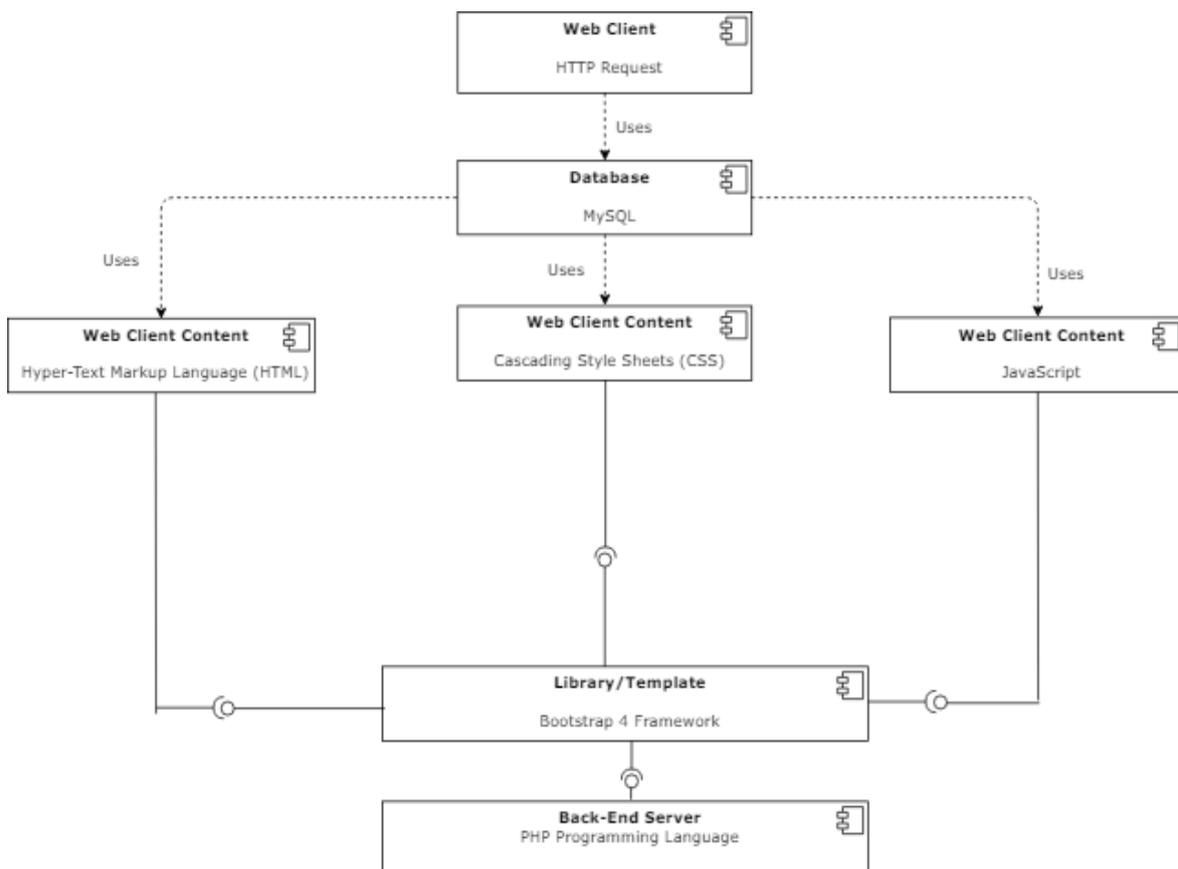


Figure 3.7 Component Diagram

The component diagram depicts the main technological modules that are used to construct the e-Kartela management system. This component diagram is designed and refers only to the web-based software as the implementation of an additional mobile app is left for future work. As a web-based system, the client server will communicate via HTTP requests and the back-end server will use the functionalities of PHP programming language to set the business logic underlying the requirements of the system.

Deployment Diagram

Deployment diagram shows a graphical view of the hardware for this system, the software that is installed on the hardware, and the middleware used to connect the machines to one another.

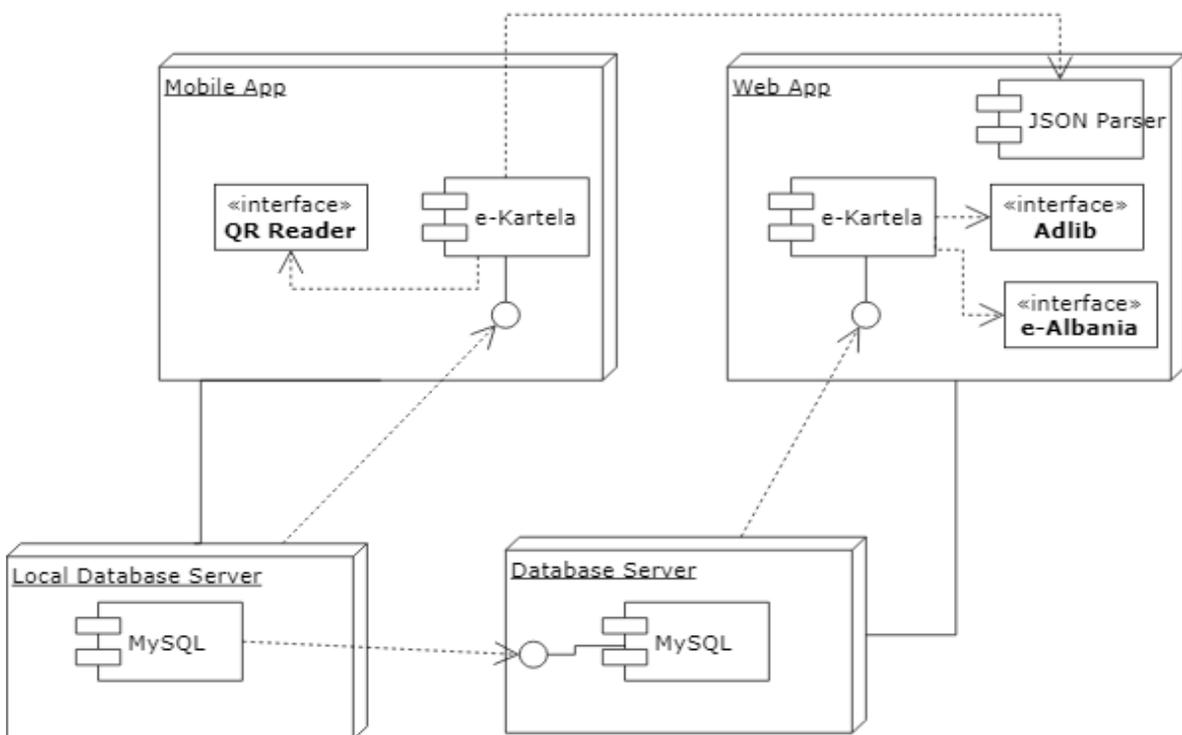


Figure 3.8 Deployment Diagram

This deployment diagram describes how the web app and the mobile app are planned to be implemented with the software release. The mobile app will need to use an API for QR Reader and be connected to a local database server within the smartphone, which is connected with the main server through a HTTP request. While the web app, will integrate the functionalities of e-Albania for user registration and Adlib digital library for the digitalized search of library item.

CHAPTER 4

IMPLEMENTATION

In this chapter, a thorough analysis on the implementation methods and techniques used will be discussed, initially by describing the technologies used for building the software, followed by the database format for storing all the necessary data and lastly a demonstration on the software's main functionalities will be shown.

4.1 Technologies Used

e-Kartela management system is initially modeled as a web-app for storing information and automating the library functions. To make this happen, the following technologies are used for the web-platform.

HTML

Hypertext Markup Language forms the skeleton of all web pages as it is a well-defined standard markup language through which documents can be displayed into a browser effectively. Considering the web-app nature of the e-Kartela management system, HTML is the basis of building such a software with all the necessary UI and content.

CSS

Cascading Style Sheets assists on the foundation of a web-app laid initially by the use of HTML to make it more graphically pleasing and more responsive to smart devices. CSS is also used in abundance through the software, mainly by taking advantage of the popular

framework of CSS: Bootstrap. Bootstrap templates are used to create the original interface of the program and many elements have been altered to fit the usage of the system.

PHP

Hypertext Preprocessor is the most widely used programming language to develop web-based systems or applications. It is very simple to use and enables many frameworks to make the developing easier and more efficient. For the development of the software, simple PHP has been used and the CRUD functionalities have been implemented. Linking PHP Object-Oriented Programming with the HTML and CSS interface, makes the system responsive to user requests and fulfills the automation of the tasks.

JAVASCRIPT

Known as a scripting language rather than a programming one, Javascript is used mostly in the dialog boxes seeking the confirmation of certain operations within the system. JS takes advantage of the jQuery library to make the content manipulation easier and the site respond faster. These technologies are used interchangeably with each other within the software.

MYSQL

The storage of data is done through the popular MySQL database platform. Database management through MySQL is done by the help of queries and relations set between interacting entities of the system. An analysis on the usage of MySQL as the data storage and data manipulation platform for this system will be provided below.

4.2 Database

In order to store and do manipulation on the data of the system, e-Kartela will use the MySQL database platform. The advantages of using MySQL over other platforms is that MySQL is open source and easy to use while also having reliability, stability and fast solutions to data management problems. The database the software is using will have certain tables to fulfill the needs of the system. One of these tables is the 'members' table

which will contain important information on the registered members of the NLA. As main attributes, the 'members' table will have by default an auto-incremental id. Each member will have personal information stored in the database such as first name, surname, date-of-birth, residency, profile picture etc.

The primary key for this table is the id of each member which will be used to create relationships with other tables on the database. Another important table is the 'books' table which will be directly connected to the 'members' table and the 'books_reserved', 'books_renewed', 'books_requests', 'books_returned' through two primary keys which will be an auto-incremented book_id and the ISBN which is the standardized unique number identifier for books. The 'books_reserved', 'books_renewed', 'books_returned' and 'books_requests' will hold the necessary information to link books with the respective user of the library. These tables will hold data on the date of reservation, date of return and the availability and approval status of books requested for loaning by users of the library.

As the system is planned to integrate a mobile app for the scanning of the QR code and the ISBN, it will include a local database on the smartphone of the registered member as well. This local database will hold only information on the personal QR codes that will be shown on the library card.

4.3 Mobile App

e-Kartela management system plans to integrate a mobile app which will simply be used to scan the QR code on the library cards of registered members and the ISBN on the back on the library materials to give a short description on the contents. The mobile app can also be used as a digital library card by scanning the individual QR code to link it to a member's online account. The secretary can scan the QR code to quickly identify members and accept requests made by avoiding waiting lines.

Another usage of QR code scanning will be to keep track on the number of active users of NLA premises by checking in at the main entrance before entering reading halls. However, this technology is costly and will be explained on the section of future work as an intended improved solution to the digital card system being proposed on this thesis.

4.4 Software Demonstration

In this section, the most important operations of the software will be provided with a snapshot of the system, along with a quick description on the functionalities.



Figure 4.1 Software Demonstration – 1

The main login page of the web-app will be as shown in this screenshot above. The user is required to enter his own username and password in order to gain access within the e-Kartela Management System. Each user, admin, secretary or member will login through the username and password validation. Member accounts will have a randomly generated username and password emailed to their personal email account when the registration via e-Albania portal is successful. Otherwise, as explained in detail in the requirements, the user needs to resubmit registration documents for his application to be valid. The login page offers users the opportunity to reset their passwords in case they have forgotten the credentials. Also, an option is put for the new member to register into the system. The registration link will direct the users into an information page on the how the online registration is done through e-Albania and followed by the link directing to the government portal.

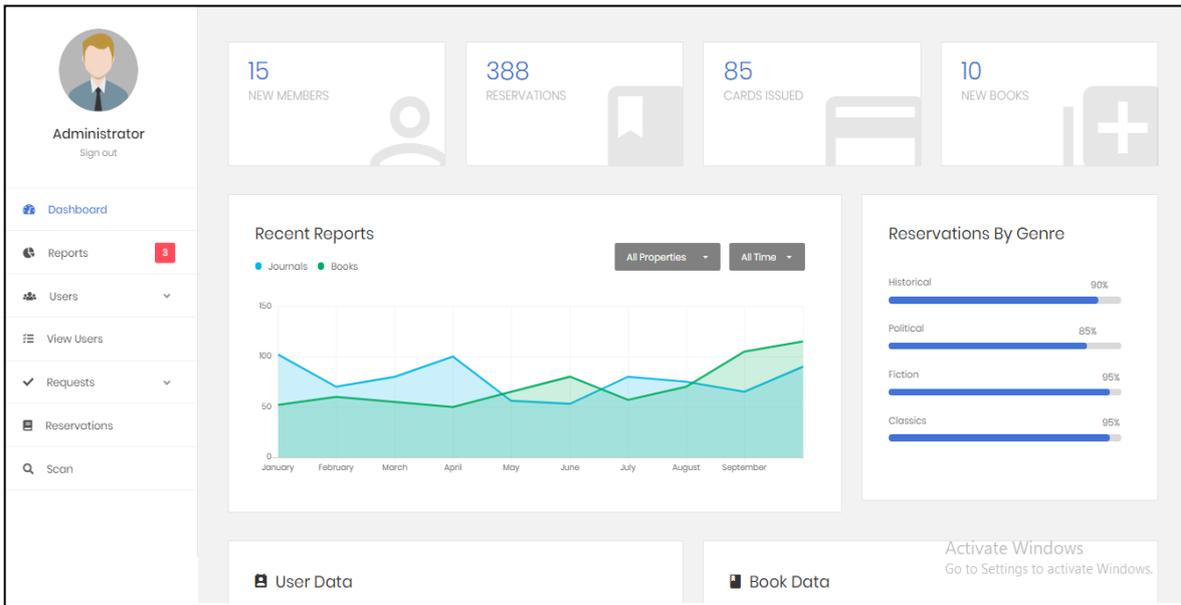


Figure 4.2 Software Demonstration – 2

In this screenshot of the software, the administrator dashboard is displayed. The admin account will have a very interactive dashboard, which will show the latest statistics upon successful login. The main activities are displayed at the top of the page such as new members registered, book reservations made, library cards issued and book requests put by members. On the side of the dashboard, the administrator will be able to get the latest reports on either membership data or the circulation of library materials. Also, the admin account can add new members or new employees, i.e. secretaries, as well as view their data in a tabular format. A list of requests such as card requests for lost or damaged library cards and book requests for missing library materials is also available to the administrator account. Lastly, the Scan feature will connect the web-app with the planned mobile application, where the scanning of book barcodes, ISBN, and the scanning of members' library cards via QR technology is easily done in order to obtain summarized information on the books, or connect the library card with the respective user data. The secretary profile is similar to the admin but with some limited operations. The secretary is not able to add new employees, only new members. Also, the reports are more summarized than the detailed charts that are shown for the admin profile. Next, the secretary account has the options for renewals, accepting reservations and also handling the return process of library materials.

CHAPTER 5

CONCLUSION AND FUTURE WORK

As stated on the introductory section of this thesis, the National Library of Albania has seen a tremendous increase of active users who use the library services either for borrowing materials or the reading halls as quiet studying places. With this sharp increase of individuals who are becoming interested in the services that the NLA has to offer, the system of e-Kartela will help to manage the incoming members and maintain the data on the existing ones. The software proposed under the name of e-Kartela will be a quick solution to the problems currently faced by the NLA regarding queueing, book lending, book returns and renewals etc.

Considering that the most important public library in Albania is still using handwritten and simply printed library cards to manage its registered members and the circulation of library materials, a centralized digitalized system is needed to effectively run its services and cut on the labor effort.

After a thorough analysis of three successful implementations of digitalized cards, the thesis concentrates on the execution and integration of the QR code technology to improve the record-keeping and tracking of library materials to members. The QR technology is simple to use and provides immediate accurate results by a quick scanning on the card or the smartphone.

The reason why QR code is becoming so lucrative and integrated within the web-based systems is due to its versatility. Providing a 360 degree scanning option and having the opportunity to be used for anything, QR technology can replace long identification numbers on library cards with a small graphical design that when scanned can link to a specific user.

It is important to note that QR technology requires certain investments in order to be fully functional and beneficial for the NLA premises. Reading devices should be implemented at the entrance of the NLA or at the entrance of the reading halls so that incoming members can scan their unique identifier and be 'logged in' the centralized system and have a historical record on their physical visits to the library. This will help the administrators to keep track of the flow of members using the library services on a daily or monthly basis and derive meaningful statistics that will be used to make well-informed decisions. Also, the tracking of activity can be seen by the members themselves through the historical records that will be available at the personal account by accessing the e-Kartela management system.

Another suggestion for future implementation will be the inclusion of an online paying system for penalties on late book returns. A paying API can be included for the member accounts which will calculate the fine to be paid for the overdue dates of the borrowed library materials.

To conclude, the e-Kartela management system will provide to users a reliable solution for handling their book loaning and returns, making the experience of visiting the public library more exciting. Having the availability to check everything that happens in their personal accounts and checking out book through a quick scanning process, will keep users up to date with their activity and be informed on the services provided by the NLA anywhere.

REFERENCES

- [1] 8 Legendary Ancient Libraries. Retrieved from <https://www.history.com/news/8-impressive-ancient-libraries>
- [2] Biblioteka Kombëtare e Shqipërisë. Retrieved from <http://www.bksh.al/pershkrimi.html>
- [3] National Library of Albania. Retrieved from https://en.wikipedia.org/wiki/National_Library_of_Albania
- [4] Retrieved from <http://www.instat.gov.al/media/5564/t1-2019-kultura.pdf>
- [5] Biblioteka Kombëtare e Shqipërisë. Retrieved from http://www.bksh.al/sherbimet_anetaresimi.html
- [6] Ritchie, S., & Bates, T. (2013). Enduring Links From Childhood Mathematics and Reading Achievement to Adult Socioeconomic Status. *Psychological Science*, 24(7), 1301-1308. doi: 10.1177/0956797612466268
- [7] Golian-Lui, L., & Westenkirchner, S. (2011). Library Issues in Adult Online Education. *Encyclopedia Of Information Communication Technologies And Adult Education Integration*, 485-505. doi: 10.4018/978-1-61692-906-0.ch029
- [8] Online Learning Statistics And Trends - eLearning Industry. Retrieved from <https://elearningindustry.com/online-learning-statistics-and-trends>
- [9] Pariona, A. Which Countries Read the Most?. Retrieved from <https://www.worldatlas.com/articles/the-countries-that-read-the-most.html>

- [10] What country has the Most Public Libraries in the World? - Answers. Retrieved from <https://www.mapsofworld.com/answers/regions/country-public-libraries-world/>
- [11] Biblioteka dhe Galeri | COD. Retrieved from http://cod.al/?page_id=177
- [12] INSTAT. (2016). Retrieved from http://www.instat.gov.al/media/322941/press_release_population_of_albania_1_january_2016.pdf
- [13] Reading Habits of Millennials | Princh Library Blog. Retrieved from <https://princh.com/reading-habits-of-millennials/#.XOcRrIgzblV>
- [14] Benedictine Rule | monasticism. Retrieved from <https://www.britannica.com/topic/Benedictine-Rule>
- [15] Scriptorium | writing room. Retrieved from <https://www.britannica.com/art/scriptorium>
- [16] Sir Anthony Panizzi | Italian librarian. Retrieved from <https://www.britannica.com/biography/Anthony-Panizzi>
- [17] Chapter 2: Digital vs. Traditional Libraries. Retrieved from http://www.wtec.org/loyola/digilibs/02_03.htm
- [18] Oppenheim, C., & Smithson, D. (1999). What is the hybrid library?. *Journal Of Information Science*, 25(2), 97-112. doi: 10.1177/016555159902500202
- [19] Library, W. Mission and Objectives - World Digital Library. Retrieved from <https://www.wdl.org/en/about/>
- [20] Digest of Education Statistics-Digest of Education Statistics - Home. Retrieved from <https://nces.ed.gov/programs/digest/>
- [21] Has the library outlived its usefulness in the age of Internet? You'd be surprised. Retrieved from <https://theconversation.com/has-the-library-outlived-its-usefulness-in-the-age-of-internet-you-d-be-surprised-58198>

- [22] Collections, staff, and operating expenditures of degree-granting postsecondary institution libraries: Selected years, 1981-82 through 2011-12. Retrieved from https://nces.ed.gov/programs/digest/d14/tables/dt14_701.40.asp
- [23] Retrieved from <https://nces.ed.gov/pubs2014/2014038.pdf>
- [24] LibGuides: Library Cards: History of Library Cards. Retrieved from <https://libguides.ala.org/librarycards/history>
- [25] The Future of Library Cards | American Libraries Magazine. Retrieved from <https://americanlibrariesmagazine.org/2017/01/03/future-library-cards/>
- [26] HCPL introduces a new kind of library card. (2015). Retrieved from <https://www.chron.com/neighborhood/lakehouston/news/article/HCPL-introduces-a-new-kind-of-library-card-9762255.php>
- [27] Retrieved from http://www.hcpl.net/sites/default/files/HCPLbythenumbers13-14-paged_0.pdf
- [28] HCPL Overdrive Login.
- [29] Shanghai Library_Mobile Reader Card App Is the New Shanghai Library Initiative_. (2015). Retrieved from <http://www.library.sh.cn/Web/news/2015824/n88222477.html>
- [30] The State Library of Young Adults. Retrieved from <http://www.rgub.ru/en/library/>

Appendix A: Activity Diagrams

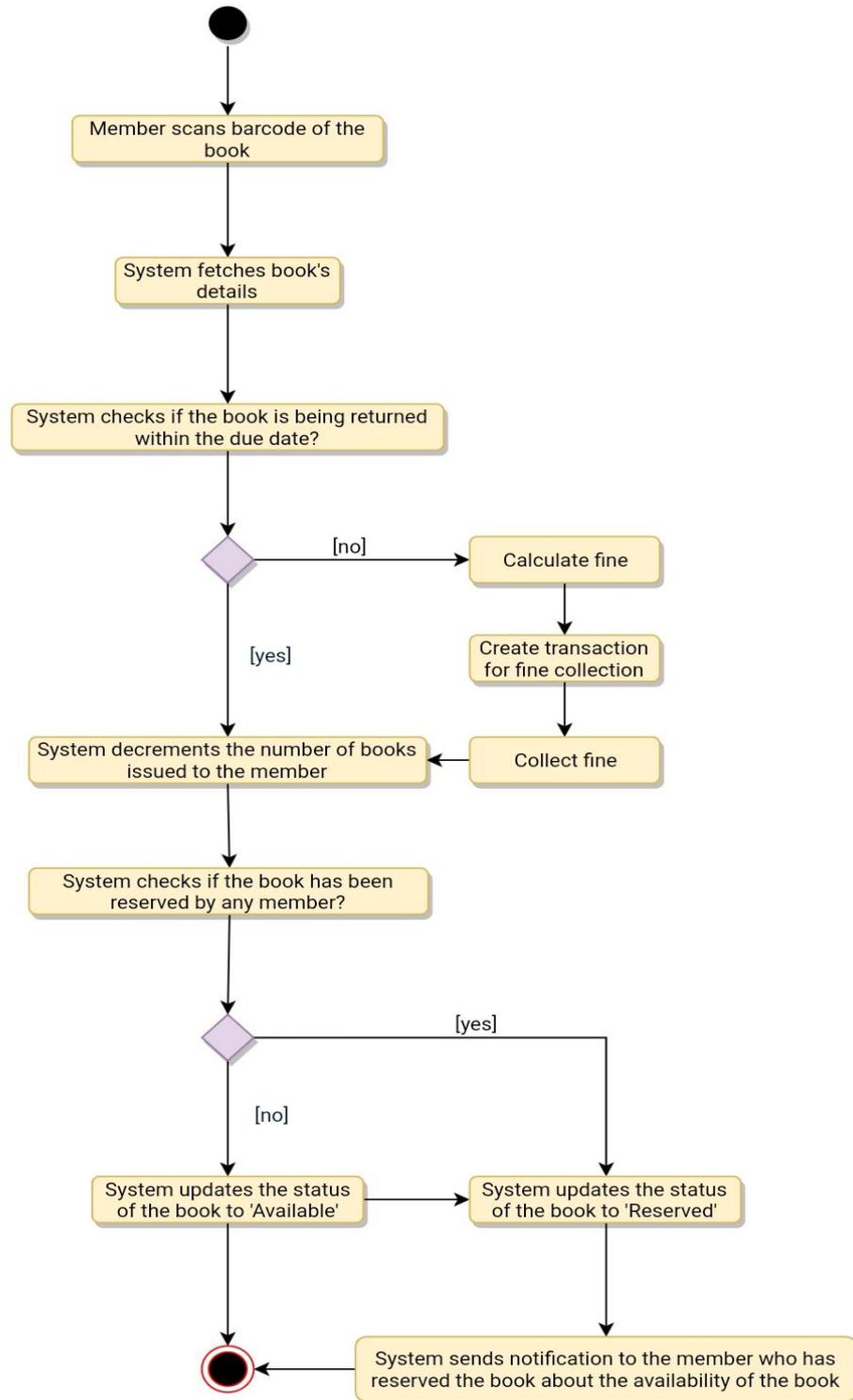


Figure A: Activity Diagram – Return Book

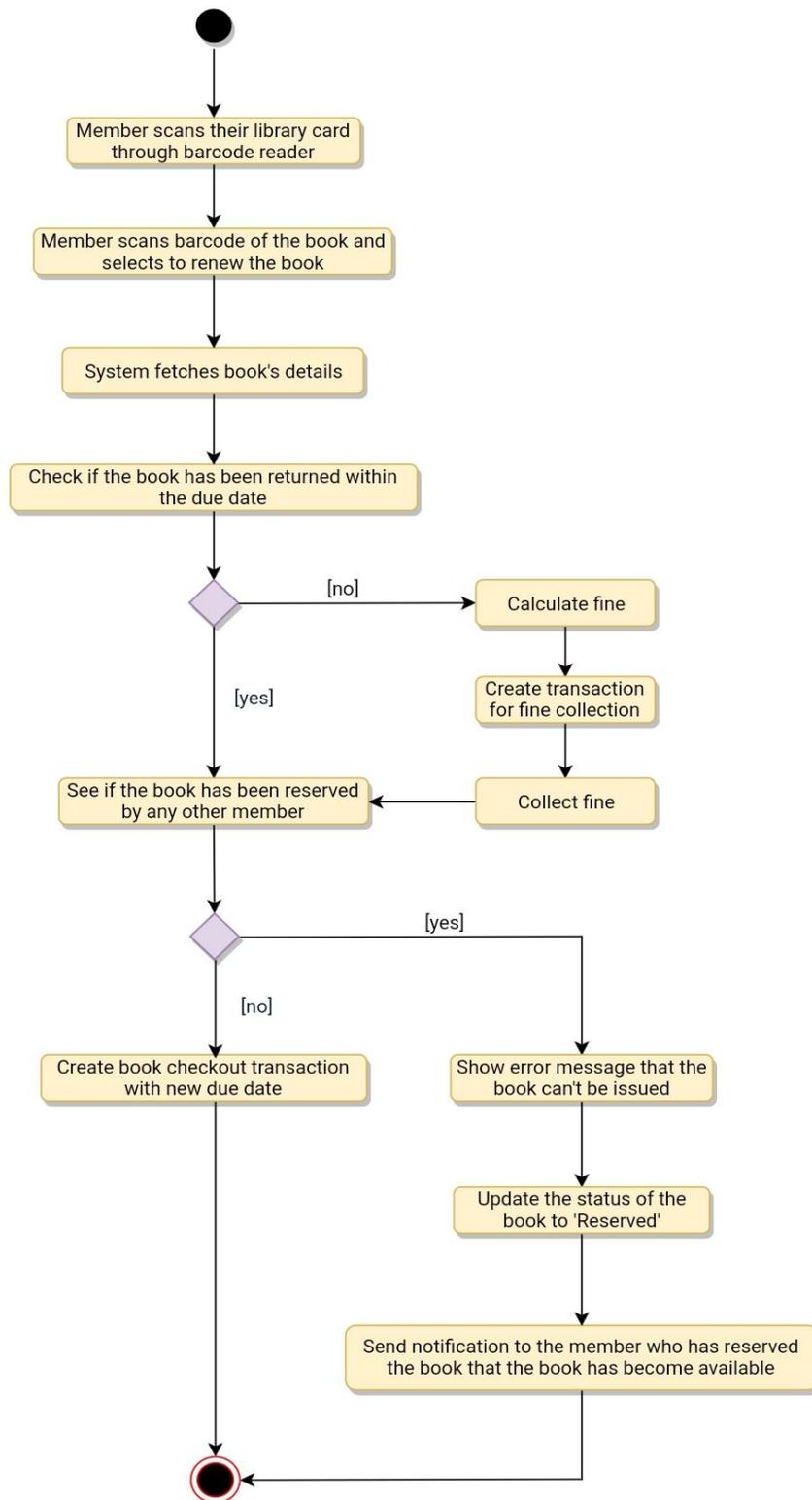


Figure B: Activity Diagram – Renew Book

Appendix B: Code Fragments

```
public abstract class Account {
    private String id;
    private String password;
    private AccountStatus status;
    private Person person;

    public boolean resetPassword();
}

public class Librarian extends Account {
    public boolean addBookItem(BookItem bookItem);
    public boolean blockMember(Member member);
    public boolean unBlockMember(Member member);
}

public class Member extends Account {
    private Date dateOfMembership;
    private int totalBooksCheckedout;
    public int getTotalBooksCheckedout();
    public boolean reserveBookItem(BookItem bookItem);
    private void incrementTotalBooksCheckedout();

    public boolean checkoutBookItem(BookItem bookItem);
    public boolean returnBookItem(BookItem bookItem);
    public boolean renewBookItem(BookItem bookItem);

    public boolean checkoutBookItem(BookItem bookItem) {
        if(this.getTotalBooksCheckedout() >=
Constants.MAX_BOOKS_ISSUED_TO_A_USER ) {
            showError("The user has already checkedout maximum number of
books");
            return false;
        }
        BookReservation bookReservation =
BookReservation.fetchReservationDetails(bookItem.getBarcode());
        if( bookReservation != null && bookReservation.getMemberId() !=
this.getId() ) {
            // book item has a pending reservation from another user
            showError("This book is reserved by another member");
            return false;
        } else if( bookReservation != null ) {
            // book item has a pending reservation from the give member,
update it
            bookReservation.updateStatus(ReservationStatus.COMPLETED);
        }

        if(!bookItem.checkout(this.getId())) {
            return false;
        }

        this.incrementTotalBooksCheckedout();
        return true;
    }
}
```