Library Management System

Version 4

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1 Introduction

With the increase in the number of readers, better management of libraries is required. This Library Management System is developed not only for web access but also available as phone applications that focus on issuing, renewing, reserving, and managing books.

1.1 Problem Statement

The purpose of this system is to maintain the details of books, magazines, research papers, DVDs, and Library members. It provides an easy circulation system between members and libraries, to issue books, search books, return books, renew book, requesting reading sources and reserve books, also to maintain details about the members (fine, address, phone number). All these features are available from MOBILE also. It helps the Librarian to manage the daily library activity in electronic format.

The objectives are as follows:

- A Public Website which can be accessed only by the resident of Ireland and must be a registered member of a public library.
- An Admin Website that can only be accessed by the librarian, which include the functionality like managing Oracle database.
- A Mobile application that reflect the functionality of the public website.

1.2 Intended Audience and Reading Suggestions

The purpose of this document is to convey information about the user requirement, both functional and non-functional, to the reader. This document provides:

- A description of the user expectation.
- A definition of website and mobile application capabilities.
- A specification of functional and non-functional requirements.

1.3 Scope

- Updating the library system into the mobile application so that users can know the details of the books/research paper/Magazines/DVDs available in the library and maximum limit on borrowing through their phones and computer.
- The AIL system provides information's like details of books, insertion of books, deletion of lost books, fine on keeping the book more than the due date, handling RFID system, request processing for NatSColl by member.

2 Process Model

answer would be no, as with the changing trend and evolving goners, the user's need along with reachable to information will also change, demanding quick response and easy access. there is where agile comes in.

2.1 Justification for Process Model

We have chosen the Agile Scrum framework model because in today's world it's not possible to accept the user changes based on technology. Libraries must adapt in order to serve their user. Since in this frequent change of demand from members based on the numbers of books choices available digitally, hence we should adopt scrum framework so that frequent changes from members can be accepted and implementation can be done in the early phase.

Scrum allows the relatively rigid compared to other frameworks. Scrum team comes from rugby where each player huddles together to remove the challenge faced within the team and can have the vision to archive the goal.

Difference between Agile and another model:

- Since every business is revamping and redefining the structure. So, it undergoes challenges to accept the changes given by customers given at runtime.
- Agile along with other models have phases and process, each process follows another one, being receptive to change, agile methodology incorporates the change in the correct way by repeating the process in a short time limit while adding new modifications. Agile as compared to other models are not phase generated.
- Other methodologies are consisting of the process having a time limit set out since start along with the predefined changes that can cause an incorrect or delayed development of the product because of enhancement or changes introduced after the finalization of the first step.
- In an agile scrum framework, we provide a minimum viable product that is shippable or deliverable to the customer along with a demo. Hence the customer can view the product and decide to finalize or enhance the product by providing change requirements. quickly.
- Every individual effort is counted and visible this the highest hierarchy.

Process:

- Team Formation: 1 senior developer, 1 mid-level developer for user interface development, 1 mid-level developer and 1 junior developer as tester, and 1 mid-level developer as Scrum master.
- Developer will create the database part first and parallel tester will create test scenario for it and user interface developer will create the UI layout of the application in Sprint 1.
- Scrum master will facilitate the team to pick the user story based on the priority and critically for sprint 1. When the layout is created then demo will be given to product Owner.

- In Sprint 2 Developer will create the admin part and all other features and all the defects and modifications given by the product Owner will be added in Sprint 2.
- Final application demo will be given by Scrum master to product Owner and then approval will be provided, and development will be in production environment.

3 Software Requirement Specification

3.1 Product Perspective

The AIL system will allow the user to perform all the functionality online which was previously not possible like, issuing books or all reading material online, getting the information about the nearby

library, requesting a book from National Specialist Collection, user can search a book and can put it on hold. Also, the user can check for the fine and can make payment for the fine online. This system will save time in searching for a record that was previously very difficult because records are large in number.

3.2 User Classes and Characteristics

"AIL " has basically 3 types of users.

Member:

- Availability of the books
- Issue Books
- Reserve Books
- Return Books
- Renew Books
- Fine Details
- Watch Trailer
- Locating Library
- Request for Book from National Specialist Collection Librarian:

- Add new books
- Remove book
- Cancel membership
- Issue Smart card
- Add RFID information
- Update details of book

Admin:

- Register User
- Book Search
- Fine Calculation
- RFID tag Information
- Update Member's information
- Report Generation Fine Details

3.3 Software Requirement

Front End:

- Application Developer Tool
- Advance Java
- HTML5 and CSS Back End:

- Oracle Database

3.4 Hardware Requirement

- Operating System: Windows 7/8/8.1/10, Android version 2.3 gingerbread or more.
- Memory: 2GB RAM or more
- Processor Speed: 1.2GHz processor
- Processor: Intel i3 or more
- Hard Disk Space: Min 3GB for Database usage.

3.5 Functional Requirement

1 Register:

- Description: First user must register into the system. There are two type of user.
- Librarian: It must provide details about the name of library, address of library, phone number, email-id.
- Member: The user must provide details of full name, address, nationality, Identity Number, phone number, email-id. Login
- Input: Enter the membership_id and password that is already provided.
- Output: Member will be able to use the features of system. 2. Manage Items by Member

Items Issued:

- Description: List of all the books, magazines, research paper and DVDs will be displayed along with the date of return.

Search:

- Input: Insert the price, name of author, publisher, ISBN/ISSN, Edition, category of book, magazine, DVDs to be issued.
- Output: books, magazine, DVD found related to the typed keyword will be displayed in list format.

Issues Book:

- State: Search the item that the user what to issue.
- Input: Member will Select the book, magazine, DVD which they want to issue.
- Output: Conformation for the issue and apology for failure in issue
- Processing: If a selected product is available then it will be issued otherwise next available date will be displayed.

Renew Book:

- State: Item is issued and is about to reach the due date.
- Input: Select Item that user wants to renew.
- Output: Confirmation will be sent via phone and email.
- Processing: If the Issued book is already reserved by another member then the next available date will be shown and if not, then confirmation will be displayed.

Return:

- Input: Place the book in front of RFID scanner in order to return book.
- Output: The returned book will be removed from the issued table of the user.

Reserve book:

- Input: Enter the details of Magazine/Research Paper/DVD/books.
- Output: Reserved conformation message will be displayed.
- Description: If the book/Magazine/Research Paper/DVD is already issued then the user can hold it, so that members can issue it later.

Fine:

- Input: Identifying Fine.
- Output: Details about fines on different book issued by member.
- Processing: If the member does not return a book on the date of return and did not renew it then fine will be applied daily. 3.Manage Books/DVD by Librarian

Update Details:

Addition:

- Input: Enter the details of Book like name, author, edition, quantity, category, ISBN, RFID tag information.
- Output: Confirmation of addition.

Remove:

- Input: Enter the book and the quantity that the user wants to remove.
- Output: Update the list books available.

Book Request:

- Input: Request for NSC books by the member.
- Output: If the member's request is accepted by the NSC then books will be provided otherwise apology message will be displayed.
- Description: If member requests for some special book via API call to the system then that request will be transferred to the NSC by NatSColl. The response will be displayed as output.

3.6 Non-Functional Requirement:

- Availability Requirement: The system should be available all the time to the user.
- Efficiency Requirement: Mean Time to Repair - even if the system fails it will recover quickly.
- Accuracy: It will precisely provide real-time information about members data and library, taking into consideration various concurrency issues.
- Hardware Constraints: The system requires a database to store data related to the library and its members. The database should have backup capabilities.
- Privacy Requirments: No one without registered users cannot enter-into the website. Every user has its own personalised view in the system.

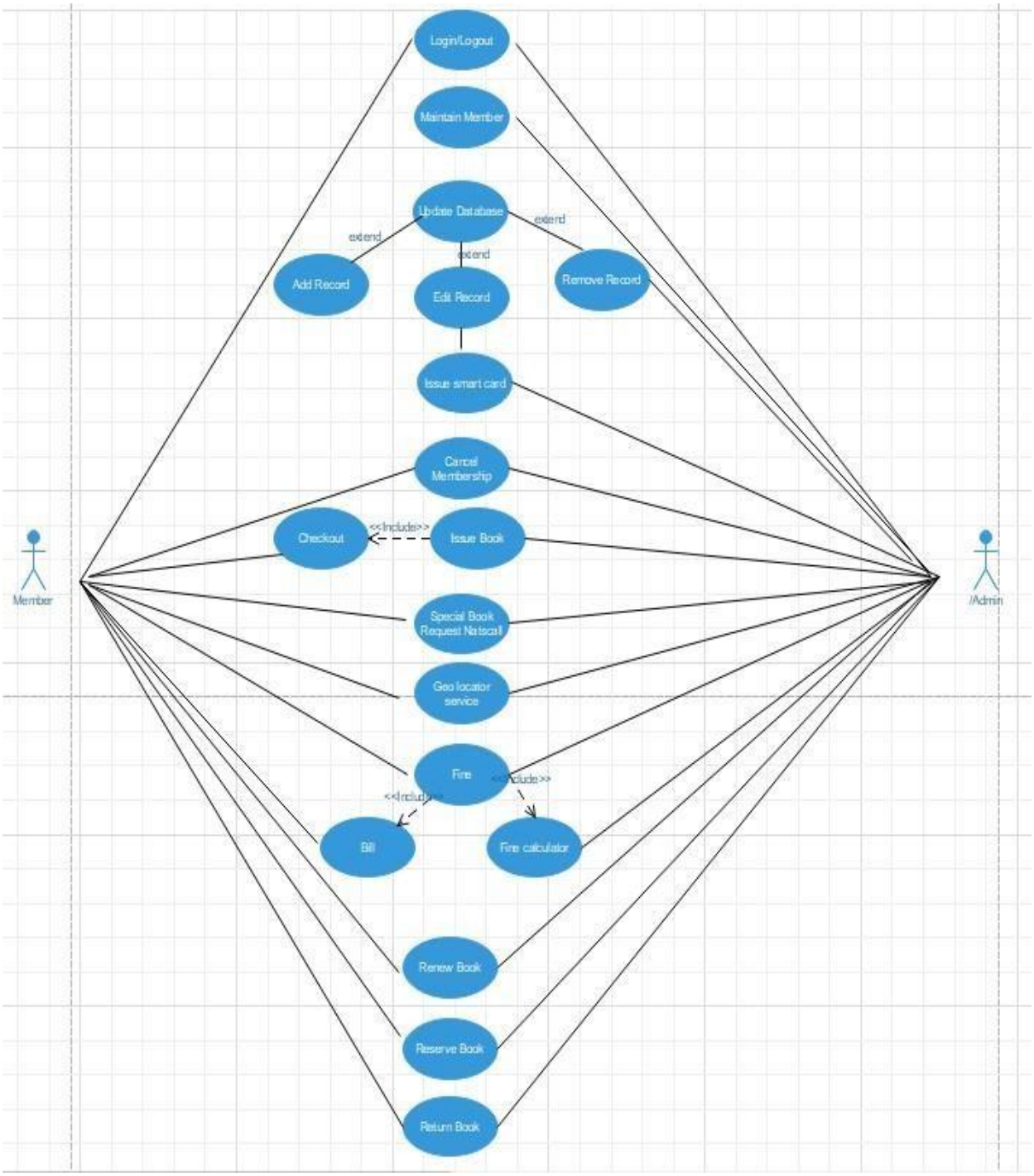
4 User Requirement

- New user Registration: This is performed by a new user to create an account. Here a user should enter the personal details like – full name, address, phone number, official id number (Passport number, license number) in addition to this librarian must enter some extra details like library name, address.
- Existing user Update: All existing user which are already present in our system are need to add and will be pulled and saved in database.
- Login: This feature used by the user to login to the system. User are required to enter the member_id and password before they can enter the system. The member_id and password will be verified and if the invalid id is there the user cannot enter the system.
- Security Question for new user creation: A set of three security questions will be set when the user is registering first time and it can be used when the user forgets the userid or password to its respective email-id.
- Register New book: This feature will be accessible by the librarian only to add a new book, magazine, research paper, DVD to the library database.
- Search book: This feature will allow the user to search for any book using author name, publisher, book title, ISBN.
- Issue book and Return book: this feature allows the user to issue and return the books. It will also tell the user the issued book detail with the return date.
- Renew book: This feature will allow the user to renew the book only if the given book is available to reissue.
- Request: This feature provides a user to make a request call for some special book to the librarian, also user can request for booking a room. Also, the user can put a hold on some book that is not available in the library.
- Geo-Locator: This feature will allow the user to get the information about the nearby library with their opening and closing time. Also, give them information about the availability of the room.
- Fine: If the user will not return a book on the due date then this feature will calculate the fine and will display the amount that the user needs to pay. Also, it will display some payment methods.
- Logout: This will help the user to come out from the system after successful execution.
- Authentication: This feature is used to check whether the user is a valid user or not. Validity will be checked if the user is from Ireland only and has a valid email-id and phone number. Once the authentication is done, the user will be registered as a valid member.
- Add/Delete: This feature will allow the librarian to Add a new book by adding information like the book title, author name, publisher, edition, RFID number, ISBN /ISSN, category. Also, allow Delete books/magazines that are lost or outdated by entering their details.
- Member Record: This feature will be accessible by the librarian in order to update data related to a member, like counting the number of issues left, updating personal information.
- Issue/Return Date: This feature will give the information about the issue date and return date of all the issued book by the user. Moreover, it will give information about the number of the issue left.

- Transaction: Payment of fines and loss of book, wear and tear of book and maintenance of infrastructure. All will be done through payment system.
- Database:
    1. User table: where new and existing user data will be given including full name, email-id, phone number, address, passport number.
    2. Admin table: for Admin details like name of the librarian, email-id of the library, name of the library, address of library, phone number of library and librarian.
    3. Authentication table: for keeping encrypted user information which checks whether a user is resident of IRELAND or not, have a correct email id and phone number.
    4. Book Issued table: which includes the data of the number of books issued with book details and return date, also the details of members who have issued the books.
    5. Fine Record table: This table will include Wear-tear of hard copies, lost books, expiry of the due date.
    6. Payment table: This will store the information of all the payment that is whether made by a member or librarian. Payment date, payment reason, and payment mode column are created.
    7. Payroll table: for resourcing working in a library, infrastructure maintenance.

5 UML Diagram:

5.1 Use Case Diagram -



Primary actor: Members, Librarian (Admin)

Stakeholder & Interest:

- Members - They want to register into the System and access the library services like issue books, watch trailer, renew book, request to National Specialist Collection system for some specific books, reserve books.

- Admin - Responsible for validation and verification of data that is entered by the user, it will also take care for EU directives related to GDPR. It will issue smart card to user which has RFID inside it.

Pre-condition: So, in order to access the system member as well as librarian need to be register first.

Post-condition: Once the member will get in the system, they can access the functionality of library remotely. Librarian will be able to maintain record online, also managing of stock become easy.

Main Success Scenario:

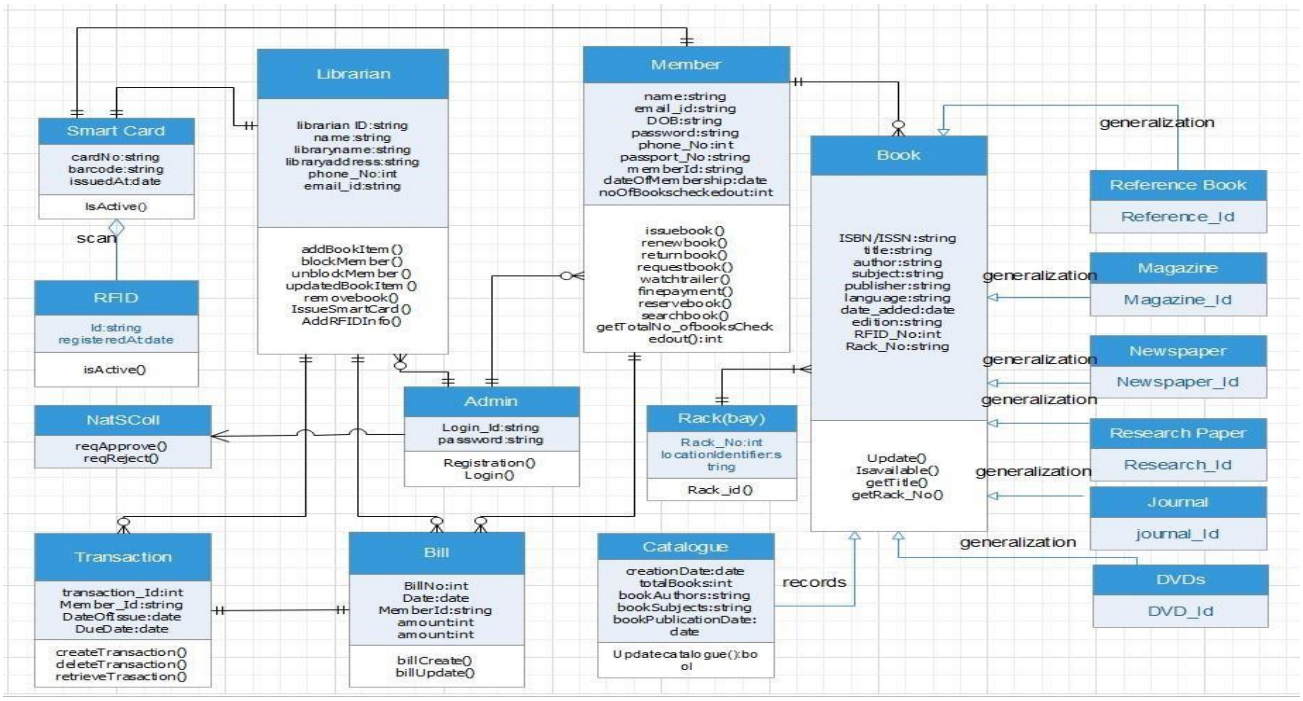
- Members and Librarian sign up in system to get registered.
- Validation of email, phone number, and passport number
- Accessible to all the functionality mentioned separately for Members and Librarian.

Alternate Flow:

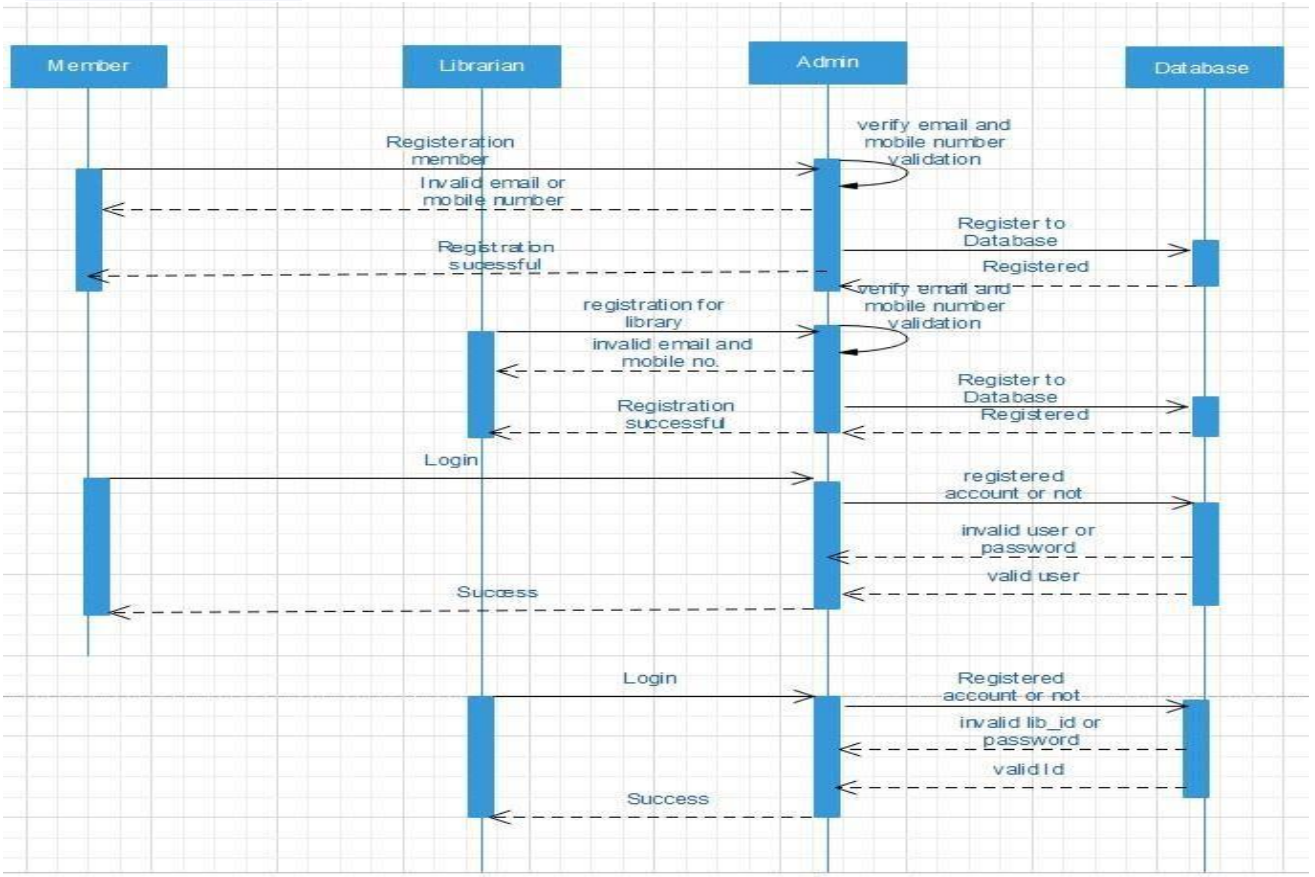
- open Website or mobile application
- Not able to Sign up due to Rise of error from Validation and verification check.
- Content might me not available due some content regulations by EU directives.

Specific Requirements: - For accessing some specialist items from National Specialist Collection Member will push a request from public website or mobile application to the admin system.
Which is followed by loan request to NatSColl system via an API call from admin website.

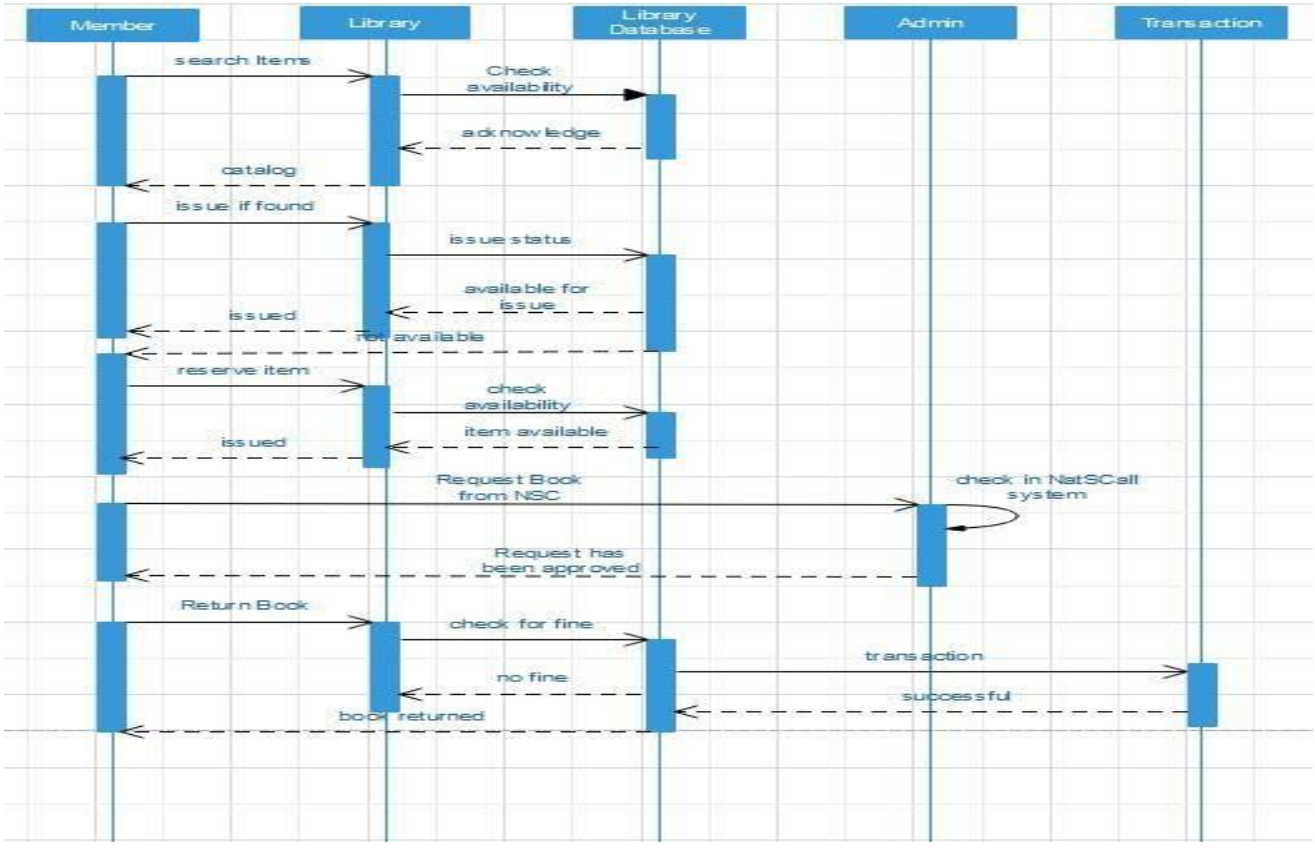
5.2 Class Diagram –



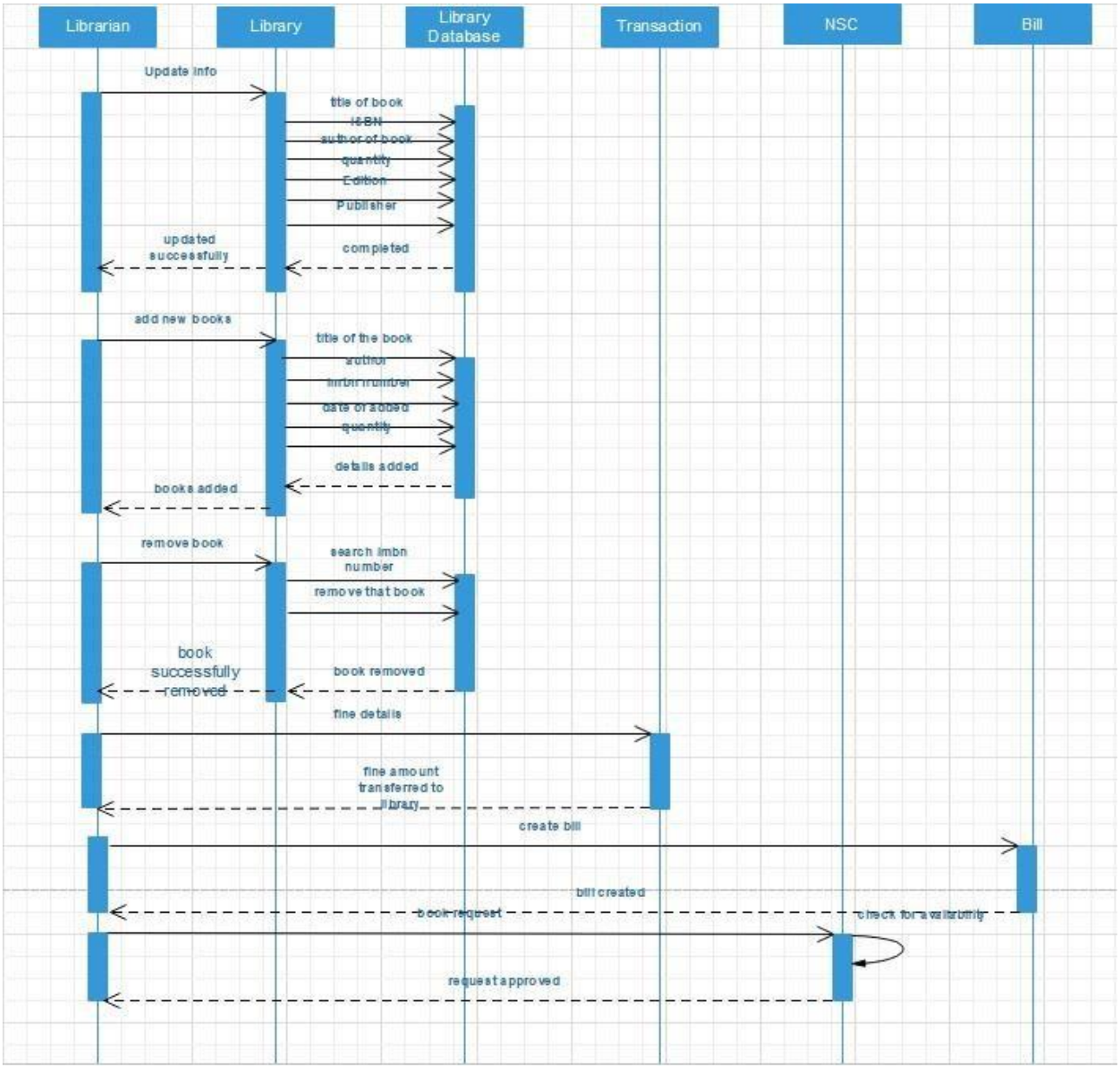
5.3 Sequence Diagram –



(a)Register and login sequence diagram

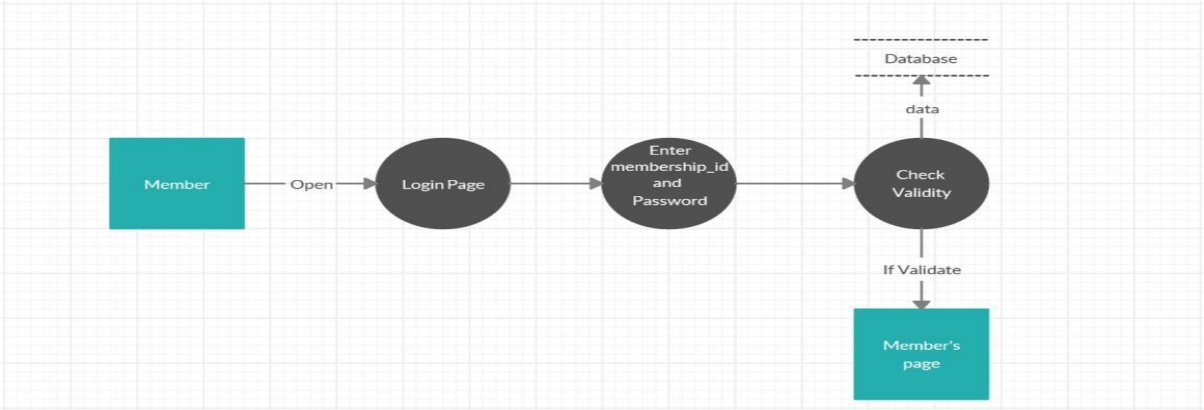


(b) Service Member could use



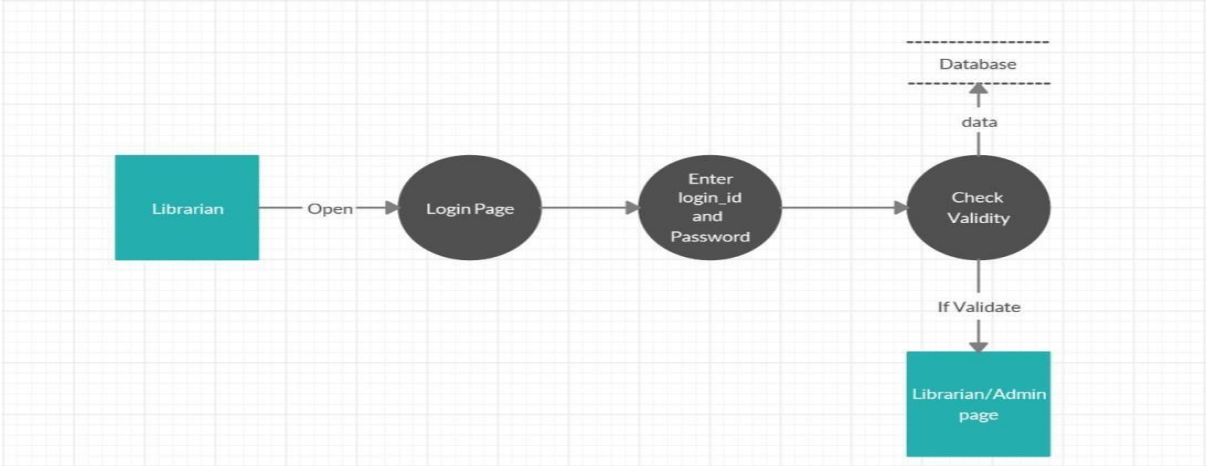
(c) Services of library

Member's Login:



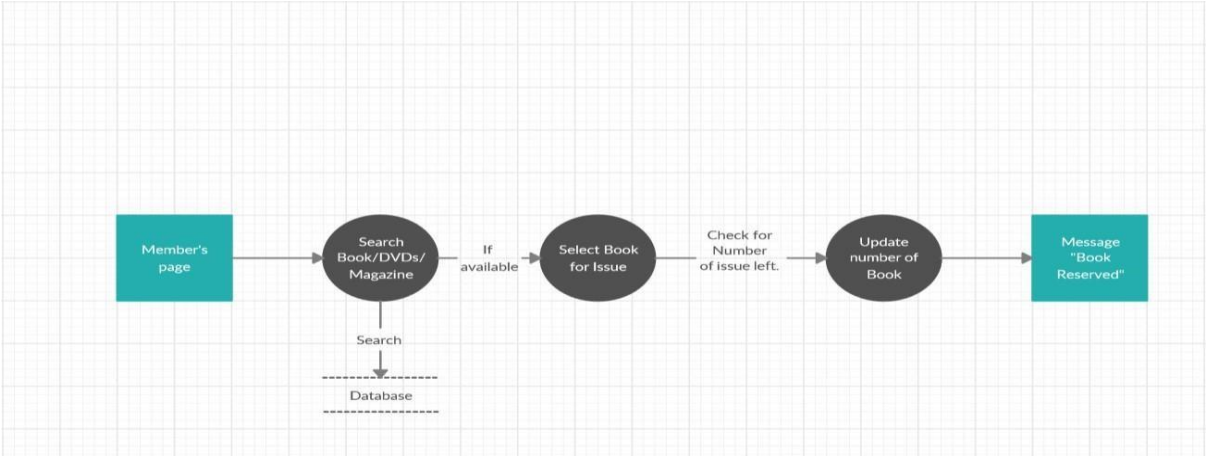
After opening the application /Web URL member will be directed to the login page where they are asked to enter membership id and password. If the member is a valid user, then the user will be directed to the member's home page. Validating of credentials will be done on the Oracle database by the Admin.

Librarian Login:



After opening the Web URL user will be directed to the login page where they are asked to enter login id and password. If the librarian is a valid user, then the user will be directed to the librarian's home page. Validating of credentials will be done on the Oracle database by the Admin.

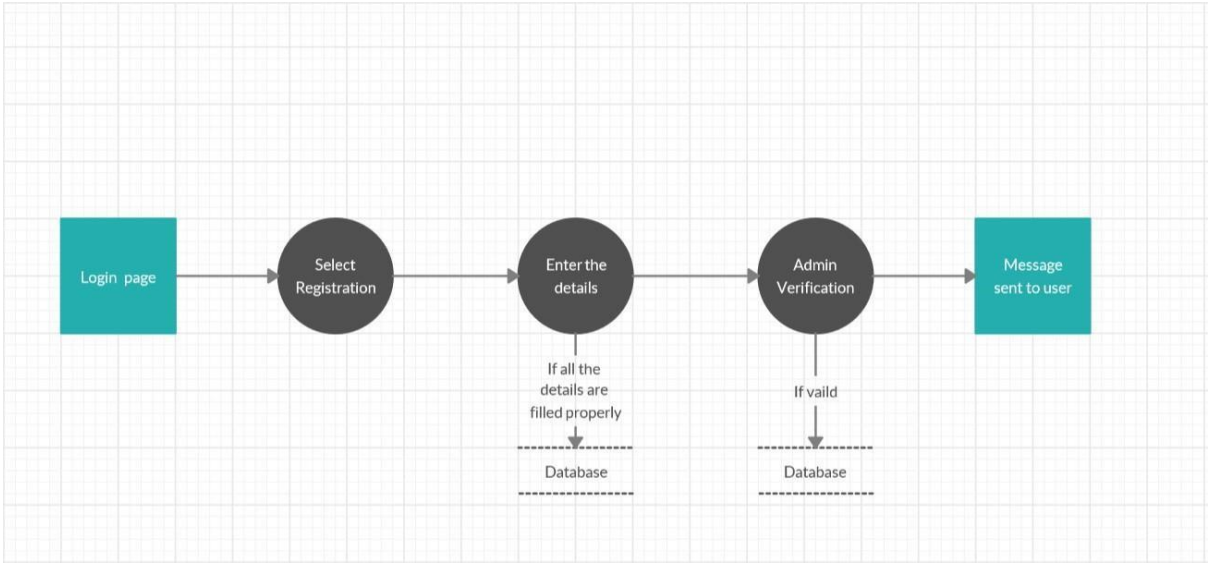
Issue book:

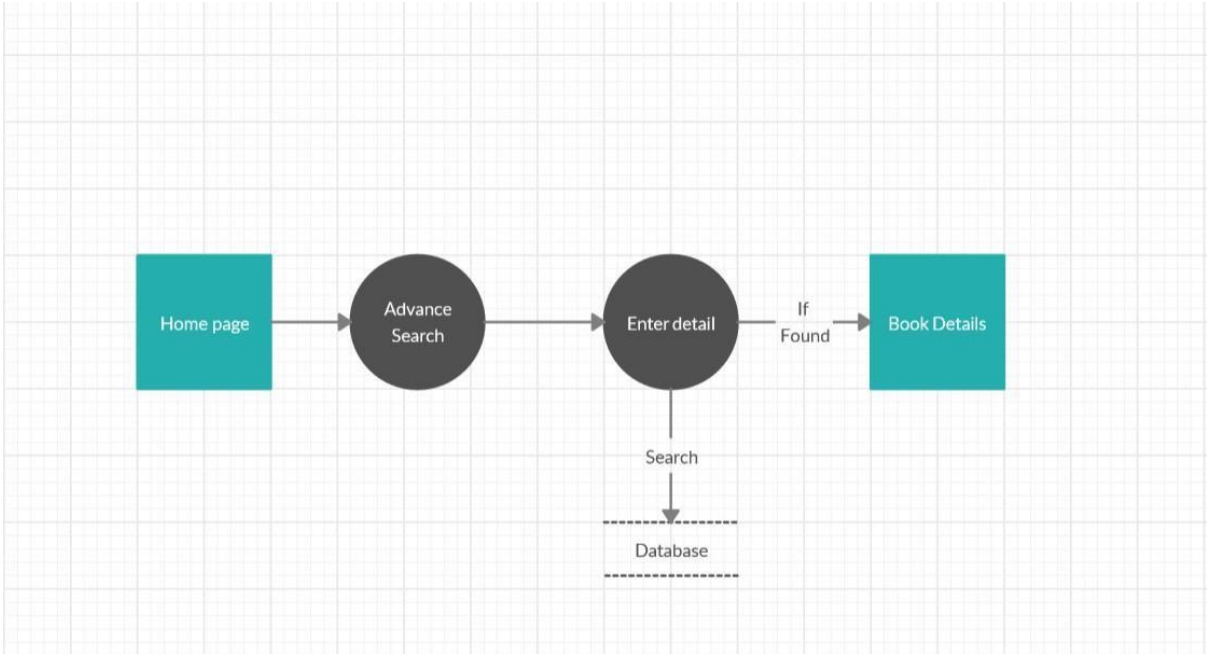


Once the user is login into an account, they can search the book that they want to issue. If the book/Magazine is available, then the user can issue the book. But before the checkout, check for the number of book issues remain is done. After that, the Librarian will update the number of books and approve the book for the issue.

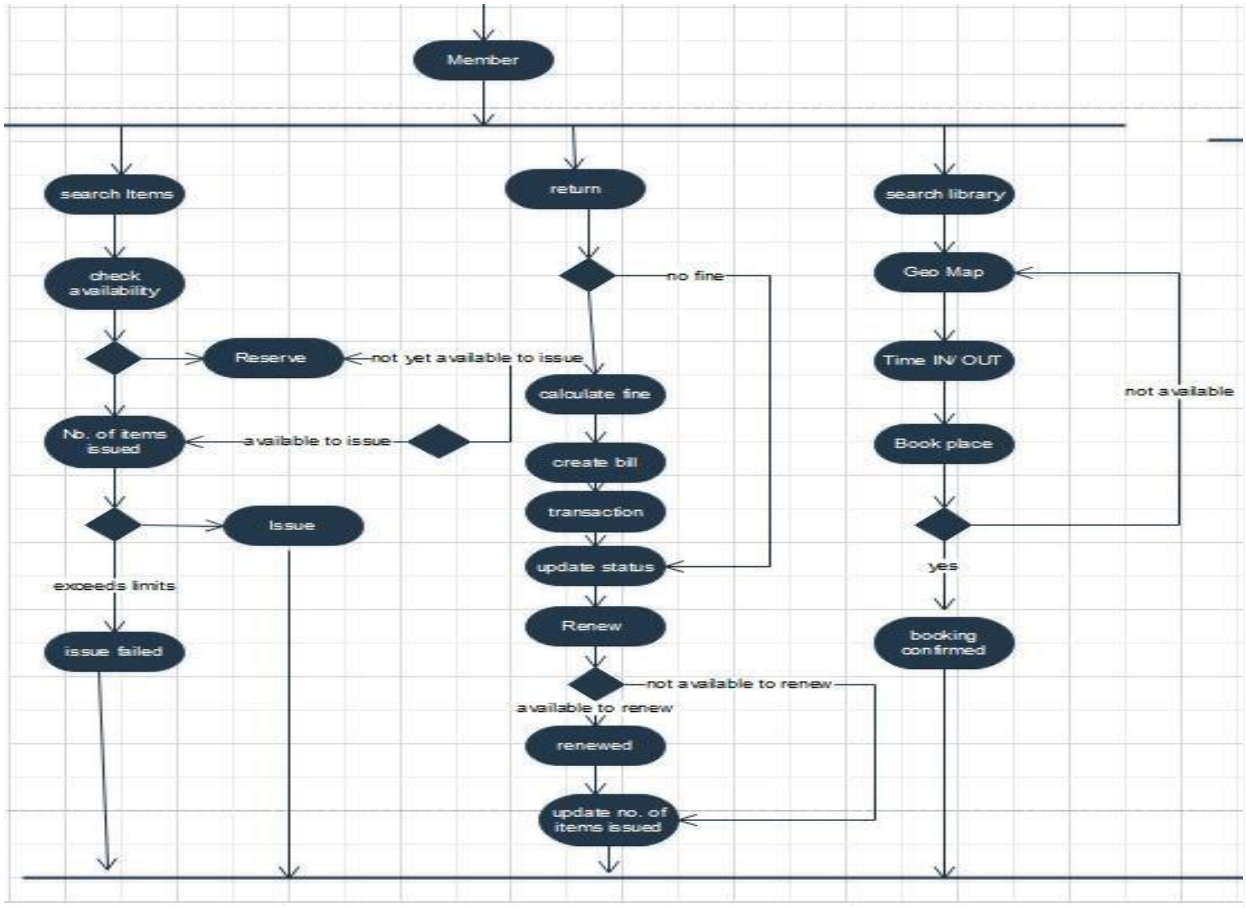
For registration:

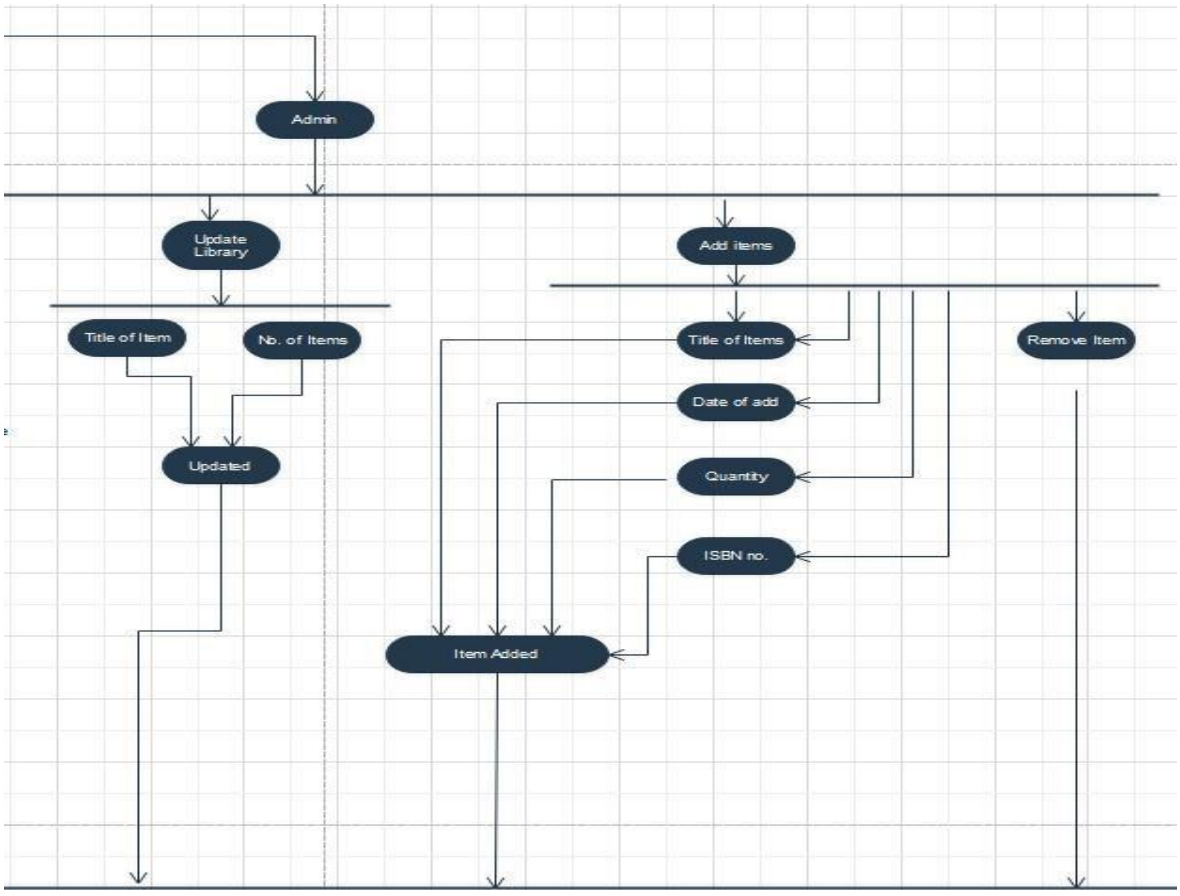
On the login page, there will be an option for registration. After entering Member's details on the registration page. These details will be verified by the admin. Once the verification is done successfully member will be approved as a registered member of the AIL.

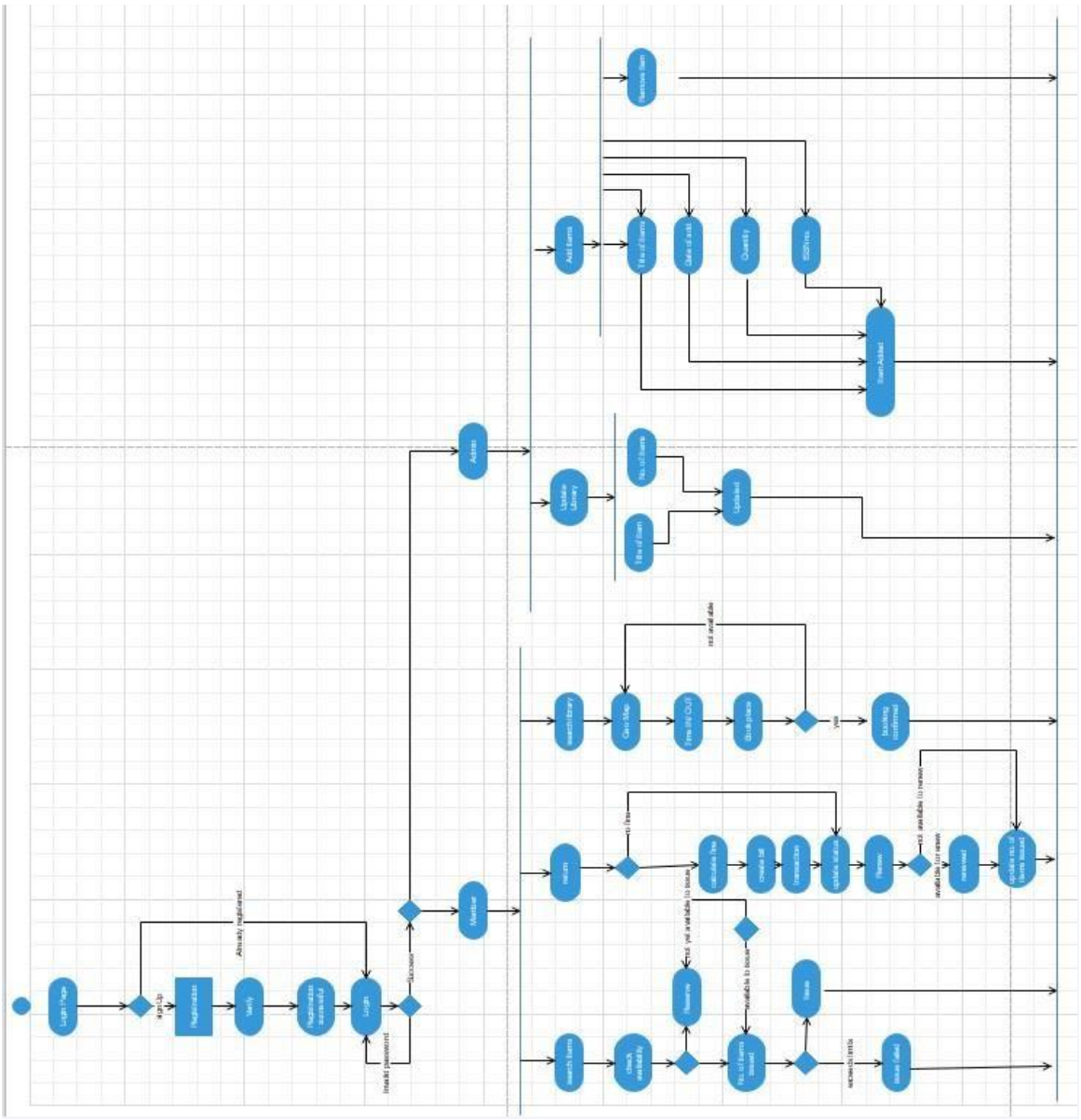




5.4 Activity Diagram _


Member
search Items
check availability
Reserve
not yet available to issue
No. of items issued
available to issue
Issue
exceeds limits
issue failed
return
no fine
calculate fine
create bill
transaction
update status
Renew
not available to renew
available to renew
renewed
update no. of items issued
search library
Geo Map
Time IN/ OUT
Book place
not available
yes
booking confirmed

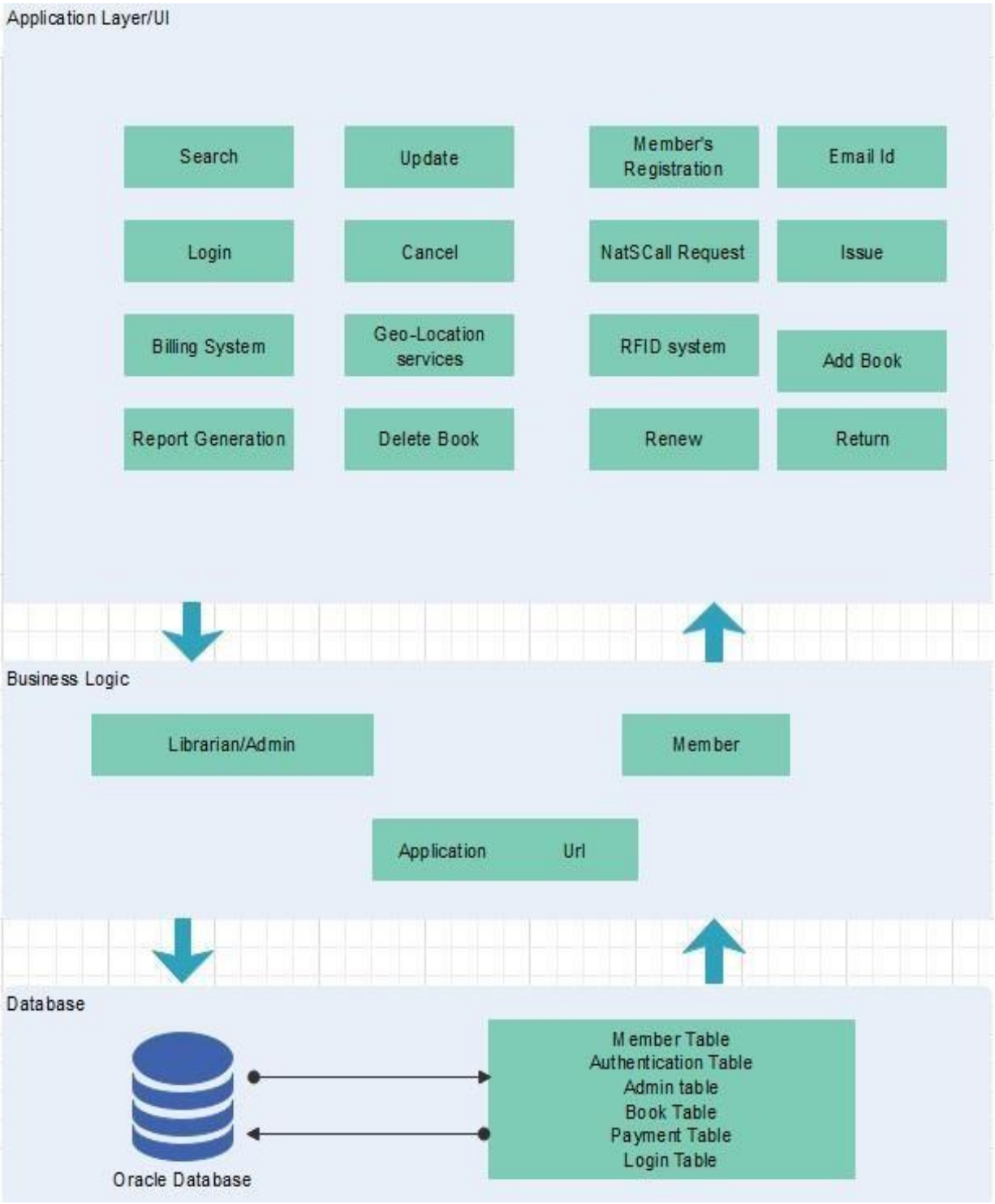

Admin
Update Library
Title of Item
No. of Items
Updated
Add items
Title of Items
Date of add
Quantity
ISBN no.
Item Added
Remove Item



6 Risk Analysis:

- Environment Issues: No down time for the end user, hence mitigation plan is to provide two servers so that if any modification is required can be done in one and other will be still up and working.
- Authentication Issue: Customer data should be secured enough hence giving encryption in URL and database. Mitigation plan is to secure data by encrypting it using RSA.
- File Lost: Data of some books and files are lost due to human environment and sometimes due to human error. Which can be avoid by making that data available and accessible on computer via browser or application.
- Security Issue: No third party spoofing the data, so the mitigation plan is to provide secure database and Admin access using LDAP server.
- Business Continuity Plan: All data must be independent of Geography hence the mitigation plan is to keep the server in nearby place to DUBLIN.
- Frequent Change in the Customer requirement: End user requirement and change in business rules are kept by maintaining a register in share point which can be updated and viewed by complete team.
- Version Controlling Issue: As the book version are always updated and need to be maintained, hence version control modification and updating is controlled in share point.

7 System Architecture:



Electronics libraries are libraries in which collections are stored in electronic media formats and accessible via computers. The electronic content may be stored locally or accessed remotely via computer networks. An electronic library is a type of information retrieval system. In this work Oracle database and php dynamic 3-tier website is design.

Application layer presents all the operations that can be performed by both librarian/admin and the member. Like search, billing system, report generation, NatSColl request etc. Then the business logic layer which is used for authentication, verification, restriction and validation based

on GDPR for the library. Database layer where all the data is stored which includes members table, authentication table, admin table, book table, payment table and login table.

8 Recommendations:

There is the future scope of a given system like we can add online lecture by the well-known lecturer/Speaker. Also, some user interactive assignments can be added which can help user to get more knowledge about their subjects. E-Book can also be added to the library which in all reduce the problem of book/Doc availability. AI (Artificial Intelligence) bot can also be used for interaction between user and system which can help in a same way as a librarian can.

9 Conclusion:

This Website and mobile application of AIL makes the entire process online, where members can search books, issue books, request books, renew books also librarians can generate a report on the bases of insertion and deletion of books and can maintain the member's record. It also provides the information of near-by library with the address which includes their opening and closing time. It gives the member information about the book that is already issued and their return date and if a member fails to return the book on or before the due date then the user has to pay the fine which can be made online also.

10. Proposed Testing Approach Compared to Others

When discussing testing approaches, you might consider a few popular methodologies like Agile, Waterfall, or DevOps. Each has its strengths and weaknesses. For instance, Agile might be suitable for frequent iterations and adaptability in a Library Management System where requirements can evolve, while Waterfall could offer a more structured, sequential approach for well-defined requirements. Discussing the pros and cons of each in the context of your project's needs would be valuable.

11. Testing Levels

Testing levels refer to the different stages or layers of testing. These often include unit testing (testing individual components or functions), integration testing (verifying interactions between integrated components), system testing (ensuring the entire system works together), and user acceptance testing (validating if the system meets user requirements). Considering these levels and their importance within the Library Management System will help build a comprehensive testing strategy.

12. Testing Types, Techniques, and Tactics

Here, you'd delve into specifics like functional testing (ensuring the system performs as intended), performance testing (checking how the system handles load), security testing (ensuring data protection), and usability testing (checking user-friendliness). Techniques and tactics might include automated testing for efficiency, boundary value analysis for robustness, or exploratory testing to uncover unforeseen issues.

13. Proposed Testing Process

Outline a step-by-step plan for how testing will be executed. This could involve test planning (defining scope, objectives, and resources), test design (creating test cases/scenarios), test execution (running the tests), defect tracking (recording and managing issues found), and test closure (evaluating completion criteria and reporting).

14. Measurement in Software Testing

Measuring testing involves assessing the effectiveness of your approach. This could include metrics like defect density, test coverage, and mean time to failure. Defining a hierarchy of testing difficulty could involve categorizing test cases based on complexity or criticality to

prioritize their execution. Test plans and test cases are integral parts of this measurement as they define what needs to be tested and how.