

# Software Architecture and Quality

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## 1 Introduction

In this assignment, we try to implement the architectural design for the given library management System description. It is interpreted from the problem statement that creative learning platform- CLI, currently being used by the library management system is a common learning platform used by the librarian, administrator, student, employees at university. The university was notified about various issues like lack of support for access the books, records, research papers among many others. The university is in plans to shift to a new platform keeping all the previous features intact and incorporating few specified requirements. It has been concluded in our analysis that the previous version must have had poor architectural design and for a better, robust and efficient system, software architecture is required.

- I. Design purpose
- II. Quality Attributes
- III. Primary Functionality
- IV. Architectural concerns
- V. Constraints

## 2 Design purpose

Robust software architecture and design are necessary from the initial stages of software development to predict cost, quality, and timeline of the project. Software architecture can be stated

as the key to ensuring the agility of a software system. Software architecture encompasses within itself several parts that play a key role in the project such as tools, technologies, and skills required to develop the current system. Although an efficient software Architecture alone can't guarantee project success, it can be stated that projects without efficient software architecture may have a tendency to fail most of the time. The demerits of poor software architectural design are aspects like the ability to modify, add or remove new features thereby increasing the load on the development team. Maintenance is also an issue with poor architectural design. Low usability, limited features are among the various features that are being faced by the university. Maintenance has also been a challenge. Problem statement conveys that the university is presently using CLP – Creative Learning platform to manage courses, feedback, grades, etc. CLP also lacks support for features such as grades reporting, scheduling, and management of resources (lecture rooms, labs, equipment) among others. Due to the lack of integration of all services into one platform, users use multiple applications which are resulting in the usage and maintainability being inefficient.

With the assumption that the primary cause of these difficulties is poor software architectural design can be made. Despite the fact, the software architectural design has initial capital required, it can be seen that the benefits of a good design outweigh the initial costs in the long run.

### **3 Quality Attributes**

**Usability:** In this, we can discuss different scenarios about stakeholders we can take some examples like the school management has usability problems as the present Library server is not centralized with all the key components. School management requires to use most of the applications to do the work required by the librarian and administrator. Here the blueprint of architecture design can be seen below. Architecture design is planned according to the user interaction with different user actions finally we have gone through the best user interface that interacts with each and every feature according to the user and end-user. The structure of each action can be shown below.

#### **Components of usability in the Library management system**

**Student interaction with Server:** the architecture is user-friendly. It is understood by every user and uses according to the required action. The end-user should be interacting with library

management system architecture to communicate the requests with the server. The user interface is well designed to interact with each member according to the action required by the user. In this specific user has some rights to access the server. According to the user qualification, the rights are given in the access management system. In this architecture full access is given to administration and limited access to librarians and students.

**Required Functionality:** The required functionality is performing by the system. It user-friendly according to the required features that should be available in the library management system. According to the functionality written in code. The server acts according to the end-user, so each click plays a different action according to user rights.

**Network Operations:** The software must be designed to enable all the features needed by the end-user to the system. the interface is connected to all the features so the user can get the action based upon the click.

**Response Time of system:** The response time of the system should be user-friendly and guiding documents and guide the user about the features available in the library management system according to user rights. When the user interacts with the system on the background there are actions going on based on click. So, the user will get the answer based on click here time places a critical role. The server should send a response based on the user click. The data from the server should uses according to the page displays on the screen. Finally, the response from the system should be very high.

## Scenarios

### 1. Student search for the book User: Student

**Motivation:** Students search for specific books on the server.

**Artifact:** Connect to the server.

**Environment:** The User interface.

**Returns:** When the user clicks on the search book it redirects to the content page so the user can

Search for books.

**Measurements:** When a user searches for the book. The page loads and redirect. The server may take less than 10 secs based upon internet speed.

## **2. Librarian tries to download the Ebook from the Library management system.**

**User:** Librarian

**Motivation:** Click on

**Artifact:** Connect to the server

**Environment:** User interface

**Returns:** When the user clicks on eBook it redirects to the content page so the user can download the book.

**Measurements:** Redirect and load the page you are looking for. But it takes less than 10sec.

**Data Integrity:** The integrity of data relates to software accuracy and quality throughout its lifecycle. Data integrity defines its state of our data. Information reliability is the data's ability to provide a detailed view. The integration of data is an essential aspect of the management of business data. It is a system that is extremely complex and requires multiple tasks.

Every time data is recorded if was monitored by cloud services and if any errors occur, we can solve it based on error. Data was back up in the server. Data from a server should be accurate and when the user interacts with the library management system there should be no errors with respect to protocols

Logical Integrity holds information intact as it is used in a relational database in various ways. User integrity contains the rules and restrictions that the client has developed to satisfy their specific needs. Server, referential, and credibility of the domain sometimes aren't enough to protect information. Domain integrity is a set of processes to determine that each piece of data in a domain is correct.

## **Scenarios**

### **1. Administrator stores the data in server.**

**User:** Administrator.

**Motivation:** Provide the updates data to the server.

**Artifact:** Users can retrieve the data and access anywhere based on user rights.

**Environment:** Server in the cloud.

**Feedback:** The data stores in the database can be accessed and modify it.

**Measurements:** Data can be accessed and modify by the administrator at any time. The user and employee can fetch the data when it updated. Sometimes a server may be down due to maintains.

## 2. An employee needs to update user data on the server.

**User:** Employee

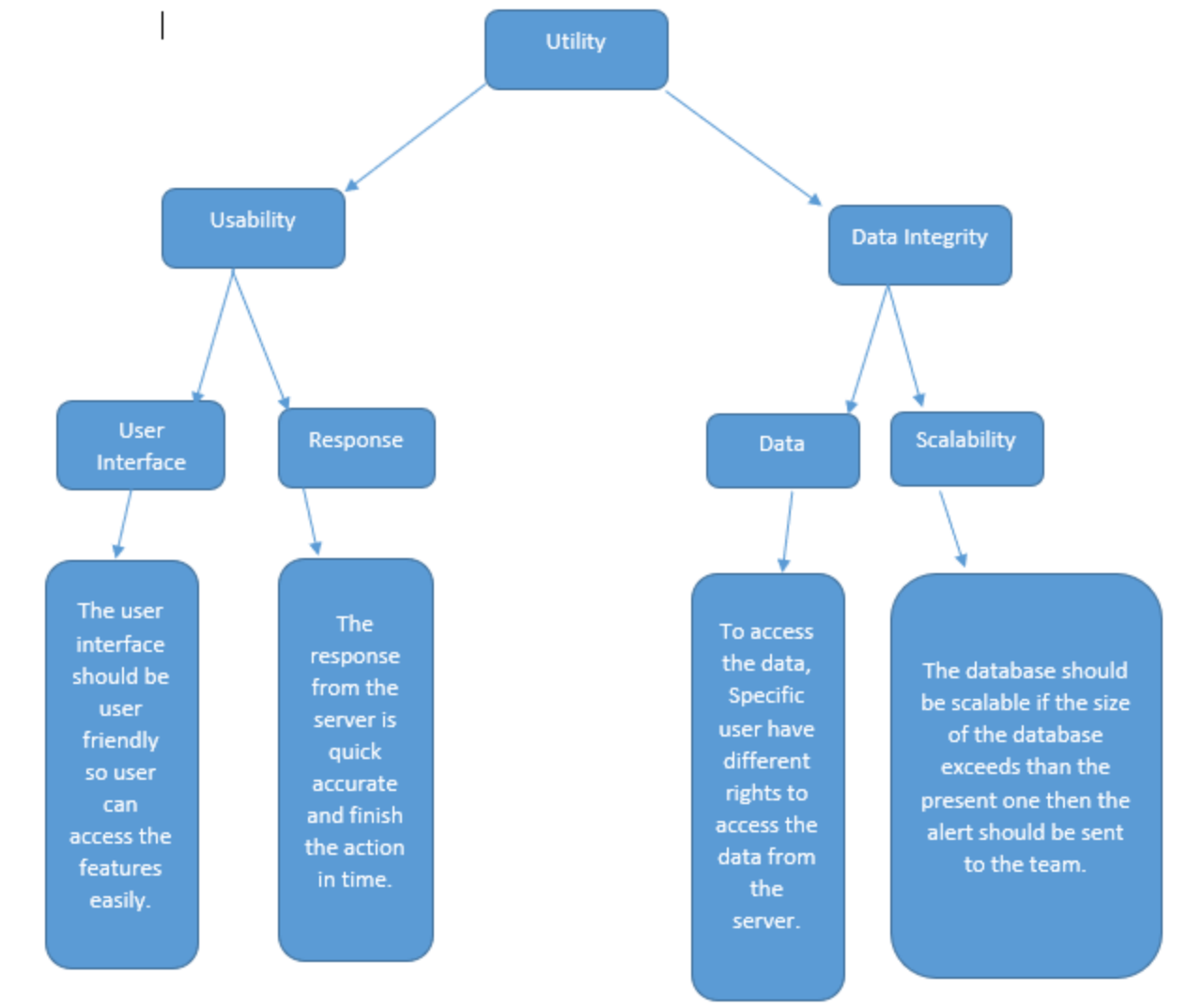
**Motivation:** Employee login to his profile updates the information.

**Artifact:** Data repository and retrieval.

**Environment:** Server in the system.

**Feedback:** In the server verifies the employee is related to his database or not if the employee has rights so the server gives permission to an employee then login to his profile, he modifies the data then saves it. **Measurements:** When the server is in maintains employee can't access his profile.

## Utility tree



**Figure 1**

#### 4 - Primary functionality:

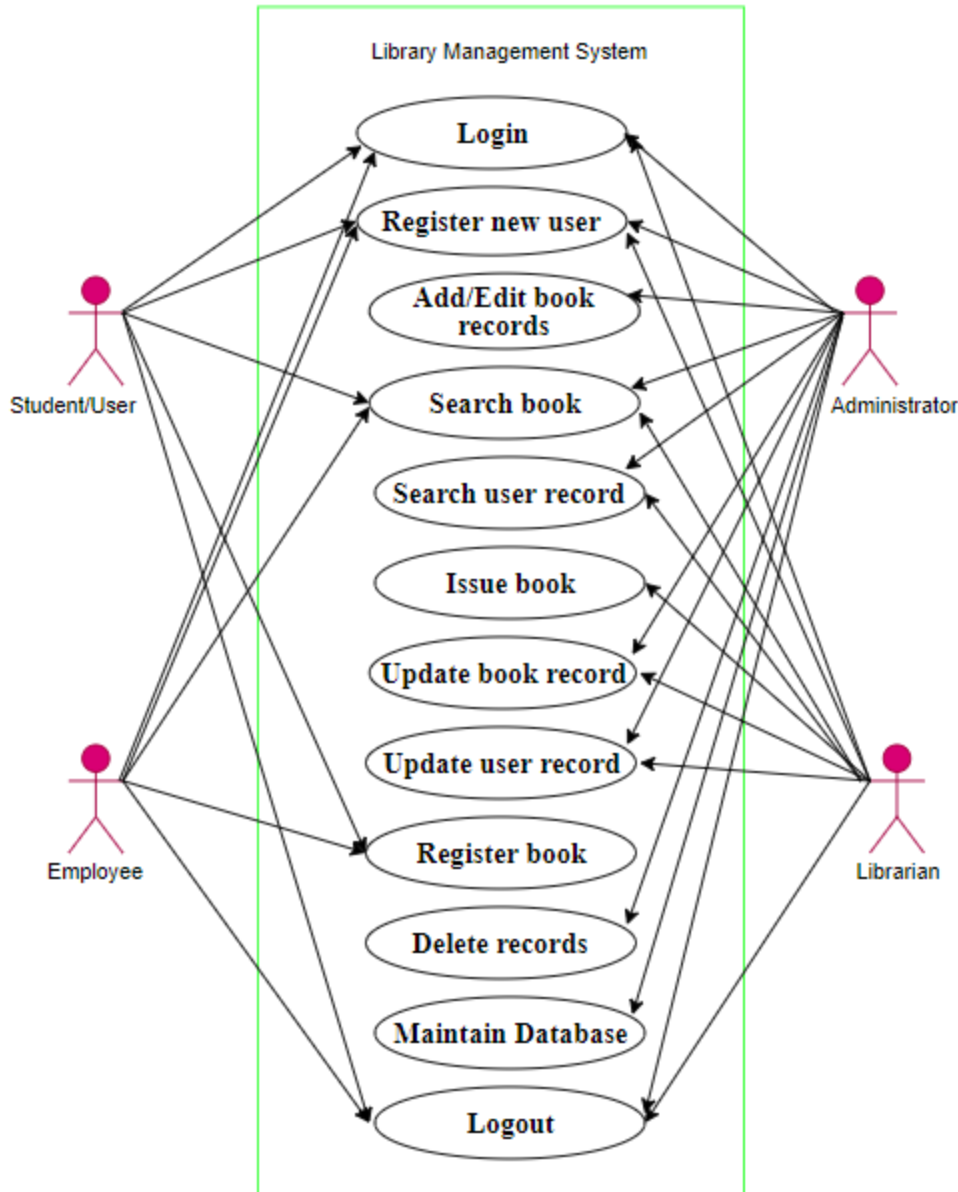


Figure2

#### Primary Functions:

**Login:** The first functionality of this login use case login is the enter the user of ID information to the system under the security process by student/Librarian/student information its commonly require the username or id and then the password system verify the enter details correct or wrong.

Student /User: This case is permeating by the student who wants to log in to the library before the user entered into the system about their required books.

Librarian: This case is permeating by the librarian to enter the correct information before the librarian entered into the system.

Employee: This case is permeating by the employee to enter the correct details before the employee entered into the system.

Administrator: This case is permeating by the administrator to enter the correct details before the administrator entered into the system.

- The user verification is provided when registering.
- The system only must allow the user to log in with a registered Id and password.
- After using the system, the user must be able to log out.

**Register new user:** The functionality of register new users is creating an account with a valid username and password.

Student /User: This case is permeating by user/student register for the account in the library with a valid id/username with a strong password.

Librarian: This case is permitting by the librarian after registered by the user if registered details are valid librarians can permit for the account.

Administrator: This case is permitting by an administrator to check any problems or errors with the registration phase case administrator resolve the problem.

- The system should be validating the registered details.
- Systems should be verified if the information is incorrect.

**Add/Edit book records:** The functionality of the Add/Edit use case depends on users, sometimes they are adding new books and sometimes they are returning the books and sometimes they are renunciation books from the library.

Librarian: This case is permeating by the librarian collecting and issue books to the users and Update the user database based on user activities.

Administrator: This case is permeating by the administrator checks if there is any problem related to the user records if is there any problem from this case administrator resolve the problem.

- The system should be entered details in the database.



- The system should be updated after any changes.

**Search book:** The functionality of the Search book is checking the availability or not from the library. Availability or not depends on user or employee enters title or author, then the system performs a search through the library database if the book is available, the system shows the status of the book.

Student /User: This case user enters title or author, then the system performs a search through the library database if a book is found system shows the status of the book.

Librarian: This case librarian checks the book availability or not after the user entered their requirements if its available then issue books to the user.

Employee: This case the employee uses the name or author and then the system checks through the database from the library if it's found the system shows the status of the book.

Administrator: This case is permeating by the administrator checks if there is any problem related to search book if is there any problem from this case administrator resolve the problem.

- The system should check the process in the database according to the search type form.
- The system needs to be able to filter books with keywords.

**Search user record:** The functionality of the search user record, admin wants to view membership records of all users the system shows the records of all users that are a member of the library.

Librarian: This case is permeating by the librarian who wants to see the registration of all users on the system that display the registrations of all the users in the library.

Administrator: This case is permeating by the administrative authority must check the registry of all users on the system, which shows all users registrations in the library. if there is any problem happened with the user records administrator resolve the problem.

- The system must show a valid user record.
- The system must remove invalid information.

**Issue book:** The functionality of the Issue book, after searching functionality if the book is available then book issue to the user and update the record from the database.

Librarian: This case is permeating by the librarian, after the searching process if the book is available, then the book issue to the user and updates the library records.

- The system should be updating the data from the database after the issue.
- The system must be restored after the issue.

**Update book record:** The functionality of the update book record, after the book issue to the user, update the book details into the library database.

Librarian: This case is permeating by the librarian, update the book information to the library database during the user's book issue.

Administrator: This case is permeating by the administrator, check the issues when the librarian updating the book records. if there is any problem happened with the updating book records the administrator can resolve the problems.

- The system should be verifying the book details.
- The system must be updated to enter the number of books from the user account.

**Update user record:** The functionality of the update user record, after the book issue to the user, update the user details into the library records.

Librarian: This case is permeating by the librarian, update the user information at the library database when the librarian issued the book.

Administrator: This case is permeating by the administrator, check the issues when the librarian updating the user records. if there is any problem that happened with updating user records the administrator can resolve the issues.

- The system should be verifying the user details.
- The system must be updated the user information from the user account.

**Register book:** The functionality of register book, who wants the book they visit the library and register the required book if it's available.

Student /User: This case user/student visits the library and reserve a book.

Employee: This case the employee visits the library and reserve a book.

- The system must not allow more than five books with the same library identification.
- The system should be checked the user details.

**Delete records:** The functionality of Delete record, who wants to exit from the library that records will be removed by admin.

Librarian: This case is permeating by the librarian who wants to leave the library that records will be deleted by the librarian.

Administrator: This case is permeating by the administrator, who would like to leave the library that the administrator will remove data from the database.

- The system must be updated to the library database after deleted records.
- The system must be checked user data after submitted books.

**Maintain Database:** The functionality of the Maintain database, the administrator would be maintaining the database he/she can solve any issues that occurred in the database.

Administrator: This case is permeating by the administrator, if there is any problem happened with the user records administrator can resolve the problem.

- The system must be updated the database after any changes.

**Logout:** The last functionality of this logout use case, to leave the website, etc. so that the next time you want to use it, you need to re-enter your personal information.

Student /User: This case is permeating by the students who want to logout into the library site after the user entered the system.

Librarian: This case is permeating by the librarian who wants to log out into the library site after the entered into the system.

Administrator: This case is permeating by the Administrator who wants to log out into the library site after the entered into the system.

Employee: This case is permeating by the employee who wants to log out into the library site after the entered into the system.

- The system should be allowed the user to logout with their registered Id and password.
- After using the system, the user must be able to log out.

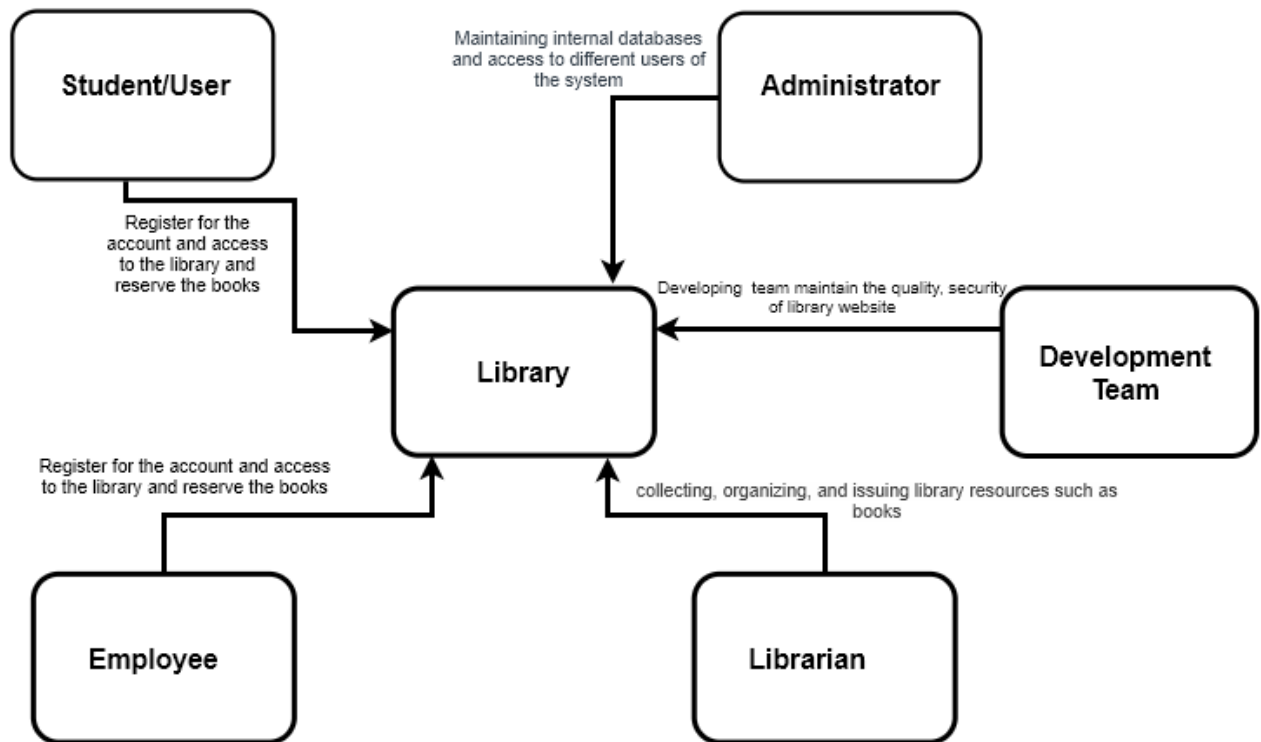
## **5 Architectural Concerns**

We are designed this architecture based on specific concerns and this system architecture we can regenerate features efficiency to the system and also we can provide the security of the system and source code is developed by easily it will be understood by any users and it allows to attach more features in coming stages. These concerns are mainly divided into three types they are.

- General Concerns
- Specific Concerns
- Other Concerns

### **General Concerns**

In this system efficiently used by the users/students, librarian, employees, administrators, and system is simultaneously improved by the development group. the system functionality is explained in the below diagram. The (GUI) graphical user interface is easily understood by all users and employees and the database is designed with security.



**Figure 3**

### **Specific Concerns**

In this system usability and Data Integrity are considered the specific concerns and Our specific concern is usability because the old system has already had these structural problems and because of the same kind of problems with the new systems, no use of this kind of system.

### **Other Concerns**

In this users and librarian, the administrator has some access limitations they are users can log in the website and reserve the books only and librarian can access the only issue and return the books only and administrator can access solve specific problems.

## 6 Constraints

Every software development project constraints are one of the parts of the architectural design system. Constraints play a very important role in the software development process. During the design, process constraints are represented to keep away from the problems or issues during the software development process.

**Technical constraints:** For this, we have selected a cloud server because we can store the data efficiently and it has high security. The software can be created without difficulty and it has largely salable, through this cloud server we get high-speed access to the database and we can store the data into different addresses.

**Database:** In this software project we need to create server storage for students/employees to store details of the student and employee account details. the database contains hug information about daily events like student registrations, issues or return of books details of every user. Every person has some access limitations to the database.

**Team of Developers:** For this project developers and testers are followed by agile methods this are used for software development system because every software project has occurred some modifications during the development process. For these, agile techniques are more desirable for changes in requirements.

**Date of Delivery:** Ever software project is delivered by the end of the deadline. Through the agile methodology, we can achieve the desired outcomes of the project. For this we can use Work Breakdown Structure through this we can deliver the product within time. For this, we need to estimate the effort need to full fill each activity and time.

## 7 Assumptions

In the process of designing the software architecture, after specific assumptions that were considered essential for the system were created.

- The system should be user-friendly.

- Users are accessed from different types of computers that should contain internet connection and internet browsing facilities.
- User should be searching for a book by its name or author and publication
- Provide security for user data.
- Provide mobile apps for users to access easily to the system.
- Users are using different types of platforms for accessing systems so provide access to any type of users.
- Provide good user interfaces for easy understanding.
- User is not allowed to enter book information.
- Convert the manual application into the web application.

## References

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