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Software Requirements Specification

for

Browser Compatibility Test- based Network Connectivity (Library Search System)

5TH SEM, B.Tech (CSE)

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Revision History

Name	Date	Reason For Changes	Version
Software Squad	15/10/2023	Initial draft	1.0 draft 1

1. Introduction

In an era where digital resources have become indispensable in academic and research environments, the Library Search System plays a pivotal role in providing access to a vast repository of knowledge. The quality and reliability of this system, particularly in diverse web browsers and network conditions, are of paramount importance. This document outlines the software requirements for conducting a Browser Compatibility Test based on Network Connectivity to ensure that the Library Search System meets the evolving needs of its users.

1.1 Purpose

The product whose software requirements are specified in this document is a library search system. The purpose of a Browser Compatibility Test based on Network Connectivity is to ensure that the Library search system functions effectively and consistently across different web browsers and under various network conditions, guaranteeing a seamless user experience for all users, regardless of their choice of browser or network quality.

1.2 Product Scope

The product scope for the Browser Compatibility Test based on Network Connectivity for the Library Search System is to assess and ensure that the Library Search System functions optimally and consistently across various web browsers and under diverse network conditions.

1.2.1 The scope encompasses the following key elements:

- **Browser Compatibility:** The project aims to verify that the Library Search System functions effectively on popular web browsers, including Mozilla Firefox, Google Chrome, Internet Explorer, Safari, and more.
- **Network Condition Resilience:** It seeks to evaluate how the system performs under challenging network conditions, including slow connections, to ensure accessibility for all users.
- **Cross-Browser Consistency:** The project's objective is to maintain a consistent user experience across different browser platforms, allowing users to choose their preferred browser without compromising functionality.
- **User-Centric Testing:** It focuses on user experience and responsiveness, ensuring that the system remains user-friendly even under network constraints.
- **Security Assessment:** The project will include a security assessment to identify and address potential security vulnerabilities that may arise from differences in browser behavior or network conditions.

1.3 References

1. <https://rdcu.be/doxKX>
2. https://www.researchgate.net/publication/221554140_Automated_cross-browser_compatibility_testing
3. <https://doi.org/10.1145/2642937.2642942>
4. https://www.researchgate.net/publication/221307477_A_Cross-browser_Web_Application_Testing_Tool

2. Overall Description

2.1 Product Perspective

The Browser Compatibility Test based on Network Connectivity is being specified in this SRS for a library search system. The library search system is a self-contained product designed to facilitate efficient and user-friendly search and retrieval of library resources, including books, journals, digital media, and other educational materials. This product is integral to the operations of libraries, educational institutions, and research facilities.

2.2 Product Functions

- **Browser Compatibility Testing:** The system shall perform compatibility testing with a variety of web browsers, including Google Chrome, Mozilla Firefox, Microsoft Edge, Safari, and others.
- **Network Connectivity Testing:** The system shall assess the performance of the library search system under different network connectivity conditions, including high-speed, low-speed, intermittent, and secure network connections.
- **Browser and Network Environment Simulation:** The system shall simulate different web browsers and network conditions to replicate real-world scenarios for testing.
- **Cross-Browser and Cross-Platform Functionality:** The product must ensure that all essential library search functionalities work consistently across different browsers and operating systems.
- **Performance Metrics Collection:** The system shall gather performance metrics, such as response times, page loading speeds, and resource utilization, to evaluate the system's behavior under various network conditions.
- **Error Handling and Reporting:** The product should identify and report compatibility and performance-related issues, including any errors that may occur during testing.

2.3 User Classes and Characteristics

Library Patrons

User Characteristics:

- Varied levels of technical expertise, ranging from novice to experienced.
- Diverse educational backgrounds and age groups.
- Frequent users of the library search system.

Privileges: Typically have read-only access to search the library catalog, view item availability, and place requests for materials.

Library Staff and Administrators

User Characteristics:

- Moderate to advanced technical expertise.
- Responsible for system configuration and maintenance.
- Manage library resources and user accounts.

Privileges: Full control over the library search system, including the ability to add, modify, or remove records, grant or restrict access, and configure settings.

Technical Support and IT Personnel

User Characteristics:

- Advanced technical expertise.
- Responsible for troubleshooting and maintaining the library search system's technical infrastructure.

Privileges: Access to system logs, performance monitoring, and debugging capabilities.

System Administrators

User Characteristics:

- Advanced technical expertise.
- Responsible for configuring and maintaining the testing environment for browser compatibility and network connectivity testing.

Privileges: Manage test configurations, set up automated testing, and generate compatibility

reports.

Third-party Developers and Testers

User Characteristics:

- Technical experts in web development and quality assurance.
- May be external contractors or testers hired to conduct compatibility testing.

Privileges: Limited access to the testing environment for conducting compatibility tests.

Compliance Officers and Auditors

User Characteristics:

- Familiar with web accessibility standards and compliance regulations.
- Conduct compliance audits to ensure the library search system meets legal requirements.

Privileges: Access to compliance reports and the authority to recommend or mandate changes for accessibility compliance.

2.4 Operating Environment

Hardware Platform

- The software should be compatible with a range of hardware configurations commonly used by library patrons and administrators. This includes desktop computers, laptops, tablets, and mobile devices.
- Compatibility testing may involve various hardware components like CPUs, RAM, and display resolutions to ensure that the library search system performs optimally across different devices.

Operating System

The software should be compatible with the following operating systems and their respective versions:

- Windows: Windows 10, Windows Server 2016/2019
- macOS: macOS 10.14 (Mojave) and later
- Linux: Ubuntu 18.04 LTS and later, CentOS 7 and later
- Mobile Platforms: iOS 12 and later, Android 9 (Pie) and later.

Web Browsers

The software should support compatibility testing on a range of web browsers:

- Google Chrome
- Mozilla Firefox

- Microsoft Edge
- Apple Safari
- Opera
- Any other browsers commonly used by library patrons

Network Connectivity

The software must be capable of functioning under various network connectivity conditions, such as:

- High-speed broadband connections.
- Low-speed connections, including 3G/4G mobile networks.
- Intermittent connections with occasional disruptions.
- Secure network environments, including VPNs and proxy servers.

Web Server and Database

- The software can interact with database management systems commonly used for library catalog and resource management, such as MySQL, PostgreSQL, or others.
- The software can integrate with web server software for hosting the library search system, like Apache, Nginx, or Microsoft Internet Information Services (IIS).

2.5 Design and Implementation Constraints

The Browser Compatibility Test based on Network Connectivity for the Library Search System project encounters several design and implementation constraints that guide and limit the development process. These constraints encompass:

- **Hardware and Network Limitations:** The testing environment faces constraints related to available hardware resources and network conditions. Hardware limitations include access to a predefined set of testing devices, each with its own memory and processing capabilities. Network limitations require the simulation of slow or unreliable connections, which may be restricted by hardware and software configurations.
- **Interfaces and Integration:** The project's successful execution is dependent on the stability and compatibility of interfaces and integration with the Library Search System . If there are changes or problems with how it connects to these systems, it can cause issues with the testing process.
- **Technologies and Tools:** The project is bound by the technologies and testing tools selected for browser compatibility and network connectivity testing. Compatibility with these tools, including those for cross-browser testing, network simulation, and performance evaluation, is a fundamental constraint.

- **Security Considerations:** Security is a very important constraint. We have to make sure the library Search System stays safe and works correctly during testing. This is especially important when we look for problems that could make it less secure or not work well because of browser and network issues.
- **Language and Communication Protocols:** The testing project is limited by the language and communication protocols used within the Library Search System and the broader institution. Any deviations from these established language and communication protocols may result in various challenges.
- **Design Conventions and Standards:** The project must strictly adhere to some design conventions and programming standards. These standards define coding practices, testing methodologies, and quality benchmarks. Any deviation from these established conventions can introduce inconsistencies and affect the quality of the testing process.

2.6 Assumptions and Dependencies

The success of the Browser Compatibility Test based on Network Connectivity for the Library Search System project relies on a set of assumptions and external dependencies.

- **Availability of Third-Party Components:** The project assumes that third-party or commercial components required for browser compatibility testing, network simulation, and performance evaluation are readily available and compatible with the project's objectives. Any unavailability or compatibility issues may require alternative solutions, potentially impacting the project schedule.
- **Stability of the Development Environment:** It is assumed that the development and testing environments will remain stable throughout the project's lifecycle. Any unexpected changes or disruptions in the development environment could have a significant impact on the testing process.
- **Timely Access to Testing Devices:** The project depends on access to a variety of devices and browsers for compatibility testing. Assumptions include the timely acquisition and availability of these devices for testing purposes. Delays or unavailability of testing devices may affect project timelines.
- **Stability of the Library Search System:** The project assumes that the Library Search System remains stable and does not undergo significant changes or updates during the testing phase. Any major changes to the system could affect the testing process.
- **Availability and Accessibility of External Data Sources:** Assumptions are made regarding the stability and accessibility of external data sources that the Library Search System depends on. The project assumes that these sources will remain accessible during testing. Any disruptions or unavailability of data sources may hinder testing efforts.
- **Reuse of Software Components:** The project may depend on the reuse of software components from other projects or sources. These components are assumed to be available

and compatible for integration. Any unexpected incompatibilities may require additional development effort.

3. External Interface Requirements

3.1 User Interfaces

UI-1: User Interface for Slow Connection Testing:

- The testing team should have access to a user interface that allows them to simulate slow network connections.
 - This interface should provide options to configure different types of slow connections, such as 3G, 4G, or custom-defined network conditions.
 - It allows testers to set parameters for network latency, bandwidth throttling, and other connection characteristics.
 - The user interface also includes control for initiating tests on various browsers and monitoring the results.
- ##### *UI-2: GUI (Graphical User Interface):*
- The graphical user interface is created in a modern and user-friendly manner. It shall adhere to recognized GUI standards. A responsive design guarantees that the interface adapts to different devices and screen sizes, such as desktop computers, tablets, and smartphones.

UI-2: Alternative Browser Access:

- The testing team have access to alternative browsers for cross-browser testing.
 - These browsers can include Mozilla Firefox, Google Chrome, Internet Explorer, Safari, and others, depending on the target browser configurations.
- ##### *UI-4: Keyboard Shortcuts and Help*

UI-3: Proxy and VPN Controls:

- The testing team can enable or disable proxies and VPN connections to test their impact on website access.

UI-4: Firewall Configuration Check:

- The testing team has access to tools or settings to check if a specific website has been added to a firewall block.

3.2 Hardware Interfaces

HI-1: Server Hardware

Dedicated servers with the requisite processing power and memory shall be employed to ensure the system can handle simultaneous user interactions efficiently.

HI-2: Storage Devices

The system will interact with various storage devices, encompassing both primary and backup storage. Data interactions primarily involve read and write operations, ensuring data integrity and availability.

HI-3: Network Connectivity

The software will have robust network connectivity to facilitate communication between software components and external systems. This connectivity encompasses databases, external payment gateways, and communication.

3.3 Software Interfaces

SI-1: Interconnections with Other Software Components

The software interfaces of the present project encompass interconnections with diverse software components and external systems.

SI-1.1: Database Management System (DBMS):

- The system communicates with a relational database (e.g., MySQL version 8.0) to store and retrieve information related to books, users, transactions, and library resources.
- Data items include user account information, book details, availability status, transaction records, and more.
- Data sharing involves querying and updating the database to manage the library's catalog and user accounts.

SI-1.2: Operating System:

- The system runs on a specific operating system (e.g., Linux Ubuntu 20.04) and relies on OS functions for file I/O, process management, and security.
- Data items include configuration files, log files, and temporary storage for user sessions.
- Services like file read/write and process control are needed for system operations.

SI-1.3: Web Services:

- The system is hosted on a web server (e.g., Apache HTTP Server version 2.4) to serve web pages and handle HTTP requests.
- Data items include HTML, CSS, JavaScript files, and web page content.
- The system communicates with the webserver to render web pages and process user requests.

SI-1.4: API's and Libraries:

- The system may utilize third-party APIs and libraries for various functions, such as authentication (e.g., OAuth 2.0) or geolocation services (e.g., Google Maps API).
- Data items include tokens, user information, and geospatial data.
- The system communicates with these external services to enhance its functionality and

provide features like location-based search.

3.4 Communications Interfaces

CI-1: Communication Protocols

- The system employs standard communication protocols (e.g., HTTP/HTTPS) to interact with external services and APIs.
- Data items include HTTP requests and responses, JSON/XML data, and authentication tokens.
- The nature of communication involves making HTTP requests to external APIs and receiving data in response.

CI-2: Integrated Commercial Components

- The system may integrate with commercial components, such as a payment gateway (e.g., PayPal) for handling fines and payments for library services.
- Data items include payment details, transaction records, and receipts.
- Communication with these components is necessary to process financial transactions securely.

CI-3: Inter-Module Data Sharing

- Within the system, different modules, such as the user management module, search module, and transaction module, share data.
- Data items include user preferences, search queries, and transaction information.
- Data sharing mechanisms are typically implemented through well-defined APIs and internal data structures.

To ensure proper integration and data sharing across these software components, adherence to established protocols, standards, and API documentation is critical. Implementation constraints, if any, should be documented to ensure data consistency and system reliability. Additionally, documentation of these interfaces is essential for system maintenance and future enhancements.

4. System Features

4.1 System Feature- Partial Loading under Slow Connection

4.1.1 Description and Priority

This requirement ensures that when users access the Library Search System with a slow network connection, the system loads partially. It aims to provide a basic interface even under slow network conditions, displaying essential components like the search bar and main navigation.

Priority: High

4.1.2 Stimulus/Response Sequences

Stimulus: User accesses the system with a slow network connection.

Response: The system should load partially, displaying essential components like the search bar and main navigation.

4.1.3 Functional Requirements

REQ-1: The system should load partially when accessed under a slow network connection.

REQ-2: The partial loading should provide a basic interface for users even under slow network conditions, displaying essential components such as the search bar and main navigation.

4.2 System Feature-2: Full Rendering on Slow Connection

4.2.1 Description and Priority

This requirement focuses on rendering the complete Library Search System even under slow network conditions. It is essential to maintain core functionality and ensure that users can access resources and perform searches.

Priority: High

4.2.2 Stimulus/Response Sequences

Stimulus: User accesses the system with a slow network connection.

Response: The system should render the complete Library Search System, maintaining core functionality.

4.2.3 Functional Requirements

REQ-3: The system should ensure that the complete Library Search System is rendered, even when accessed under slow network conditions.

REQ-4: The rendering should maintain the core functionality of the system, allowing users to search for and access resources.

4.3 System Feature-3: Handling Missing Elements on Slow Connection

4.3.1 Description and Priority

This requirement specifies that the system should avoid missing critical elements, such as search results, navigation menus, and resource details, during rendering under slow connectivity.

If any elements are temporarily missing, the system should load and display them promptly.

Priority: High

4.3.2 Stimulus/Response Sequences

Stimulus: User accesses the system with a slow network connection.

Response: The system should avoid missing critical elements during rendering and load any missing elements promptly as the connection improves.

4.3.3 Functional Requirements

REQ-5: The system should avoid missing critical elements, such as search results, navigation menus, and resource details, when rendering on a slow connection.

REQ-6: If any elements are temporarily missing during rendering due to slow connectivity, the system should load and display them promptly once the connection improves.

4.4 System Feature-4: ISP Speed Impact on Rendering

4.4.1 Description and Priority

Description: This requirement emphasizes the system's ability to adapt to varying ISP speeds. It ensures that rendering of web pages remains consistent and is not significantly degraded based on network performance. The system should also optimize resource loading to mitigate the impact of slow ISP speeds.

Priority: High

4.4.2 Stimulus/Response Sequences

Stimulus: Vary the ISP speed.

Response: The system should adapt to varying ISP speeds to ensure consistent rendering and optimize resource loading.

4.4.3 Functional Requirements

REQ-7: The system should adapt to varying ISP speeds to ensure that the rendering of web pages remains consistent and does not significantly degrade based on network performance.

REQ-8: The system should optimize resource loading and content delivery to mitigate the impact of slow ISP speeds.

4.5 System Feature-5: Browser Responsiveness to Slow Connection

4.5.1 Description and Priority

This requirement focuses on user experience when accessing the system with a slow network connection. It specifies that the system should be designed to be responsive, acknowledging user interactions and providing feedback during loading.

Priority: High⁴

4.5.2 Stimulus/Response Sequences

Stimulus: User accesses the system with a slow network connection.

Response: The system should be responsive, acknowledging user interactions and providing feedback during loading.

4.5.3 Functional Requirements

REQ-9: The system should be designed to be responsive and provide a smooth user experience even under slow network conditions.

REQ-10 User interactions, such as search queries and navigation, should be acknowledged promptly, and the system should provide feedback to users while loading.

4.6 System Feature-6: Cross-Browser Compatibility

4.6.1 Description and Priority

Cross-browser compatibility is crucial for ensuring the system works consistently across different web browsers, such as Mozilla Firefox, Google Chrome, Internet Explorer, Safari, and others. The system should render correctly and maintain functionality in various browser configurations.

Priority: High

4.6.2 Stimulus/Response Sequences

Stimulus: Users access the system with various browsers (e.g., Mozilla Firefox, Google Chrome, Internet Explorer, Safari).

Response: The system should render consistently and correctly in different browser configurations.

4.6.3 Functional Requirements

REQ-11: The Library Search System should be thoroughly tested and optimized to ensure compatibility with different web browsers, including Mozilla Firefox, Google Chrome, Internet Explorer, Safari, and others.

REQ-12: It should render consistently and correctly in various browser configurations.

4.7 System Feature-7: Proxy and VPN Handling

4.7.1 Description and Priority

This requirement addresses the system's ability to operate reliably when users access it with or without proxy or VPN services enabled. It ensures that the system is not negatively affected by the use of proxy or VPN services and provides users with consistent performance.

Priority: High

4.7.2 Stimulus/Response Sequences

Stimulus: Users access the system both with and without proxy or VPN services enabled.
Response: The system should operate reliably under both conditions and not be negatively affected by proxy or VPN services.

4.7.3 Functional Requirements

REQ-13: The system should operate reliably when users access it both with and without proxy or VPN services enabled.
REQ-14: It should not be negatively affected by proxy or VPN services, and users should experience consistent performance.

4.8 System Feature-8: Firewall Block Checking

4.8.1 Description and Priority

This requirement highlights the need for the system to proactively check for potential firewall blocks. If the system is blocked by a firewall, it should notify the user and provide suggestions for resolving the issue.

Priority: High

4.8.2 Stimulus/Response Sequences

Stimulus: The system should proactively check for potential firewall blocks.
Response: If blocked by a firewall, the system should notify the user and suggest solutions.

4.8.3 Functional Requirements

REQ-15: The system should proactively check and verify if it has been added to any firewall blocklist.
REQ-16: It should provide a notification or alert to the user if the system is blocked by a firewall, suggesting potential solutions or actions.

5. Other Nonfunctional Requirements

5.1 Performance Requirements

The Library Search System must meet the following performance requirements:

Response Time: The system should respond to user queries within 2 seconds under normal network conditions to ensure a smooth user experience.

Search Latency: Search results must be displayed to the user within 5 seconds, even under heavy concurrent usage.

Scalability: The system should be able to handle a minimum of 500 concurrent users without

performance degradation.

Data Retrieval: Data retrieval from the database should not take more than 1 second.

5.2 Safety Requirements

Safety requirements for the Library Search System include:

Data Protection: The system must adhere to data protection laws and regulations to ensure the privacy and security of user data.

Backup and Recovery: The system should have regular automated backup and recovery processes to prevent data loss in case of system failures.

User Authentication: Strong user authentication measures must be in place to prevent unauthorized access to sensitive data.

5.3 Security Requirements

Security requirements include:

User Data Security: All user data must be encrypted during transmission and storage to prevent unauthorized access.

Authorization: Access to certain parts of the system should be role-based and require proper authorization.

Logging: The system should maintain detailed logs of all user actions and system events for security auditing.

Compliance: The system must comply with industry-standard security certifications such as ISO 27001.

5.4 Software Quality Attributes

Maintainability: The Codebase must be well-documented and follow best practices to ensure ease of maintenance and future enhancements.

Usability: The system should provide an intuitive and user-friendly interface, with a user satisfaction score of at least 90% in user surveys.

Interoperability: The system should be able to integrate with external systems, such as library databases and user management systems.

Reliability: The system should have an uptime of at least 99.9% to ensure 24/7 availability.

Robustness: The system should gracefully handle unexpected errors and prevent data corruption.

5.5 Business Rules

The Library Search System adheres to the following business rules:

User Roles: Only registered library users are allowed to borrow books. Librarians have the authority to approve new user registrations.

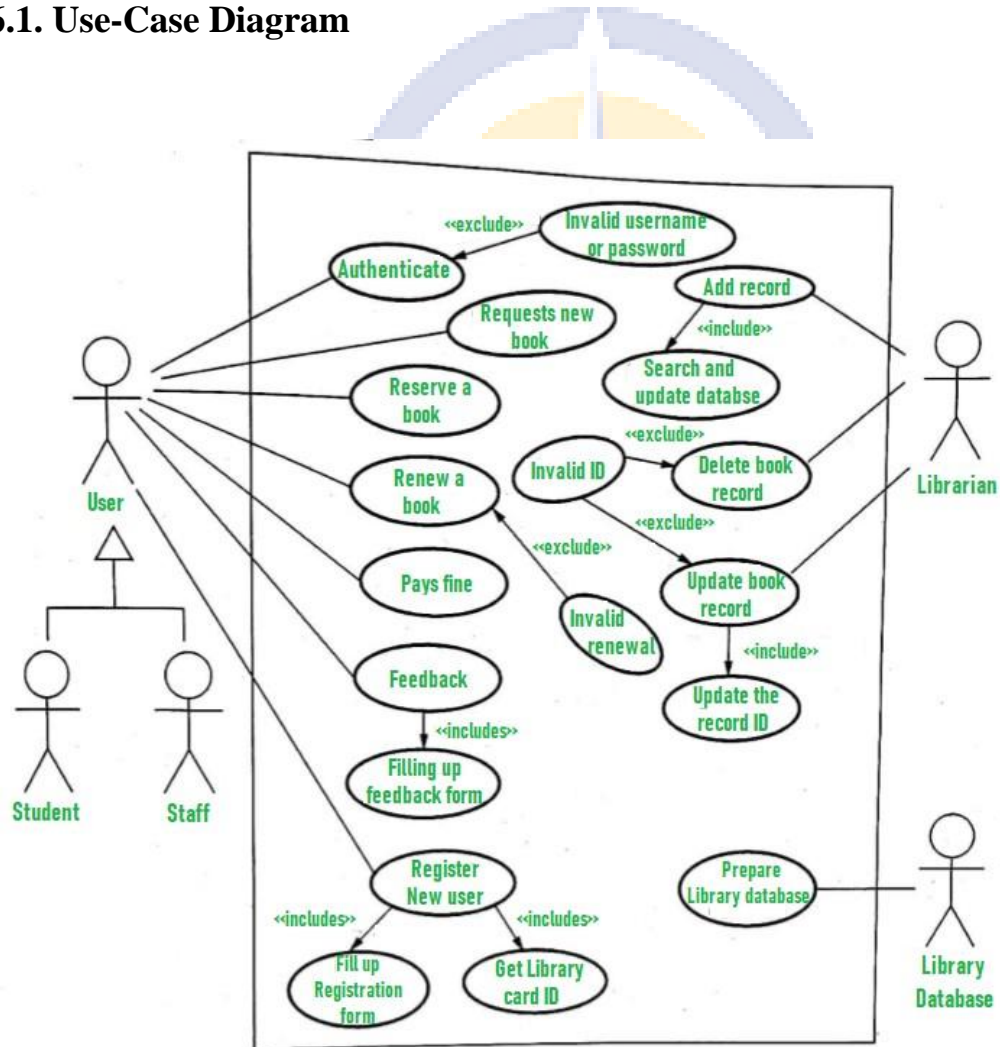
Borrowing Limits: Users can borrow a maximum of 2 books at a time, and the loan period is 14

days.

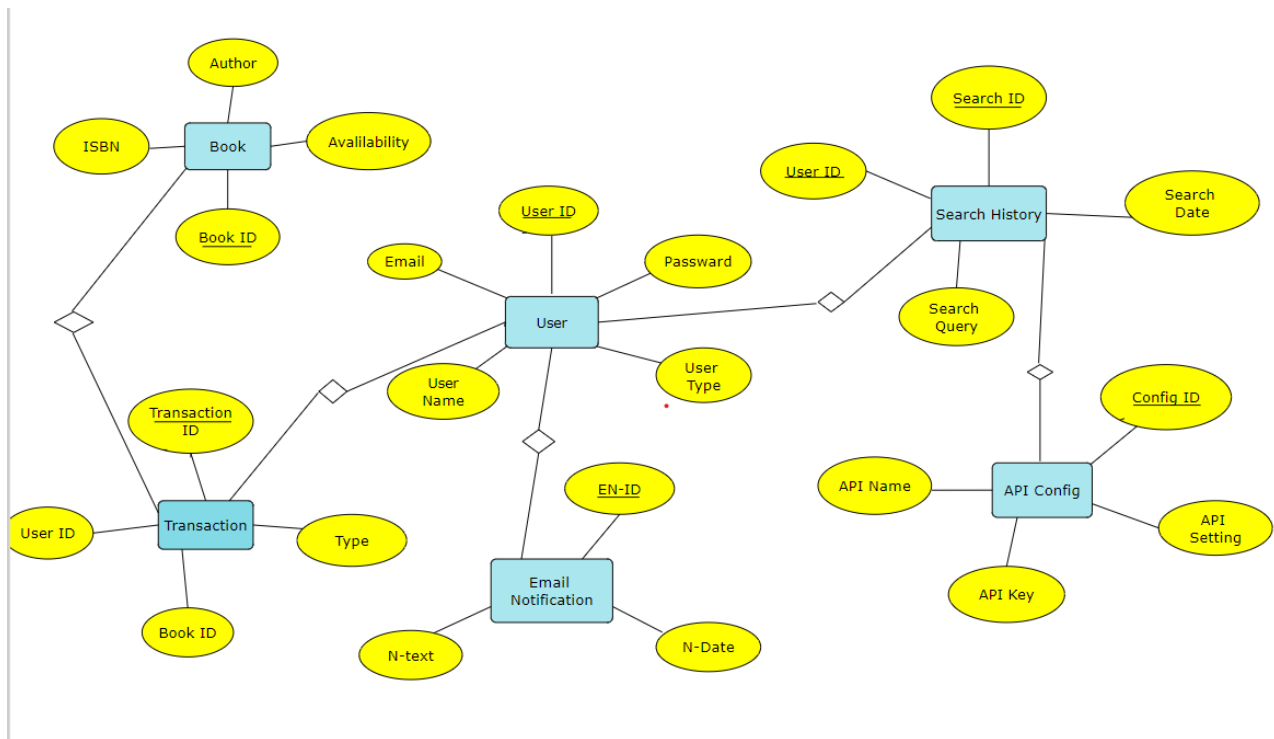
Fines: Users will incur fines for returning books late, with a fine rate of 5/- per day.

6. Model Analysis

6.1. Use-Case Diagram



6.2 ER – Diagram



7. Other Requirements (not done)

Database Requirements: The system should efficiently retrieve and display data from the database even under slow network conditions. The database should be capable of handling concurrent requests from different browsers and configurations.

Internationalization Requirements: The system should support multiple languages and character sets to accommodate a diverse user base. Date and time formats should be adaptable to the preferences of different regions and locales.

Legal Requirements: The system should adhere to all relevant legal and regulatory requirements, including data privacy and copyright laws. Accessibility standards and guidelines, if applicable, should be followed to ensure compliance with disability and accessibility laws.

Reuse Objectives: The project should aim to identify and document reusable components, scripts, or code that can enhance the efficiency of future testing activities. Create a knowledge repository for testing scenarios and solutions to support future testing efforts.

Appendix A: Glossary

Browser Compatibility: The ability of a web application or system to perform consistently and as intended across various web browsers and their different versions.

Network Connectivity: The state or quality of a network connection, which may vary in terms of speed, reliability, and performance.

Website Loading: The process of retrieving and displaying a web page or website in a user's web browser.

Partial Loading: The condition where only a portion of a web page or website is loaded and displayed in the user's browser, typically due to slow network conditions.

Rendering: The process of displaying the content and layout of a web page or website in a user's web browser.

Slow Connection: A network connection with limited bandwidth, resulting in slower data transfer speeds.

Important Elements: Key components or content on a web page that are essential for its functionality or user experience.

ISP Speed: The speed and quality of an Internet Service Provider's network connection, which can affect the performance of web applications.

Browser Responsiveness: The ability of a web browser to react to user interactions and provide feedback even when the network connection is slow.

Alternative Browsers: Different web browsers, other than the primary browser, used to access a website for testing and compatibility purposes.

Proxies: Intermediate servers that act as intermediaries between a user's device and the web, often used for privacy or security reasons.

VPN (Virtual Private Network): A technology that allows users to establish a secure connection to a private network over the Internet.

Cross-Browser Testing: The process of testing a web application or system to ensure it works correctly and consistently across various web browsers and configurations.

Mozilla Firefox, Google Chrome, Internet Explorer, Safari: Examples of popular web browsers that may be used in cross-browser testing to ensure compatibility.

Firewall Block: A security measure that prevents specific websites or services from being accessed through a network firewall.

Appendix B: Field Layouts for Browser Compatibility Test

Field Name	Lenght	Data Type	Description	Is Mandatory
Test Scenario	N/A	N/A	Description of the specific test scenario being performed	Yes
Partial Loading	N/A	N/A	Check if the website loads partially under a slow connection.	Yes
Full Rendering	N/A	N/A	Check if the website is rendered at all on a slow connection.	N/A
Missing Elements	N/A	N/A	Check if the website misses important elements while completely rendering on a slow connection.	N/A
ISP Speed Impact	N/A	N/A	Check if the ISP speed affects the rendering of the page across the browser.	Yes
Browser Responsiveness	N/A	N/A	Check if the browser responds well to a slow connection.	N/A
Alternative Browsers	N/A	N/A	Use alternative browsers to access the website.	Yes
Disable Proxies/VPN	N/A	N/A	Disable proxies or VPN and try to access the website.	Yes
Enable Proxies Extensions	N/A	N/A	Enable proxy extensions and try to access the website.	Yes
Cross-Browser Testing	N/A	N/A	Cross-browser testing allows ensuring the correct work of	Yes

			the app in different browser configurations: Mozilla Firefox, Google Chrome, Internet Explorer, Safari, etc.	
Firewall Block Check	N/A	N/A	Check if any specific website has been added to the firewall block.	Yes

