

Non-Functional Requirements Document

Library Book Loan System

Document Information

- **Document Version:** 1.0
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 - **Project:** Library Book Loan Automation System
 - **Status:** Draft
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1. Executive Summary

This document defines the non-functional requirements for the Library Book Loan System, specifying quality attributes, performance criteria, and operational constraints that the system must satisfy.

2. Performance Requirements

2.1 Response Time (NFR-001)

- **Book Availability Check:** Response time ≤ 2 seconds
- **Membership Validation:** Response time ≤ 1 second
- **Fine Calculation:** Response time ≤ 3 seconds
- **Complete Loan Process:** End-to-end processing ≤ 10 seconds
- **Payment Processing:** Transaction completion ≤ 30 seconds

2.2 Throughput (NFR-002)

- **Concurrent Users:** Support minimum 50 concurrent loan transactions
- **Peak Load:** Handle 200 loan requests per hour during peak times
- **Database Queries:** Process 1000 queries per minute
- **Batch Operations:** Process 10,000 records per hour for bulk operations

2.3 Capacity (NFR-003)

- **Book Records:** Support minimum 100,000 book records
- **Member Records:** Support minimum 50,000 active members
- **Transaction History:** Maintain 5 years of loan history

- **Fine Records:** Store unlimited fine transaction history
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3. Availability Requirements

3.1 System Availability (NFR-004)

- **Uptime:** 99.5% availability during library operating hours
- **Downtime:** Planned maintenance window 2 hours/week outside operating hours
- **Recovery Time:** System recovery within 15 minutes of failure
- **Backup Systems:** Automatic failover to backup systems within 5 minutes

3.2 Business Continuity (NFR-005)

- **Offline Mode:** Basic loan processing capability during network outages
 - **Data Synchronization:** Auto-sync when connectivity is restored
 - **Manual Override:** Staff capability to process emergency loans manually
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4. Reliability Requirements

4.1 System Reliability (NFR-006)

- **Error Rate:** Less than 0.1% transaction failure rate
- **Data Integrity:** 100% accuracy in inventory and fine calculations
- **Transaction Consistency:** All loan transactions must be atomic
- **Fault Tolerance:** System continues operating with single component failure

4.2 Data Reliability (NFR-007)

- **Data Backup:** Daily automated backups with 30-day retention
 - **Data Recovery:** Point-in-time recovery capability
 - **Corruption Detection:** Automatic data integrity checks
 - **Audit Trail:** Complete transaction logging for all operations
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5. Security Requirements

5.1 Authentication & Authorization (NFR-008)

- **User Authentication:** Multi-factor authentication for staff accounts
- **Member Authentication:** Secure member ID verification

- **Role-Based Access:** Different permission levels for staff roles
- **Session Management:** Automatic session timeout after 30 minutes inactivity

5.2 Data Security (NFR-009)

- **Data Encryption:** AES-256 encryption for sensitive data at rest
- **Transmission Security:** TLS 1.3 for all data in transit
- **PII Protection:** Compliance with data protection regulations
- **Payment Security:** PCI DSS compliance for payment processing

5.3 Access Control (NFR-010)

- **Network Security:** Firewall protection and intrusion detection
 - **Database Access:** Encrypted database connections only
 - **API Security:** OAuth 2.0 authentication for API access
 - **Audit Logging:** Complete logging of all security events
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6. Usability Requirements

6.1 User Interface (NFR-011)

- **Response Time:** UI response within 1 second for all actions
- **Learning Curve:** New staff productive within 2 hours of training
- **Error Messages:** Clear, actionable error messages in plain language
- **Navigation:** Intuitive navigation with maximum 3 clicks to any function

6.2 Accessibility (NFR-012)

- **Standards Compliance:** WCAG 2.1 AA accessibility standards
- **Screen Reader:** Full compatibility with screen reading software
- **Keyboard Navigation:** Complete keyboard navigation support
- **Visual Impairment:** High contrast mode and font size adjustment

6.3 User Experience (NFR-013)

- **Workflow Efficiency:** Streamlined loan process with minimal steps
- **Visual Feedback:** Clear status indicators for all operations
- **Help System:** Context-sensitive help and user documentation
- **Mobile Responsiveness:** Responsive design for tablet and mobile devices

7. Scalability Requirements

7.1 Horizontal Scalability (NFR-014)

- **Load Balancing:** Support for multiple application servers
- **Database Scaling:** Read replicas for improved query performance
- **Caching:** Distributed caching for frequently accessed data
- **Microservices:** Modular architecture for independent scaling

7.2 Vertical Scalability (NFR-015)

- **Resource Utilization:** Efficient CPU and memory usage
 - **Database Performance:** Optimized queries and indexing
 - **Storage Scaling:** Automatic storage expansion capability
 - **Performance Monitoring:** Real-time performance metrics and alerts
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8. Compatibility Requirements

8.1 System Integration (NFR-016)

- **Legacy Systems:** Integration with existing library management systems
- **Database Compatibility:** Support for multiple database platforms
- **API Standards:** RESTful API design following OpenAPI specifications
- **Third-Party Integration:** Compatible with common payment gateways

8.2 Platform Compatibility (NFR-017)

- **Operating Systems:** Support for Windows, Linux, and macOS
 - **Web Browsers:** Compatible with Chrome, Firefox, Safari, Edge
 - **Mobile Platforms:** iOS and Android app support
 - **Database Systems:** MySQL, PostgreSQL, Oracle compatibility
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9. Maintainability Requirements

9.1 Code Quality (NFR-018)

- **Code Standards:** Adherence to established coding standards
- **Documentation:** Comprehensive technical documentation

- **Testing:** 90% code coverage with automated tests
- **Version Control:** Git-based version control with branching strategy

9.2 Operational Maintenance (NFR-019)

- **Logging:** Comprehensive application and system logging
 - **Monitoring:** Real-time system health monitoring
 - **Deployment:** Automated deployment and rollback capabilities
 - **Configuration:** Externalized configuration management
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10. Compliance Requirements

10.1 Regulatory Compliance (NFR-020)

- **Data Protection:** GDPR compliance for member data handling
- **Financial Regulations:** Compliance with payment processing regulations
- **Library Standards:** Adherence to library industry standards
- **Accessibility Laws:** Compliance with disability access requirements

10.2 Industry Standards (NFR-021)

- **ISO 27001:** Information security management standards
 - **ISO 9001:** Quality management system standards
 - **MARC Standards:** Bibliographic data format compliance
 - **Dublin Core:** Metadata standards for digital resources
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11. Environmental Requirements

11.1 Operating Environment (NFR-022)

- **Hardware Requirements:** Minimum server specifications defined
- **Network Requirements:** Bandwidth and latency specifications
- **Power Requirements:** Uninterrupted power supply considerations
- **Climate Control:** Server room environmental requirements

11.2 Deployment Environment (NFR-023)

- **Development Environment:** Separate dev, test, and production environments
- **Cloud Deployment:** Support for cloud-based deployment options

- **Containerization:** Docker container support for deployment
 - **Load Testing:** Environment for performance testing
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12. Legal Requirements

12.1 Intellectual Property (NFR-024)

- **Copyright Protection:** Respect for copyrighted material handling
- **Software Licensing:** Compliance with open source licenses
- **Patent Compliance:** Avoidance of patent infringement
- **Trade Secrets:** Protection of proprietary algorithms

12.2 Liability (NFR-025)

- **Data Breach:** Procedures for data breach notification
 - **System Failure:** Liability limitations for system downtime
 - **User Data:** Clear terms for user data handling
 - **Service Level:** Defined service level agreements
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13. Quality Assurance

13.1 Testing Requirements (NFR-026)

- **Unit Testing:** 90% code coverage requirement
- **Integration Testing:** All system interfaces tested
- **Performance Testing:** Load and stress testing before deployment
- **Security Testing:** Penetration testing and vulnerability assessment

13.2 Quality Metrics (NFR-027)

- **Bug Density:** Less than 1 bug per 1000 lines of code
 - **Customer Satisfaction:** 90% user satisfaction rating
 - **System Reliability:** 99.9% transaction success rate
 - **Performance Benchmarks:** All performance requirements met
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14. Requirements Traceability

Each non-functional requirement is mapped to:

- Business objectives
 - Functional requirements
 - Test cases
 - Acceptance criteria
 - Risk assessments
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This document ensures the Library Book Loan System meets quality, performance, and operational requirements beyond basic functionality.