

Software Requirements Specification (SRS) Template

Project: Smart URL Shortener with QR, Link Safety and Health Check

Version: 1.0

Authors:

N Aneesh Dutt (PES1UG23CS371)

Nagarjun N (PES1UG23CS375)

Nishant Holla (PES1UG23CS401)

Pranav Hemanth (PES1UG23CS433)

Date: 1-09-2025

Status: Model Answer / Approved

Revision history

Version	Date	Author	Change summary	Approval
1.0	18-08-2025	Instructor	SRS with diagrams embedded	

Approvals

Role	Name	Signature / Email	Date
Course Coordinator			

Table of Contents

1. Introduction
2. Overall description
3. External interfaces
4. System features (detailed)
5. Non-functional requirements (detailed)
6. Quality attributes & Acceptance tests
7. UML Use-Case Diagram
8. Requirements Traceability Matrix (RTM)

1. Introduction

1.1 Purpose

This document specifies requirements for a URL shortener platform enhanced with real-time health checking, malicious link detection, and QR code generation. It defines functional and non-functional requirements, external interfaces, and security constraints.

1.2 Scope

- The system allows users to:
- Shorten URLs for ease of sharing.
- Generate QR codes for shortened URLs.
- Automatically verify URL availability (health checks).
- Check for malicious or phishing content before shortening.

1.3 Audience

Developers, QA Engineers, System Integrators, Maintenance Technicians, and Assessment Evaluators.

1.4 Definitions

- **URL** Uniform Resource Locator
- **QR Code** Quick Response Code
- **API** Application Programming Interface
- **NFR** Non-Functional Requirement
- **FR** Functional Requirement

2. Overall description

2.1 Product perspective

The system is a web application and REST API with a database backend. It provides short links and QR codes, while integrating with security APIs (e.g., Google Safe Browsing) for malicious link checks.

2.2 Major product functions (detailed)

- Shorten long URLs.
- Expand short URLs back to the original URL.
- Generate QR codes for shortened URLs.
- Perform automated health checks (HTTP response codes, uptime).
- Detect and block malicious/phishing links.
- User authentication and management.

2.3 User roles and characteristics (expanded)

- **Guest User:** Can shorten URLs and generate QR codes anonymously (with limited features).
- **Registered User:** Full access, analytics dashboard, URL management.
- **Administrator:** Manages users, oversees blacklist, reviews flagged URLs.

2.4 Operating environment

- Web browser (latest Chrome/Firefox/Edge).
- REST API (JSON over HTTPS).
- Backend: Linux-based server with relational (PostgreSQL/MySQL) or NoSQL database.

2.5 Constraints

- Must use HTTPS with TLS 1.2+.
- Free tier supports up to 1000 URLs per user.
- Response latency must be <500 ms under normal load.

3. External interface requirements

3.1 User interfaces

- Responsive web portal for URL input, QR preview, analytics dashboard.
- REST API for developers (documented with OpenAPI/Swagger).

3.2 Hardware interfaces

No dedicated hardware dependency, only standard web/mobile devices.

3.3 Software interfaces

Database Backend(SQL/NoSQL).

Optional integration with external malware databases.

3.4 Communications

- Enforced HTTPS (TLS 1.2+).
- RESTful JSON APIs.
- QR codes downloadable as PNG/SVG.

4. System features

Each requirement below includes acceptance criteria and a reference test case.
15 FRs are listed (IDs: URL-F-001 ... URL-F-015) below.

4.1 URL Shortening & Expansion

Req ID	Requirement	Type	Priority	Source/Stakeholder	Acceptance criteria / Test case ref	Comments / Dependencies
URL-F-001	The system shall shorten valid URLs into unique short links.	Functional	High	Customer	AC-URL-F-001: Valid shortened URL Test: TC-Func-01	Core API
URL-F-002	The system shall expand a short link back to its original URL.	Functional	High	Customer	AC-URL-F-002: Shortened URL redirects to the correct website. Test: TC-Func-02	Core API
URL-F-003	The system shall prevent duplicate short links for the same URL if user opts for canonical mapping.	Functional	High	Customer	AC-URL-F-003: System rejects duplicate short links for the same URL Test: TC-Func-03	Core API

4.2 QR Code Generation

Req ID	Requirement	Type	Priority	Source/Stakeholder	Acceptance criteria / Test case ref	Comments / Dependencies
URL-F-004	The system shall generate QR codes for shortened URLs.	Functional	High	Customer	AC-URL-F-010: System generates a valid QR Code that contains its URL Test: TC-QR-01	Core API check required

URL-F-005	The system shall allow users to download QR codes in PNG/SVG format.	Functional	High	Customers	AC-URL-F-011: The system displays the QR code that can be downloaded as PNG or SVG Test: TC-QR-02	Core UI
-----------	--	------------	------	-----------	---	---------

4.3 URL Health Checking

Req ID	Requirement	Type	Priority	Source/Stakeholder	Acceptance criteria / Test case ref	Comments / Dependencies
URL-F-006	The system shall perform a health check (HTTP status 200 OK) before accepting a URL.	Functional	Medium	Customer	AC-URL-F-001: The system visits the URL and checks the status code it returns. Test: TC-Health-01	Support API
URL-F-007	The system shall periodically recheck health status of stored URLs.	Functional	Low	Customer	AC-URL-F-002: The system rechecks the health of the URLs periodically. Test: TC-Health-02	Audit review required

URL-F-008	The system shall display health status (Healthy, Broken, Unknown) in user dashboard.	Functional	High	Security	AC-URL-F-003: Test: TC-Auth-03	Support UI
-----------	--	------------	------	----------	--------------------------------	------------

4.4 Malicious Link Detection

Req ID	Requirement	Type	Priority	Source/Stakeholder	Acceptance criteria / Test case ref	Comments / Dependencies
URL-F-009	The system shall check submitted URLs against a blacklist/malware database.	Functional	High	Customer	AC-URL-F-009: When a URL is submitted, it is validated against known malicious databases. Test: TC-SEC-01	Requires integration with external APIs (Google Safe Browsing / VirusTotal)
URL-F-010	The system shall block shortening of malicious or phishing URLs.	Functional	High	Customer	AC-URL-F-010: Malicious URLs are rejected, with user notified of reason. Test: TC-SEC-02	Depends on blacklist/malware detection module

URL-F-011	The system shall log all blocked attempts with reason..	Functional	High	Security	AC-URL-F-011: Every blocked attempt is recorded in the audit log with reason. Test: TC-SEC-03	Requires secure logging mechanism + admin access for review
-----------	---	------------	------	----------	--	---

4.5 Analytics & Management

Req ID	Requirement	Type	Priority	Source/Stakeholder	Acceptance criteria / Test case ref	Comments / Dependencies
URL-F-012	The system shall track number of clicks on each short URL.	Functional	High	Customer	AC-URL-F-012: Each short URL's click count is incremented on access. Test: TC-AN-01	Requires database logging of click events
URL-F-013	The system shall provide analytics dashboard (click count, referrer, timestamp)..	Functional	High	Customer	AC-URL-F-013: Dashboard displays click count, referrer, and timestamps for each URL. Test: TC-AN-02	Depends on analytics module + DB schema

URL-F-014	The system shall allow registered users to delete their URLs.	Functional	High	Security	AC-URL-F-014: Deleted URL becomes inaccessible, confirmed by DB check. Test: TC-MGMT-01	Requires authentication + ownership check
URL-F-015	The system shall provide admin with a blacklist management panel.	Functional	High	Security/Admin	AC-URL-F-015: Admin can view, add, or remove blacklisted URLs. Test: TC-ADMIN-01	Depends on admin authentication & role-based access

5. Non-functional requirements (detailed)

NFRs below are measurable and tied to test plans. IDs URL-NF-####.

Req ID	Requirement	Category	Priority	Acceptance criteria / Measurement
URL-NF-001	The system shall respond to API requests in ≤500 ms for 95% of requests.	Performance	High	90th percentile ≤ 5s in production-like test. Test: TC-Perf-01
URL-NF-002	The system shall support up to 100,000 URLs and 10,000 daily requests.	Reliability	High	Uptime reports show ≥99.9% per month. Test: Ops reports.

URL-NF-003	The system shall maintain 99.9% uptime monthly	Security/Compliance	High	PCI-DSS audit checklist pass. Test: TC-Sec-01
URL-NF-004	The system shall use TLS 1.2+ and encrypt passwords with bcrypt.	Audit/Data Retention	High	Automated archival and retrieval verified. Test: TC-OPS-01
URL-NF-005	The web interface shall follow WCAG 2.1 AA accessibility guidelines.	Usability/Accessibility	Medium	Accessibility audit pass. Test: TC-UX-01

5.1. Security

5.1.1 Security Objectives

Ensure shortened URLs cannot redirect users to known malicious or phishing content.

Ensure confidentiality and integrity of user data through encryption and authentication.

5.1.2 Security Requirements

Req ID	Requirement (shall...)	Type	Priority	Acceptance criteria / Test case ref
URL-SR-001	All communications shall be secured with TLS 1.2+..	Security	High	AC-SR-001: All API/web requests succeed only via HTTPS. Test: TC-Sec-01

URL-SR-002	User passwords shall be hashed and salted (bcrypt/argon2)	Security	High	AC-SR-002: Database inspection shows no plaintext passwords. Test: TC-Sec-02
URL-SR-003	The system shall implement rate limiting to prevent brute-force attacks.	Security	High	AC-SR-003: >5 failed login attempts triggers temporary block. Test: TC-Sec-03
URL-SR-004	The system shall store an audit trail of all admin actions.	Security	Medium	AC-SR-004: Admin actions (create/delete blacklist, user mgmt) appear in audit logs. Test: TC-Sec-04
URL-SR-005	The system shall sanitize all URL inputs to prevent XSS/SQL injection.	Security	High	AC-SR-005: Malicious input payloads rejected; system not compromised. Test: TC-Sec-05

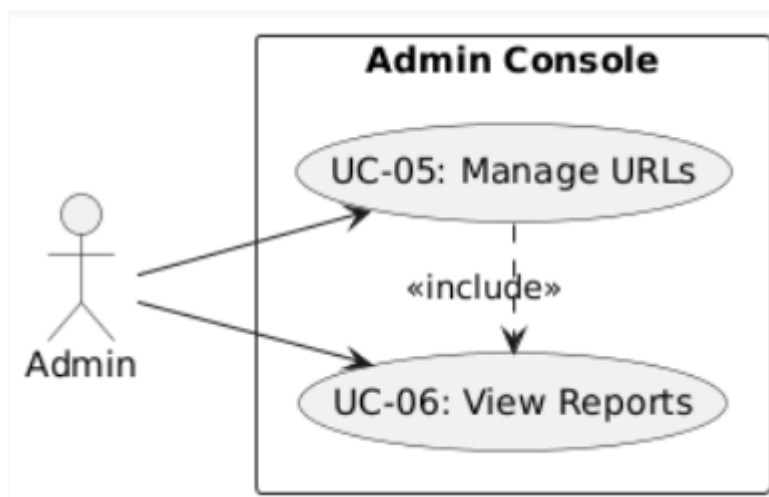
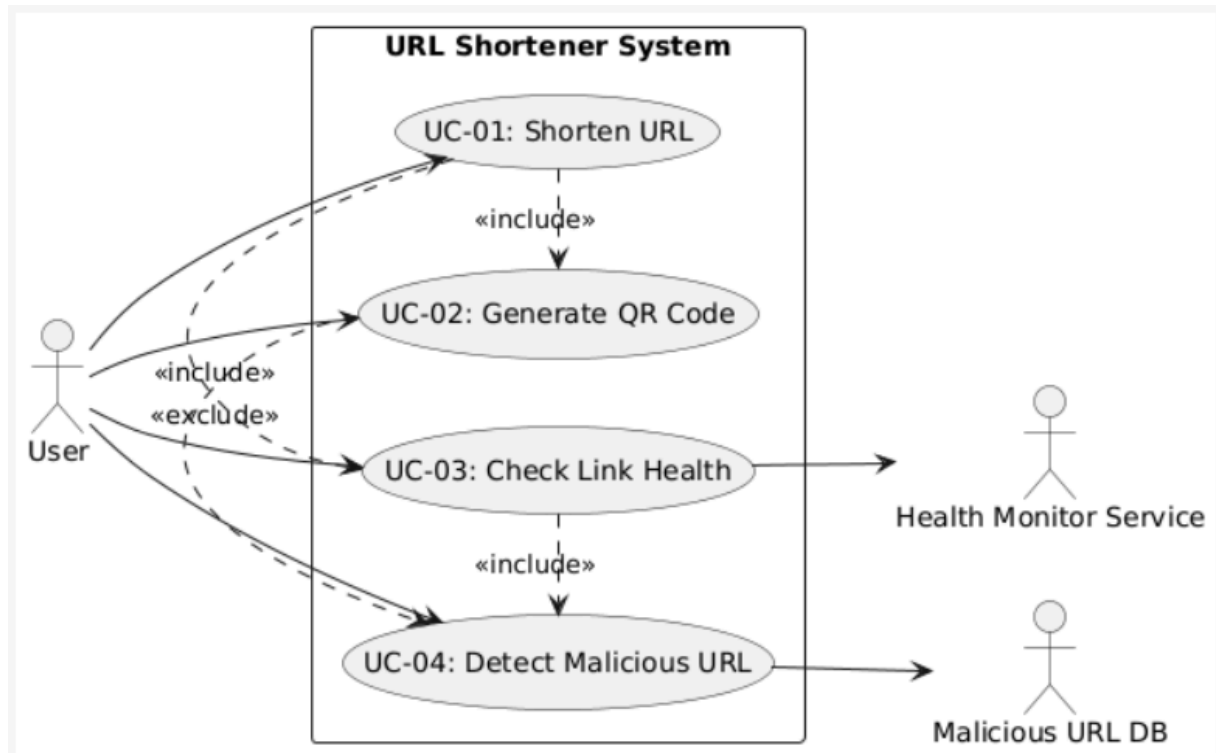
6. Quality attributes & Acceptance tests

- All FRs implemented and tested with 100% pass rate.
- No broken/malicious URLs bypass detection.
- Performance test confirms ≤ 500 ms latency.
- Usability test confirms compliance with accessibility guidelines.

7. System models and diagrams

7.1 UML Use-Case diagram

At least 2 UML use case diagrams to be created.



8. Requirements Traceability Matrix (RTM)

Req ID	Requirement short	Section ref / Design Spec	Module	Test case(s)	Status (N/P/A)	Comments
URL-F-001	Shorten URL	4.1	ShortenerModule	TC-SH-01	N	Depends on DB for mapping

						original to short URL
URL-F-006	Health check URLs	4.3	HealthCheckModule	TC-HC-01, HC-02	N	Requires integration with HTTP response monitoring
URL-F-009	Malicious link detection	4.4	SecurityModule	TC-SEC-01	N	Relies on external APIs (Google Safe Browsing / VirusTotal)
URL-F-012	Analytics (click tracking)	4.5	AnalyticsModule	TC-AN-01, AN-02	N	Needs timestamp, referrer logging in DB
URL-NF-001	Response time ≤ 500 ms	5	API Gateway	TC-Perf-01	N	Subject to server load; benchmark testing required
URL-SR-003	Brute-force prevention	5.1	SecurityModule	TC-SEC-04	N	Implemented via rate limiting and account lockout