# Universal Software-Driven Constraint Tracking Form

**Purpose**

This document captures software-driven constraints for the Lexora project. These constraints originate from:  
• Architectural decisions (Flask backend, JSON database, single-user design)  
• Performance targets (AI response time, TTS generation limits)  
• Technology limitations (OpenAI API rate limits, local storage constraints)  
• Interface restrictions (web-based, responsive design requirements)  
• Resource management (daily podcast generation limits)  
  
Traceability to IEEE 29148 (SRS), W3C Web Standards, OpenAI API Guidelines, OWASP Security Practices, and Flask development best practices is maintained.

**Constraint Tracking Table**

| **Constraint ID** | **Category** | **Constraint Description** | **Design Rationale** | **Owner** | **Impacted Requirements** | **Domain Application(s)** | **Impacted Components** | **Associated Standard(s)** | **Verification Method** | **Risk Impact** | **Status** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SWC-01** | API Limit | OpenAI API rate limit: ~500 requests/day (free tier estimate) | Cost management and free tier usage restrictions | Backend Lead (Gülsüm) | FR-1, FR-2, FR-3 | Backend, AI Integration | AI Meaning Service, Synonyms API, Examples Generator | OpenAI API Guidelines, IEEE 29148 | API Rate Monitoring, Error Handling Test | High | Active |
| **SWC-02** | Performance | AI response time target: < 3 seconds per word query | User experience requirement for real-time learning feedback | AI Integration (Ozan) | FR-1, FR-2, FR-3, Implicit NFR | Backend API, Frontend | Dictionary API endpoints, Loading UI | Web Performance Best Practices, IEEE 29148 | Performance Testing, Load Time Analysis | Medium | Active |
| **SWC-03** | Storage | JSON database max practical size: ~10MB (~5,000 words) | Local JSON file limitations for single-user application | Backend Lead (Gülsüm) | FR-4, FR-5 | Database, Backend | database/words.json, loader.py | JSON Best Practices, File System Constraints | Storage Capacity Test, Load Time Test with Large Data | Medium | Active |
| **SWC-04** | Resource Limit | TTS Podcast generation limit: 10 words per day | API cost management and abuse prevention | AI Integration (Ozan) | FR-7, FR-12 | TTS API, Backend | Podcast Generator, Daily Limit Logic | TTS API Guidelines, Business Logic Constraints | Functional Test, Limit Enforcement Test | High | Proposed |
| **SWC-05** | Architecture | Single-user application: No authentication or multi-user support | MVP scope limitation, 75-hour time budget constraint | System Architect (Nurefşan) | EX-1, EX-2, FR-5 | Full Stack | All application modules | SRS Scope Definition, Project Constraints | Architecture Review, Scope Validation | Low | Active |
| **SWC-06** | Compatibility | Browser support: Chrome, Firefox, Safari (latest 2 versions) | Responsive design requirement and modern web standards | Frontend Lead (Nurefşan) | Implicit NFR, UI/UX Requirements | Frontend, Web | All HTML/CSS/JS components | W3C Standards, Responsive Design Best Practices | Cross-Browser Testing, Responsive Design Test | Low | Active |
| **SWC-07** | Security | API keys must be stored in .env file, never hardcoded | Prevent credential exposure in version control (GitHub) | Backend Lead (Gülsüm) | Implicit Security NFR | Backend, Deployment | app.py, .env configuration | OWASP Security Guidelines, 12-Factor App | Code Review, Static Analysis, GitHub Scan | High | Active |
| **SWC-08** | Timing | Streak counter updates: Real-time (< 1 second delay) | User engagement and immediate feedback requirement | Backend Lead (Gülsüm) | FR-6, FR-9 | Backend, Frontend | Streak Tracking System, Navbar Streak Display | Real-time System Best Practices | Integration Test, UI Response Time Test | Low | Proposed |
| **SWC-09** | Data Integrity | No cloud sync: All data stored locally with no backup mechanism | Single-user local application design, scope exclusion (EX-3) | Backend Lead (Gülsüm) | EX-3, FR-4 | Database, Storage | JSON database files | Local Storage Guidelines, Data Loss Risk Management | Data Persistence Test, Recovery Test (Manual) | Medium | Active |
| **SWC-10** | Deployment | Flask development server: Not suitable for production deployment | Development-grade server limitation, security concerns | Deployment Lead (Nurefşan) | Deployment NFR | Backend, Server | app.py Flask server | Flask Production Deployment Guidelines, WSGI Standards | Deployment Documentation, Security Review | High | Active |
| **SWC-11** | PDF Export | PDF generation library constraints: Layout and formatting limitations | Python PDF library (ReportLab/FPDF) capability restrictions | Backend Lead (Gülsüm) | FR-8 | Backend, Export | PDF Export Service | PDF/A Standards, Document Generation Best Practices | PDF Output Validation, Format Compliance Test | Low | Proposed |
| **SWC-12** | Audio | TTS voice accent options: Limited to provider-supported accents | TTS API capability constraint (e.g., gTTS, Azure TTS) | AI Integration (Ozan) | FR-7, FR-11 | TTS API, Audio | Podcast Generator, Accent Selector | TTS API Documentation, Audio Quality Standards | Accent Selection Test, Audio Quality Review | Low | Proposed |

**Approval & Control**

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| --- | --- | --- | --- |
| **Role** | **Name** | **Signature** | **Date** |
| Backend Lead | Gülsüm Yıldırım |  | Nov 15, 2025 |
| Frontend Lead | Nurefşan Olfaz |  | Nov 15, 2025 |
| AI Integration Lead | Ozan Bayer |  | Nov 15, 2025 |

**Notes**

**Risk Impact Levels:**• High: Critical constraints that could cause project failure if violated  
• Medium: Important constraints that may impact quality or schedule  
• Low: Minor constraints with manageable workarounds  
  
**Status Definitions:**• Active: Constraint is currently enforced in the system  
• Proposed: Constraint planned but not yet implemented  
• Deprecated: Constraint no longer applicable  
  
**Verification Methods:**• Functional Test: Feature-based testing  
• Performance Test: Load time and response time testing  
• Integration Test: Multi-component interaction testing  
• Code Review: Manual inspection of source code  
• Static Analysis: Automated code quality checks