CAMPUS BOOKING SYSTEM

Elaboration & Non-Functional Requirements

Phase 1 · v1.0 · CBS-ELAB-001

Purpose

This document elaborates the non-functional requirements (NFRs) for the Campus Booking System, organised into four quality characteristic categories drawn from ISO/IEC 25010:2023. NFRs define how the system must behave rather than what it must do, and are essential for guiding architecture decisions in both the Phase 1 prototype and the future production system.

> *NFRs in this document are marked as [PROTOTYPE] where they apply to the Phase 1 SwiftUI mockup, or [PRODUCTION] where they are targeted at the full production system. Both categories are documented now to ensure the prototype architecture does not create blockers to future compliance.*

NFR Overview — ISO/IEC 25010 Alignment

#	NFR Category	ISO/IEC 25010 Char.	Scope
NFR-1	**Performance & Reliability**	Reliability, Performance Efficiency	Response times, uptime targets, graceful failure handling
NFR-2	**Security & Data Protection**	Security, Confidentiality	Authentication, encryption, audit trails, access control
NFR-3	**Usability & Accessibility**	Usability, Interaction Capability	UX standards, WCAG 2.1 AA, VoiceOver, learnability
NFR-4	**Maintainability & Scalability**	Maintainability, Portability	Code quality, MVVM structure, extensibility for production

NFR Category 1 — Performance & Reliability

ISO/IEC 25010 Characteristics

Reliability (Maturity, Fault Tolerance, Recoverability), Performance Efficiency (Time Behaviour, Resource Utilisation)

Rationale

A booking system's usefulness is directly tied to its responsiveness and availability. Slow load times during peak booking periods (e.g., start of semester) will undermine user trust and drive avoidance behaviour. The prototype must demonstrate responsive mock data flows as a proxy for production performance expectations.

Non-Functional Requirements

NFR ID	Scope	Requirement	Acceptance Criteria
NFR-1.1	**PRODUCTION**	The system shall respond to all booking queries within 2 seconds under normal load conditions (up to 500 concurrent users).	95th percentile response ≤ 2s under load test
NFR-1.2	**PROTOTYPE**	The prototype UI shall transition between screens with no perceptible lag; all mock data shall load within 0.5 seconds.	Screen transitions complete within 500ms on target device
NFR-1.3	**PRODUCTION**	The system shall maintain 99.5% uptime availability, excluding scheduled maintenance windows.	Monthly uptime ≥ 99.5% measured by monitoring
NFR-1.4	**PROTOTYPE**	The prototype shall handle all mock data operations without crashing or freezing on iOS 17+ devices.	Zero crashes during demo flow on test device
NFR-1.5	**PRODUCTION**	The system shall implement graceful degradation — if a service is unavailable, a user-friendly error with a retry option shall be displayed.	Error state UI shown within 5s of service failure
NFR-1.6	**PRODUCTION**	All booking transactions shall be atomic — a failed submission shall not result in a partial booking state.	No orphaned booking records under simulated failure

NFR Category 2 — Security & Data Protection

ISO/IEC 25010 Characteristics

Security (Confidentiality, Integrity, Non-Repudiation, Accountability, Authenticity)

Rationale

The CBS handles sensitive personal data including student identities, booking histories, and communication records. University data protection policy mandates encryption, access controls,

and audit trails. Security NFRs must be designed into the architecture from the outset — retrofitting security into a production system is significantly more costly and risky.

Non-Functional Requirements

NFR ID	Scope	Requirement	Acceptance Criteria
NFR-2.1	**PRODUCTION**	All data transmitted between the iOS client and server shall be encrypted using TLS 1.3 or higher.	No unencrypted traffic detectable via network inspection
NFR-2.2	**PRODUCTION**	All user data stored at rest shall be encrypted using AES-256.	Encrypted storage confirmed by security review
NFR-2.3	**PROTOTYPE**	Authentication tokens shall be stored in iOS Keychain, never in UserDefaults or plain local storage.	Code review confirms Keychain-only token storage
NFR-2.4	**PROTOTYPE**	Session tokens shall expire after 30 minutes of inactivity, requiring re-authentication.	Token expiry enforced in mock auth flow
NFR-2.5	**PRODUCTION**	An immutable audit log shall record all booking events, cancellations, admin overrides, and data access events.	Audit log populated for every tested action scenario
NFR-2.6	**PRODUCTION**	The system shall enforce role-based access control — Students, Tutors, and Admins shall only access endpoints and data within their permission scope.	Penetration test confirms no privilege escalation possible
NFR-2.7	**PROTOTYPE**	The prototype shall not hardcode any credentials, API keys, or sensitive strings in source code.	Static code analysis reveals zero hardcoded secrets

NFR Category 3 — Usability & Accessibility

ISO/IEC 25010 Characteristics

Usability (Appropriateness Recognisability, Learnability, Operability, User Error Protection, User Interface Aesthetics, Accessibility)

Rationale

Campus resources must be equitably accessible to all students, including those with visual, motor, or cognitive impairments. University accessibility policy and the Academic Services stakeholder (external) both mandate WCAG 2.1 AA compliance and iOS VoiceOver support. Usability NFRs also address learnability — a new student should be able to complete a booking without guidance.

Non-Functional Requirements

NFR ID	Scope	Requirement	Acceptance Criteria
NFR-3.1	**PROTOTYPE**	All interactive UI elements shall have a minimum tap target size of 44x44pt, conforming to Apple Human Interface Guidelines.	All tappable elements ≥ 44x44pt in UI review
NFR-3.2	**PRODUCTION**	The application shall meet WCAG 2.1 Level AA accessibility standards throughout all user-facing screens.	Accessibility audit confirms AA compliance
NFR-3.3	**PROTOTYPE**	All screens shall be fully operable using iOS VoiceOver, with meaningful labels on all interactive and informational elements.	VoiceOver audit: all elements labelled correctly
NFR-3.4	**PROTOTYPE**	A first-time user shall be able to complete a room booking flow without any onboarding instruction or external guidance.	Usability test: 80% of new users complete booking in ≤ 3 minutes
NFR-3.5	**PROTOTYPE**	Colour contrast ratios shall meet a minimum of 4.5:1 for normal text and 3:1 for large text across all screens.	Contrast checker confirms ratios across all screens
NFR-3.6	**PRODUCTION**	The system shall support both English and Arabic interface languages with full right-to-left layout support for Arabic.	Language switching confirmed functional in both locales
NFR-3.7	**PROTOTYPE**	Error messages shall be clearly descriptive, explaining what went wrong and providing a corrective action for the user.	All error states reviewed: actionable and non-technical

NFR Category 4 — Maintainability & Scalability

ISO/IEC 25010 Characteristics

Maintainability (Modularity, Reusability, Analysability, Modifiability, Testability), Portability (Adaptability, Installability)

Rationale

The Phase 1 prototype must be architected in a way that does not create technical debt for the production system. The MVVM pattern was chosen specifically to ensure clean separation of concerns and high testability. Maintainability NFRs ensure that future developers — and the Phase 2 team — can extend, debug, and deploy the system without excessive friction.

Non-Functional Requirements

NFR ID	Scope	Requirement	Acceptance Criteria
NFR-4.1	**PROTOTYPE**	All SwiftUI views shall follow MVVM architecture with a clear separation between View, ViewModel, and Model layers.	Architecture review confirms MVVM compliance across all modules
NFR-4.2	**PROTOTYPE**	All ViewModels shall be independently unit-testable with no direct dependency on SwiftUI view rendering.	Unit tests can run without a running simulator
NFR-4.3	**PROTOTYPE**	The codebase shall maintain a maximum cyclomatic complexity of 10 per function, enforced by SwiftLint.	SwiftLint report shows zero complexity violations
NFR-4.4	**PROTOTYPE**	All mock data sources shall be isolated in dedicated Mock Data layer files, replaceable by real API calls without modifying ViewModel logic.	Switching to live data requires changes only in data layer
NFR-4.5	**PRODUCTION**	The backend architecture shall support horizontal scaling to handle a minimum of 5,000 concurrent users without architectural change.	Load test confirms 5,000 concurrent users at ≤ 2s response
NFR-4.6	**PROTOTYPE**	All new features shall be addable as independent modules without modifying existing epic code, following the Open/Closed Principle.	Feature addition reviewed: no modification to existing modules required
NFR-4.7	**PRODUCTION**	The system shall be deployable to a new environment (staging or production) using a reproducible automated pipeline with no manual steps.	Deployment pipeline executes end-to-end without

NFR ID	Scope	Requirement	Acceptance Criteria
			manual intervention

NFR Traceability Matrix

Each NFR category maps to the following ISO/IEC 25010 characteristics and Phase 1 epics:

Category	ISO/IEC 25010	Primary Epic	Owner	NFRs
NFR-1 Performance	Reliability, Performance	All Epics	Saad Alzamzami	**6**
NFR-2 Security	Security, Confidentiality	Authentication, Admin	Saad Alzamzami	**7**
NFR-3 Usability	Usability, Accessibility	All Epics	Syeda Ahmed	**7**
NFR-4 Maintainability	Maintainability, Portability	All Epics	Saad Alzamzami	**7**

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