

Software Requirements Specifications

(Mujawwad)

Project Code

TAJWEED-AI-22-26

Internal Advisor

Dr. Hussam Ali (internal)

External Advisor

Mr. Bilal Arshad (external)

Project Manager

Prof. Dr. Muhammad Ilyas

Project Team

Muhammad Haris (BSCS51F22S065) - Team Lead

Ahmad Raza Gul (BSCS51F22S054) - Team Member

Mahtab Ahmad (BSCS51F22S048) - Team Member

Submission Date

October 20, 2025

Project Manager's Signature

Contents

1	Document Information	1
2	Definition of Terms, Acronyms and Abbreviations	2
3	Introduction	3
3.1	Purpose of Document	3
3.2	Project Overview	3
3.3	Scope	3
4	Overall System Description	4
4.1	User Characteristics	4
4.2	Operating Environment	4
4.3	System Constraints	4
5	External Interface Requirements	5
5.1	Hardware Interfaces	5
5.2	Software Interfaces	5
5.3	Communications Interfaces	6
6	Functional Requirements	6
7	Non-Functional Requirements	6
7.1	Performance Requirements	6
7.2	Safety Requirements	6
7.3	Security Requirements	7
8	User Documentation	7
9	Assumptions and Dependencies	7
9.1	Assumptions	7
9.2	Dependencies	8
	References	9

1. Document Information

Field	Details
Customer	University of Sargodha
Project Title	Mujawwad
Project Code	TAJWEED-AI-22-26
Version	2.0
Document Status	Draft
Author(s)	Muhammad Haris, Ahmad Raza Gul, Mahtab Ahmad
Approver(s)	Prof. Dr. Muhammad Ilyas
Issue Date	October 20, 2025
Document Location	
Distribution	<ol style="list-style-type: none">1. Advisor(s)2. Project Manager3. Project Office

Table 1: Document Information

2. Definition of Terms, Acronyms and Abbreviations

Term / Acronym	Definition
Mujawwad	Pronouncing the words and letters of the Quran correctly.
Tajweed	Set of rules governing correct pronunciation and articulation of the Quran.
Qari	A reciter of the Quran (used as a professional recitation reference).
Hafs	A canonical Qur'anic recitation style (the primary Qira'a supported).
Naskh	Arabic script style used for Writing verses in Quran.
Phoneme	Smallest unit of sound in speech; used for phoneme-level alignment.
Forced Alignment	Algorithmic technique that aligns audio to a transcript at phone/word level (provides timestamps for phonemes).
Madd	Tajweed rule relating to elongation of certain vowels.
Ghunnah	A nasalization rule frequently applied in Noon/Meem contexts.
Qalqalah	Tajweed rule that alters consonant sound when in a sukun state (bouncing sound).
Noon/Meem Sakin	Rules that govern pronunciation when Noon or Meem carry a sukun or are followed by other letters.
API	Application Programming Interface.
RAM	Random Access Memory.
OS	Operating System.
CPU	Central Processing Unit.
UI	User Interface.
HTTPS	Hypertext Transfer Protocol Secure.
ASR	Automatic Speech Recognition.

Table 2: Definition of Terms, Acronyms and Abbreviations

3. Introduction

3.1 Purpose of Document

This Software Requirements Specifications (SRS) document defines the functional and non-functional requirements for the Mujawwad including interfaces, constraints, and assumptions to guide design, implementation, testing, and acceptance. It is intended for project advisors, the project manager, developers and stakeholders involved in planning, building, verifying, and maintaining the application.

3.2 Project Overview

The Mujawwad is a mobile and web application that captures a user's recitation, performs phoneme-level forced alignment [2] and provides automated feedback on Tajweed rules [1, 4]. The app highlights mistakes directly on the Quranic verses. It focuses on the Hafs recitation style and enables learners to select a verse, record audio, receive structured feedback. The primary goals are to improve accessibility to authentic Tajweed practice and reduce dependency on one-to-one instructions. This app provides immediate guidance to improve recitation.

3.3 Scope

This SRS describes what the system will and will not do.

3.3.1 In Scope

- Phoneme-level recitation verification and error detection for supported verses.
- Detection and feedback for core Tajweed rules: Madd, Ghunnah, Qalqalah, and Noon/Meem Sakin.
- Visual highlighting of detected errors within Naskh-script Arabic text with brief explanations.
- Support for Hafs recitation style and Naskh script display.
- Verse selection, audio recording/upload, and structured feedback presentation.
- Quran listening feature with verse-level playback and basic controls.
- User authentication (login/logout) and preference persistence.
- Optional premium access (e.g., extended history/features) via an integrated payment gateway.
- Web and mobile access using modern browsers and supported mobile OS versions.

3.3.2 Out of Scope

- Automatic verse identification from arbitrary audio (users must select the verse before recording).
- Multi-dialect or multi-Qiraat support beyond Hafs.
- Advanced Tajweed rules beyond the specified core set in this release.

- Quran search, browsing, or comprehensive study tools outside the practice workflow.
- Social, community, or competitive features (leaderboards, sharing, etc.).

4. Overall System Description

The Mujawwad provides automated, phoneme-level feedback on Quran recitation to help learners practice and correct Tajweed without continuous instructor supervision, focusing on Hafs recitation with Naskh script and visual error highlighting.

4.1 User Characteristics

- Beginner learners who need foundational guidance on pronunciation with frequent, clear feedback.
- Intermediate learners refining Tajweed.
- Self-learners lacking access to qualified instructors due to time, geography, or cost constraints.

4.2 Operating Environment

The app runs on Android 7–15 and iOS 12–18 (mobile), Web via Chrome 90+, Firefox 90+, Safari 13+, and Edge 90+ on Windows 7–11, macOS (versions corresponding to Safari 13+), and major Linux distributions (Ubuntu, Arch) requires a dual-core CPU, 2GB RAM, microphone, speaker, display, and a stable internet connection.

4.3 System Constraints

Here are the System Constraints.

4.3.1 Software constraints:

- Compatible modern browser required for web access; Android users may use the native app.
- Reliance on pre-built forced-alignment and prediction models.
- Real-time cloud processing requires continuous connectivity.

4.3.2 Hardware constraints:

- Device must have a functional microphone, speaker, and screen.
- Sufficient memory (e.g., 2GB RAM) and storage for recording and temporary audio files.
- Stable internet connectivity during recording and feedback.

4.3.3 Cultural constraints:

- Supported languages: English and Arabic for interface and feedback.

- Hafs recitation style with Naskh script: regional accents may affect recognition accuracy.

4.3.4 Environmental constraints:

- Quiet recording environment recommended; excessive noise degrades detection accuracy.

4.3.5 Legal and privacy constraints:

- User audio recordings will be deleted within 30 minutes after response delivery.

4.3.6 User constraints:

- Users must know basic Quran reading: manual verse selection is required (automatic verse-ID is out of scope).
- Prerequisites: ability to read Quran (Naskh), basic English for UI and feedback, familiarity with smartphone or browser use, and stable internet access.

5. External Interface Requirements

This section specifies how the Mujawwad connects to external components for audio capture, processing, secure transport, and deliver feedback.

5.1 Hardware Interfaces

- Input: User recitation is captured through the device microphone and stored as an audio file.
- Output: Recorded audio and reference recitations are played back through the device speaker.
- Supported devices: Mobile phones and desktop/laptop computers equipped with a functional microphone, speaker, and display are required for recording, playback, and visual feedback.

5.2 Software Interfaces

- Mobile and web clients interface with a backend service communicate via API [5].
- Storage and lifecycle: The system interfaces with storage for transient audio artifacts used during processing, with automatic deletion of user audio within defined duration after response delivery.
- Authentication and credential handling follow the security requirements during communication.
- The web client operates with modern browsers to enable recording, upload, and feedback delivery.

5.3 Communications Interfaces

- All client–server communications use HTTPS to protect audio uploads, feedback responses, and session data in transit.
- Requests and responses use standard web protocols.
- Sessions are authenticated and protected per the defined security.
- Interfaces operate over typical mobile and desktop internet connections compatible with the supported browser.

6. Functional Requirements

- User must be able to select Quran Verses to recite.
- Application will highlight detected Tajweed errors at word/phoneme level and link highlights to rule categories [4].
- Provide in-app recording and upload for analysis; ensure transient storage and timely deletion after processing.
- Allow users to choose a reciter and enable verse-by-verse playback.
- Support authenticated sessions with secure transport (HTTPS) and proper session handling.
- Toggle between Tajweed (color-coded rules) and a plain Quran.
- Enable secure payments for further usage.

7. Non-Functional Requirements

Followings are the non-functional requirements.

7.1 Performance Requirements

- The model will achieve an accuracy of approximately 60%–80% on the Tajweed detection rules.
- The app will provide reliable and authentic Tajweed feedback aligned with the specified rules.
- Audio data will be protected for integrity and confidentiality during capture, transmission, processing, and storage.
- The system will support a minimum of 30 concurrent users.

7.2 Safety Requirements

The safety requirements are following.

7.2.1 Potential Hazards

- Tajweed detection may be incorrect, leading to false positives or false negatives in feedback.

- Visual highlighting may not perfectly align with the phoneme location in the verse.
- End-to-end latency may vary according to network conditions, device performance, and server load.
- Audio input may be interrupted during recording due to user actions, device limitations, or environmental noise.

7.2.2 Safeguards and Mitigations

- Users should record in a quiet environment to reduce background noise and improve detection accuracy.
- Critical Tajweed validations or instructional content should be verified by a qualified Qari or domain expert.

7.3 Security Requirements

- All data transmission between clients and backend services will be encrypted using HTTPS.
- User credentials will be stored using secure hashing algorithms, and access to authentication secrets will be restricted using least-privilege controls.
- User audio files will be automatically deleted within 30 minutes after response.

8. User Documentation

This section lists the user-facing documentation that will be delivered with the Mujaawwad to ensure users can install, operate, and learn the recitation practice workflow effectively.

- User Guide documentation: A structured manual covering verse selection, audio recording, feedback interpretation (error highlights mapped to Tajweed rules), listening to reference recitations.
- Tutorial: A step-by-step walkthrough demonstrating a complete practice session (select verse → record → analyze → view highlights/explanations → compare with Qari audio), available as an online help page.

9. Assumptions and Dependencies

This section documents assumptions that, if changed, may impact requirements, and external dependencies that the project relies upon for correct and timely operation.

9.1 Assumptions

- Stability of core libraries and frameworks is assumed; major version changes in client or server libraries may alter UI behavior or audio-processing accuracy and would require validation and potential updates.

- Users will record in a reasonably quiet environment so that background noise does not materially degrade Tajweed detection accuracy or highlight alignment.
- Availability and continued support of pre-built forced-alignment/ASR models [6] is assumed; deprecation or significant changes to these models could affect detection precision and require recalibration or retraining.

9.2 Dependencies

- Users will access Mujawwad using modern web browsers (Chrome 90+, Firefox 90+, Safari 13+, Edge 90+) that fully support HTML5, CSS3, and JavaScript ES6+.
- Users and administrators will have a stable internet connection with at least 5 Mbps bandwidth to ensure smooth browsing, image processing, and dashboard operations.
- Third-party services integrated into the platform (Stripe etc.) will maintain stable APIs and backward compatibility during the system's lifecycle.
- Pre-built model: A forced-alignment/ASR component for phoneme-level alignment and Tajweed rule evaluation [3, 5] (final model name to be confirmed at integration time).

References

- [1] S. Al-Fadhli, H. Al-Harbi, and A. Cherif, "Speech recognition models for holy Quran recitation based on modern approaches and Tajweed rules: a comprehensive overview," *International Journal of Advanced Computer Science and Applications (IJACSA)*, vol. 14, no. 12, Dec. 2023, doi: 10.14569/IJACSA.2023.0141297.
- [2] M. Zerrouki and A. Balla, "Improving automatic forced alignment for phoneme segmentation in Quranic recitation," *IEEE Access*, vol. 12, pp. 1–12, Jan. 2024, doi: 10.1109/ACCESS.2023.3342567.
- [3] A. Al Harere and K. Al Jallad, "Quran recitation recognition using end-to-end deep learning," arXiv preprint arXiv:2305.07034, May 2023. [Online]. Available: <https://arxiv.org/abs/2305.07034>
- [4] N. J. Ibrahim, M. Y. I. Idris, Z. Razak, and N. N. A. Rahman, "Automated Tajweed checking rules engine for Quranic learning," *Multicultural Education & Technology Journal*, vol. 7, no. 4, pp. 275–287, 2013, doi: 10.1108/METJ-06-2013-0015.
- [5] A. M. Ahmad, M. S. Sunar, A. A. A. Seman, and Z. A. Zukarnain, "Rule-based embedded HMMs phoneme classification to improve Quranic recitation recognition," *Electronics*, vol. 12, no. 1, p. 176, Dec. 2022, doi: 10.3390/electronics12010176.
- [6] H. A. Alsayadi and A. M. ElKorany, "Building a neural speech recognizer for Quranic recitations," *International Journal of Speech Technology*, vol. 26, no. 2, pp. 367–382, 2023, doi: 10.1007/s10772-023-10025-6.