UNIVERSITY OF SARGODHA

DEPARTMENT OF COMPUTER SCIENCE
FACULTY OF COMPUTING & IT

Bachelor's Degree in Computer Science

Area: Computer Science

AI Tajweed Verification System

(Project Proposal)

Project Code

<Project code assigned by the Project Office>

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Submission Date

<Provide the date when the proposal is submitted>

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1. Abstract

Traditional Quranic learning relies on one-to-one instruction through Madarsa or personal teachers, limiting accessibility due to time, geography, and cost constraints. This project proposes developing an intelligent mobile application that captures user recitation, applies forced alignment for phoneme-level analysis, and provides automated feedback on Tajweed rules including Madd, Ghunnah, Qalqalah, and Noon/Meem Sakin variations. The system will highlight specific mistakes with explanatory feedback, enabling students and adults to learn correct Quranic recitation independently without continuous instructor supervision.

2. Background and Justification

Correct Quranic recitation requires mastery of Tajweed rules governing pronunciation and articulation. Traditional methods depend on qualified instructors, creating barriers related to geographical access, scheduling flexibility, and instructor availability.

Existing applications like Islam360, described as the "World's 1st & Only Islamic Search Engine," provide Quranic text with multiple translations, Tafseer, and audio from various Qaris [1]. Similarly, Tarteel AI, the world's first AI-powered Quran companion, utilizes artificial intelligence for Quran memorization with word-level mistake detection [2]. A 2024 study confirmed Tarteel's effectiveness in developing memorization and recitation skills among students [3]. However, these solutions primarily focus on memorization or basic word-level feedback rather than detailed phoneme-level Tajweed error detection.

Research in automated Tajweed checking demonstrates promising results. A study by Ibrahim et al. using MFCC algorithm and HMM classification achieved recognition rates of 91.95% for Ayats and 86.41% for phonemes when tested on Surah Al-Fatihah [4]. Recent work by Ahmad et al. on rule-based embedded HMMs achieved accuracy ranging from 99.87% to 100% for Medd classification [5]. This project builds upon such research by integrating forced alignment technology with comprehensive Tajweed rule verification at the phoneme level, supporting Hafs recitation style and Naskh script to provide detailed, rule-based feedback for learners.

3. Project Methodology

The proposed system follows a multi-stage processing pipeline to analyze user recitation and provide targeted feedback. Figure 1 illustrates the complete workflow.

3.1 Audio Input and Verse Selection

Users will select a specific verse or Rukuh from the Quran and record their recitation through the device microphone. The application will display Arabic text in Naskh script.

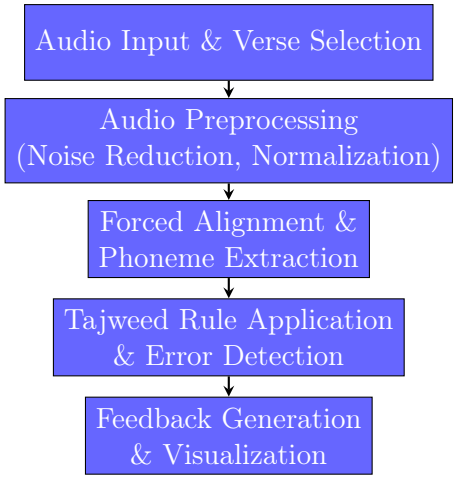

Figure 1: Project Methodology Flowchart

3.2 Audio Preprocessing

Raw audio recordings will undergo normalization including noise reduction, background filtering, and volume scaling to ensure consistent input quality.

3.3 Forced Alignment and Phoneme Extraction

The preprocessed audio will be processed using a forced alignment model trained on Quranic recitation data. This component will:

- Map the audio waveform to the expected phoneme sequence
- Generate precise timestamps for each phoneme's start and end points
- Create temporal alignment between user recitation and canonical pronunciation

3.4 Tajweed Rule Application and Error Detection

The extracted phoneme sequence will be compared against the expected model, applying specific Tajweed rules:

- **Madd:** Verification of vowel prolongation duration
- **Ghunnah:** Detection of proper nasalization for Noon and Meem sounds
- **Qalqalah:** Analysis of echoing articulation for specific consonants (د, ج, ب, ط, ق)
- **Noon/Meem Sakin rules:** Verification of Ikhfa, Idgham, Iqlab, and Izhar

3.5 Feedback Generation and Visualization

Identified errors will be highlighted in the verse text with explanatory feedback describing the correct Tajweed rule application.

4. Project Scope

4.1 In Scope

1. Phoneme-level recitation verification with error localization
2. Detection and feedback for Tajweed errors: Madd, Ghunnah, Qalqalah, and Noon/Meem Sakin rules

3. Visual highlighting of error locations within verse text
4. Support for Hafs recitation style
5. Support for Naskh script
6. Training data from EveryAyah.com [6], providing verse-by-verse MP3 audio recordings from over 44 reciters
7. User interface for verse selection and audio recording
8. Real-time feedback delivery

4.2 Out of Scope

1. Automatic verse identification from audio (users must manually select the verse)
2. Multi-dialect or multi-Qiraat support
3. Advanced Tajweed rules beyond the specified core set
4. Quran search or browsing features
5. Social or competitive features

5. High Level Project Plan

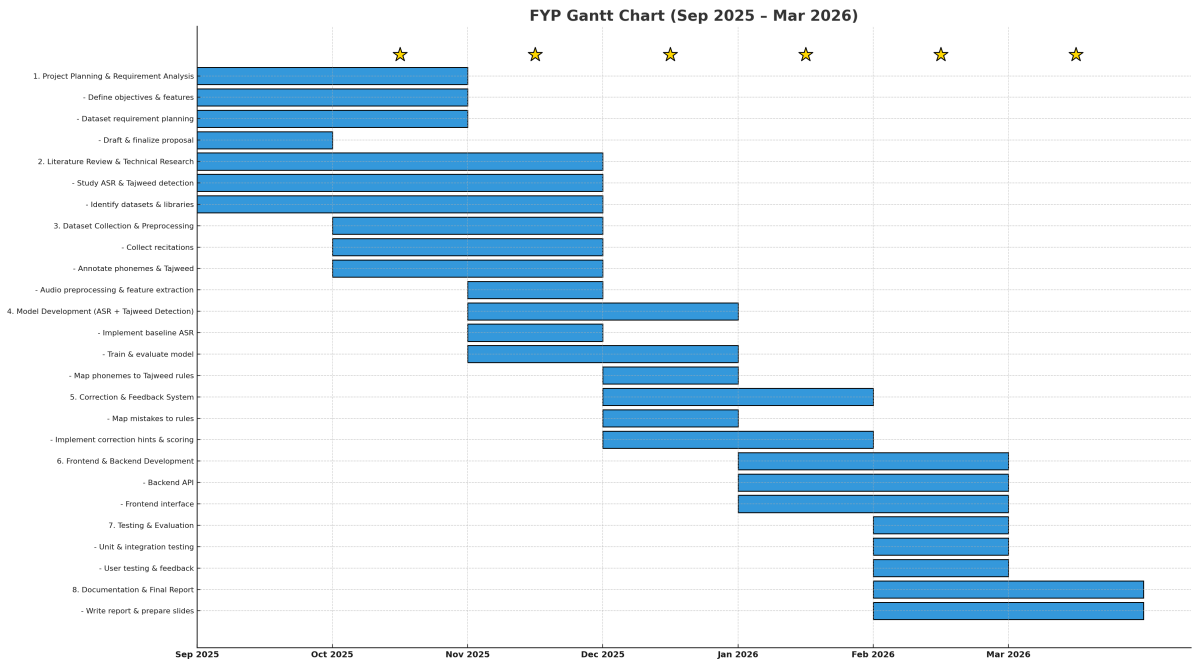

Figure 2: Project Gantt Chart (Sep 2025 - Mar 2026)

References

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[3] D. L. A. Alfarani, "The effectiveness of Tarteel application based on artificial intelligence on developing memorization and recitation skills among female students of Al-Bayan Institute for Preparing Quran Teachers," *Int. J. Humanities Social Studies*, vol. 2, Special Issue, Sep. 2024, doi: 10.61856/ijhss.v2ispc.129.

[4] N. Jamaliah Ibrahim, M. Yamani Idna Idris, Z. Razak, and N. Naemah Abdul Rahman, "Automated Tajweed checking rules engine for Quranic learning," *Multicultural Educ. Technol. J.*, vol. 7, no. 4, pp. 275-287, 2013.

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[6] EveryAyah.com, "Quran Audio MP3 Files - Verse by Verse Recitation." [Online]. Available: https://everyayah.com