

# Shiksha Setu: Multilingual AI-Powered Offline Education Platform

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## 1. Project Overview

- **Platform Goal:** To create a multilingual, AI-powered, offline-first platform connecting teachers and students in rural India, ensuring accessible and high-quality education regardless of connectivity.
- **Target Users:** Students (learner-centric features, offline study, gamification) and Teachers (content upload, live classes, AI lesson/PPT generation, training/evaluation).
- **Core Value Proposition (USPs):**
  - **22-Language Support:** Full content and UI support for all 22 official Indian languages.
  - **True Offline Functionality:** Lessons, quizzes, PPTs, summaries, and TTS audio are fully available and functional offline.
  - **AI-Generated Lessons:** Ability for students to request and receive entire, comprehensive lessons from the AI, not just summaries of teacher content.
  - **AI Interview Evaluation:** A specialized module for students to practice job/academic interviews, receiving detailed scorecards and improvement plans from the AI.
  - **Smart Sync & P2P Sharing:** Includes Smart Delta Sync for efficiency and Offline P2P sharing (Bluetooth/Hotspot) for lesson distribution.

## 2. Project Timeline (Estimated)

Phase	Duration	Focus Area	Key Deliverables
<b>Phase 1: Foundation &amp; MVP</b>	Week 1	Core Platform Setup & Basic Functionality	* Frontend (PWA/React Native) setup with 4-zone UI structure. * FastAPI Backend & Firestore integration. * Core Teacher Module (Content Upload) and Student Module (Basic Lesson Viewing). * Authentication and initial ASR (Whisper Tiny) integration for transcripts.
<b>2: AI/ML Full AI Pipeline &amp; Multilingual Hardening</b>	Week 2-3	Integration & summaries). * Implementation of the <b>Offline-First Engine</b>	* Full AI Pipeline deployment (IndicTrans2, GPT-4/Gemini for generation). * Full 22-Language <b>Phase System</b> using SQLite. * <b>Smart Delta Sync</b> and resumable upload/download functionality.
<b>Phase 3:</b>		Live Classes,	* Live Class Module (with auto-record and instant lesson generation). * AI Interview Evaluation and

**Advanced Evaluation** Teacher Training Module. \* Gamification Week 4  
**Features & Gamification** & implementation (XP, Leaderboards, Learning Games). \* **Polish Security** Security hardening (TLS, AES encryption) and final performance optimization (lightweight goal).

### 3. AI/ML Pipeline (Detailed)

This pipeline runs automatically in the background (Worker Engine) whenever a teacher uploads a lesson, creating all necessary multilingual artifacts.

Step	Model / Technology	Process / Function	Output Artifacts
<b>1. Transcription</b> (Client Preview) / (ASR)	Whisper Tiny/Small Whisper Medium (Server)	Converts uploaded video/audio content into text.	Timestamped Transcript.
<b>2. Summaries &amp; Keypoints</b>	GPT-4 / Gemini (High Quality)	Processes the transcript to 5-Line Summary, Detailed extract core concepts and structure the lesson.	Keypoints, Lesson Plan.
<b>3. Translation</b>	IndicTrans2 quiz text)	Translates all generated text artifacts (transcript, summary, 22-language versions of all languages.	JSON format for MCQs,
<b>4. Quiz &amp; Model Papers</b>	Generates structured questions True/False, Short Answers, GPT-4 / Gemini Nano	based on the lesson content.	and Full Model Question Papers.
	Custom AI Service	PPTX file containing Slide 5. PPT (Gemini/GPT-4 Titles, Bullet Points, and Generation format. orchestrated)	Structures the professional slide deck Speaker Notes.
<b>6. Interview Evaluation</b>	ASR + NLP Scoring + Audio/Camera Analysis	Assesses student/teacher mock interviews based on technical and soft skills.	Scorecard (Fluency, Clarity, Confidence, Answer Quality) + Improvement Plan.

#### 4. Challenges & Solutions

Area	Challenge	Proposed Solution
Offline	Ensuring reliable data access,	<b>Solution:</b> Use <b>SQLite</b> for robust on-device student progress tracking, and storage of all lessons (transcripts, summaries, quiz functionality in a truly offline quizzes, PPT JSON).
Reliability		
Data	Efficiently syncing large volumes of multilingual data (22 versions)	<b>Solution:</b> Implement <b>Smart Delta Sync</b> to only update files that have changed. Utilize Resumable Uploads/Downloads for large files.
Synchronization	in low-bandwidth rural environments.	
Multilingual	Maintaining high quality and cultural accuracy for AI-generated content (quizzes, interview	<b>Solution:</b> Utilize <b>IndicTrans2</b> for specialized Indic language translation and rely on high-quality LLMs (GPT-4/Gemini) for the initial
Quality	feedback) across 22 Indic generation step languages.	
	Achieving the project goal of an <b>Solution:</b> Optimize the React Native bundle, <b>extremely lightweight &amp; RAM-</b> use compressed JSON for PPTs/Quizzes, and	

## Performance

efficient application, especially on utilize smaller models like **Whisper Tiny** for older mobile devices. on-device operations when possible.

## 5. Implementation Plan / Execution Strategy

- **Frontend Strategy (Offline-First Design):**
  - Build the application using **PWA** (for browser compatibility) and **React Native** (for high-performance mobile app distribution).
  - Implement the mandatory **4-Zone Interface** for structured learning: Top Bar (Search/Language), Left Panel (Syllabus), Center Panel (Viewer), Right Panel (Tools).
- **Backend and Data Strategy:**
  - Utilize **FastAPI (Python)** for its performance and compatibility with Python-based AI/ML libraries.
  - Deploy a dedicated **Worker Engine** (asynchronous processing) to handle the longrunning AI tasks (ASR, translation, generation) without blocking the main API endpoints.
  - Use **Firebase** for real-time cloud data (user profiles, analytics, metadata) and **SQLite** for local, offline content storage.
- **Security & Compliance:**
  - Enforce **TLS** for all data communication.
  - Ensure all data stored locally on the device via SQLite is secured with **AES Encryption**.