Team Name :  GyanGrid

Team Leader Name : Chandan Kumar

Which domain does your idea address? (Agriculture / Healthcare / Skilling / Education):  Education

## What is the problem you are solving? (50 words max)

We aim to improve teaching effectiveness in India's low-income and government schools by using open-source AI to support teachers with real-time learning gap detection, personalized instruction, multilingual content creation, and low-resource tools—empowering them to manage large, diverse classrooms with limited infrastructure.

# Describe your solution. How different is it from any of the other existing ideas? How will it be able to solve the problem? USP of the proposed solution? What is the intended impact of your solution (max 350 words).

Our solution is a hybrid AI-powered educational platform that combines role-specific dashboards (Student, Teacher, Principal), multilingual content support, e-Marketplace features, and real-time analytics—all optimized for low-resource environments. Unlike many top-down edtech solutions that assume high connectivity or replace the teacher, our approach is **teacher-first, offline-friendly, multilingual, and low-resource by design**.

## Core Components:

- ***<u>AI-Powered Teacher Assistive Laye</u>***r
  Teachers are equipped with lightweight, real-time tools to identify student learning gaps using speech/text tracking during classes. Instead of disrupting lessons, our AI quietly analyzes classroom inputs and gives micro-feedback, empowering teachers to adapt content instantly.
- ***<u>Multilingual Content Engine</u>***
  Using open-source tools like AI4Bharat, IndicTrans, and Whisper.cpp, teachers can generate and adapt lesson plans into regional languages at various difficulty levels, personalizing the learning path for diverse student groups.
- ***<u>Device-Agnostic & Offline Functionality</u>***
  Built as a React + Vite PWA, the platform works smoothly on basic Android devices and desktops with minimal internet. Core features like quiz scoring, calendar updates, assignments, and even voice commands function offline using IndexedDB, localStorage, and on-device AI models (TFLite, ONNX).
- ***<u>Collaborative & Community Features</u>***
  With distinct dashboards for Students, Teachers, and Principals, our app supports dynamic routing, personalized access, and a shared communication system. Features like the e-Marketplace (for books/resources), progress tracking, fee/salary management, and internal messaging unify all stakeholders on one platform.

## Intended Impact:

- Improve classroom engagement and reduce dropout rates by making learning more responsive and inclusive.
- Reduce teacher burnout by automating routine tasks and providing real-time support.
- Empower educators with actionable insights and practical tools to improve learning outcomes.
- Build a sustainable ecosystem of open-source, AI-enhanced educational tools tailored for under-resourced schools.
- Enable **principals and admins** with actionable data on school operations and student outcomes.

## Unique Selling Proposition (USP):

An inclusive, multilingual, offline-capable educational ecosystem that **enhances, not replaces, the teacher**, while seamlessly connecting students, educators, and administrators—even in the most remote areas.

## Who is the primary user of your solution, and explain how your solution will leverage open-source AI to address the aspects mentioned in the Key Design Guidelines (max 200 words).

The **primary users** of our solution are **government and low-income school teachers** who manage large, diverse classrooms with limited resources, followed by students, school administrators and parents.

### How Our Solution Leverages Open-Source AI & Follows Key Design Guidelines:

Our platform uses open-source AI models like **T5** for content generation, **Whisper.cpp** for speech recognition, and **IndicTrans** for multilingual translation to support low-resource and multilingual learners. These models are optimized to run on-device or in **hybrid offline-first modes**, making the platform accessible even in low-connectivity environments.

The system addresses equity and personalization by identifying learning gaps in real time and recommending targeted interventions such as extra classes or resources. It empowers teachers through AI-driven feedback loops and continuous micro-learning modules, based on student outcomes. The anonymous grievance redressal system uses AI moderation for safety while amplifying student voice.

To remain open, interoperable, and cost-effective, we use open-source frontend (React + Vite), Node.js backend, and PostgreSQL, ensuring modularity and ease of local deployment. AI APIs are locally hosted wherever possible to reduce dependency on expensive cloud services.

This integrated, AI-augmented solution is designed with user dignity, inclusiveness, and long-term sustainability at its core.

## How is this solution scalable? (100 words max)

Our solution is highly scalable due to its modular architecture and cloud-based infrastructure. Each component—dashboards, fee management, salary disbursal, and e-marketplace—is independently deployable and maintainable, allowing for easy updates and expansion. Using Firebase and scalable backend technologies ensures efficient handling of increased user traffic. The platform supports multi-school onboarding, with customizable access roles for students, teachers, and administrators. Offline functionalities and data synchronization further improve accessibility. As more schools join, additional features and integrations (like AI-driven analytics and third-party ed-tech tools) can be added without overhauling the core system, ensuring long-term scalability and adaptability.

## List of features offered by the solution

**It is always better to add a few visual representations (drawings/sketches/illustrations etc.) to your presentation, it adds to the power through which it reaches the audience.**

Start → Educational Platform Solution Features Overview
↓
Student Dashboard → Attendance, Homework, Fees, Live Classes, Results, Marketplace
↓
Teacher Dashboard → Attendance, Class Scheduling, Uploads, Progress Tracking, Salary
↓
Principal/Admin Dashboard → Student Management, Fee Collection, Payroll, Circulars, Analytics
↓
Maintenance/Admin Panel → Onboarding, Customization, Ticket System, Data Sync
↓
Additional Modules → Offline Mode, Multi-language, AI Insights, Secure Login

# What open-source AI tools and technologies will you use to design the solution? (Please list all.)

## Open-Source AI Tools & Technologies

### 1. AI & ML Frameworks

- **Hugging Face Transformers** – For advanced NLP tasks (e.g., question generation, content analysis)
- **Llama / Falcon** – Cutting-edge LLMs for context-aware language understanding
- **TensorFlow Lite & ONNX** – Efficient on-device model deployment for offline functionality

### 2. Multilingual & Speech Processing

- **AI4Bharat & IndicTrans** – Robust regional language translation and localization
- **Whisper / Whisper.cpp** – Real-time, high-accuracy speech-to-text for classroom insights

### 3. AI-Driven Quiz & Chatbot Systems

- **LangChain** – Seamless integration of AI agents for dynamic quiz creation and interactive learning
- **Detoxify / Perspective API** – Ensuring safe, moderated content through effective toxicity detection

## Why are these open-source technologies the most appropriate for your solution? (150 words max)

Open-source technologies are ideal for our solution because they offer **affordability, transparency, and adaptability**—critical for low-income, resource-constrained educational settings. Frameworks like **Hugging Face Transformers**, **TensorFlow Lite**, **ONNX**, and **Whisper** enable the use of lightweight, multilingual AI models that can run efficiently on basic hardware, even offline. This ensures accessibility in rural and semi-urban schools without high-end infrastructure.

Being open-source also allows **customization for local languages, curricula, and cultural contexts**, ensuring relevance and inclusivity. This makes the solution not just technically robust, but also **ethically aligned** with the values of public education—equity, transparency, and community ownership.

# Describe the Solutions Architecture (500 words)

❑ ***Frontend (Presentation Layer)***

Built with **React.js**, the frontend ensures a responsive and intuitive experience for all users. It includes:

- **Role-based Dashboards** for Students, Teachers, and Principals with dynamic routing
- **Interactive UI** for assignments, fee payment, study materials, salary viewing, and communication
- **e-Marketplace Interface** for exchanging or purchasing academic resources
- **Common modules** like announcements, internal messaging, and calendars across all dashboards

❑ ***Admin Panel***

A separate **Admin Dashboard** handles:

- Usage analytics, school onboarding, and system settings (like commission rates)
- Processing reports, payrolls, and handling support queries
- Automation via cloud functions or cron jobs

❑ ***Scalability & Extensibility***

- **Microservice-ready** for multi-school onboarding
- Cloud-native scaling (horizontal/vertical)
- Easily expandable with features like AI progress tracking, video classes, or multi-language support

❑ ***Backend (Application Layer)***

Powered by **Node.js + Express.js**, the backend manages:

- **Authentication & Authorization** using Firebase Auth and JWT or security rules
- **Core Business Logic** for fee validation, salary workflows, and assignments
- **Secure Payments** via Razorpay for fees and salaries
- **Real-time Communication** using Firestore or Firebase Realtime DB

❑ ***Database Layer***

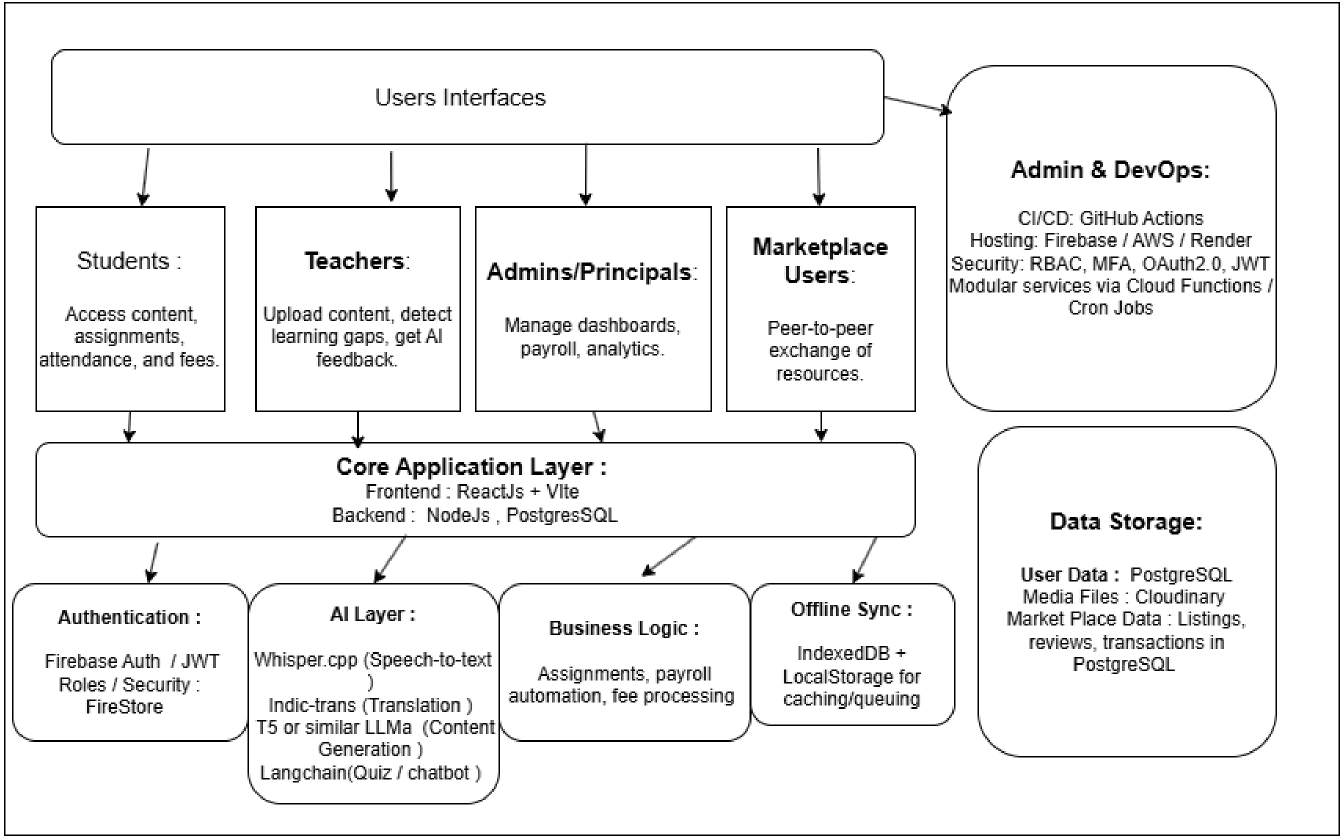
Utilizes **PostgreSQL** for:

- Structured storage of users (students , teachers , administrators) , assignments, salaries, fees, announcements, and books inventory .
- Real-time updates for messages and academic data .
- **Scalable Schema** optimized for rural deployment, offline sync, and mu language support .

❑ ***Security & DevOps***

- **Role-based access control** and data encryption
- **OAuth2.0 & MFA** for sensitive roles
- Hosting on Firebase, AWS Amplify, or Render with CI/CD pipelines (GitHub Actions, Firebase CLI)
- CDN-backed for low-latency global performance

# Provide a high-level architecture diagram or a use-case diagram of your proposed solution



Users Interfaces

**Students** :

Access content, assignments, attendance, and fees.

**Teachers**:

Upload content, detect learning gaps, get AI feedback.

**Admins/Principals**:

Manage dashboards, payroll, analytics.

**Marketplace Users**:

Peer-to-peer exchange of resources.

**Admin & DevOps:**

CI/CD: GitHub Actions
Hosting: Firebase / AWS / Render
Security: RBAC, MFA, OAuth2.0, JWT
Modular services via Cloud Functions / Cron Jobs

**Core Application Layer :**
Frontend : ReactJs + VIte
Backend : NodeJs , PostgresSQL

**Authentication :**

Firebase Auth / JWT
Roles / Security : FireStore

**AI Layer :**

Whisper.cpp (Speech-to-text )
Indic-trans (Translation )
T5 or similar LLMa (Content Generation )
Langchain(Quiz / chatbot )

**Business Logic :**

Assignments, payroll automation, fee processing

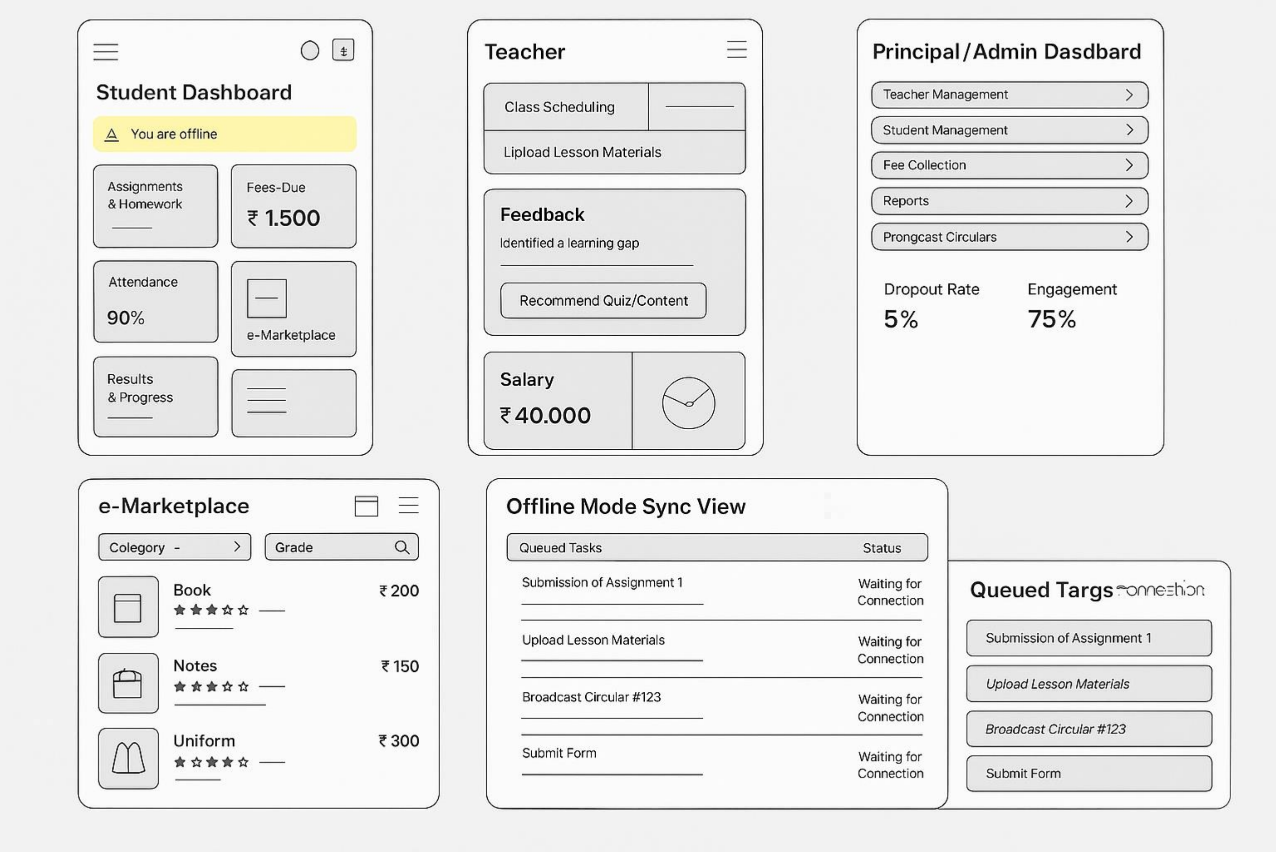
**Offline Sync :**

IndexedDB + LocalStorage for caching/queuing

**Data Storage:**

**User Data :** PostgreSQL
Media Files : Cloudinary
Market Place Data : Listings, reviews, transactions in PostgreSQL

# Please share the wireframes/Mock diagrams of the proposed solution (optional)



## Student Dashboard

You are offline

Assignments & Homework

Fees-Due ₹ 1.500

Attendance 90%

e-Marketplace

Results & Progress

## Teacher

Class Scheduling

Lipload Lesson Materials

**Feedback**

Identified a learning gap

Recommend Quiz/Content

Salary ₹ 40.000

## Principal / Admin Dasdbard

- Teacher Management
- Student Management
- Fee Collection
- Reports
- Prongcast Circulars

| Dropout Rate | Engagement |
|---|---|
| 5% | 75% |

## e-Marketplace

Colegory -

Grade

| | |
|---|---|
| Book ★★★★☆ | ₹ 200 |
| Notes ★★★★☆ | ₹ 150 |
| Uniform ★☆★★☆ | ₹ 300 |

## Offline Mode Sync View

| Queued Tasks | Status |
|---|---|
| Submission of Assignment 1 | Waiting for Connection |
| Upload Lesson Materials | Waiting for Connection |
| Broadcast Circular #123 | Waiting for Connection |
| Submit Form | Waiting for Connection |

## Queued Targs connection

- Submission of Assignment 1
- *Upload Lesson Materials*
- *Broadcast Circular #123*
- Submit Form

## What datasets will your solution use? Are they publicly available, synthetic, or user-generated?

🧠 User-Generated (Primary Source)
Collected directly from platform usage and role-based interactions:

- Student Activity Data: Assignment submissions, attendance, fee payment records, quiz scores, progress tracking logs.
- Teacher Data: Uploaded content, student evaluations, communication logs, salary-related records.
- Principal/Admin Logs: Dashboard usage, approvals, and feedback management.
- e-Marketplace Transactions: Book listings, purchase/sale histories, resource reviews.
- Internal Messaging & Announcements: Conversations, calendar syncs (processed anonymously).
- 🔐 All user data is anonymized, encrypted, and follows consent-based collection protocols.

🌍 Public Datasets (Integrated Content + Insights)
To enrich the platform with curriculum-aligned and inclusive content:

- NCERT Curriculum: For structuring digital study materials and quizzes.
- UDISE+ (Unified District Information System for Education): For school-level benchmarking and insights.
- AI4Bharat Datasets: Regional language datasets for local language support, translation, and inclusivity.

🤖 Synthetic Datasets (For Model Training & Testing)
Used to develop and improve offline AI functionalities:

- AI-generated quizzes, MCQs, and summary-based questions using LLM tools.
- Synthetic interaction logs for training chat modules and quiz scoring models in offline mode.
- Voice-to-text command sets for enhancing on-device speech features using Whisper.cpp or similar.
- These datasets are created in-house using prompt-engineering and simulation of real-world usage patterns.

🔐 Privacy, Security & Compliance
We adhere strictly to data privacy frameworks:

- Anonymized Edge Processing for all sensitive data before it leaves the device.
- Compliance with DPDP (India’s Digital Personal Data Protection Act), with potential GDPR alignment for future expansions.
- Role-Based Access Control (RBAC): Ensures data is only accessible to authorized users.
- End-to-End Encryption for communications, transactions, and personal records.

## Does your solution require cloud-based computation, or can it work with on-device processing? If cloud-based, how do you plan to address connectivity challenges and cost constraints?

🌐 Hybrid Architecture: On-Device + Cloud Support

Our educational web platform employs a hybrid architecture that ensures reliable access and functionality even in areas with limited internet connectivity. The design supports offline-first features with cloud integration for scalability and advanced processing.

📱 **On-Device (Offline Mode)**

Developed as a Progressive Web App (PWA) using React + Vite, the system works even without internet once loaded.

**Key Offline Features:**

Caching of study materials, assignments, and announcements using IndexedDB and localStorage

**Students can:**

- Access previously downloaded study content
- Submit assignments (queued for sync)
- Browse the e-Marketplace in offline preview mode

**Teachers can:**

- Upload materials (stored locally for later sync)
- Draft announcements

**Principals can:**

- View previously loaded reports and pending approvals
- On-device Intelligence (Optional Enhancements):
- Run lightweight AI models using ONNX or TensorFlow Lite for:
- Smart quiz scoring
- Student progress gap detection
- Indic language translation via IndicTrans Lite
- Offline voice commands/input via Whisper.cpp

☁️ Cloud-Based (Online Mode)

When internet is available, the app connects to the cloud for real-time data sync and advanced processing.

**Key Cloud Operations:**

- Authentication & Access Control using Firebase Auth
- Database Operations with Cloud Firestore (NoSQL)
- Support for PostgreSQL
- File Storage: Study materials, assignments, and salary slips via Firebase Storage
- Payment Integration: Secure fee payments and teacher salary via Razorpay
- Real-Time Communication: Announcements, messages, and calendar via Firebase Realtime DB
- Dashboards for all users powered by dynamic API rendering
- Admin panel to manage schools, users, reports, and platform settings

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AI for Impact Hackathon

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# THANK YOU