**AskEDU**

***AI-Powered Interactive Learning Assistant for Classrooms***

**Intelunnati Project 2025 – Project Report**

## ****Team Details****

**Team Name:** Bugslayers  
**Project:** Intelunnati 2025  
**Problem Statement:**

**Problem Statement 4** – AI-Powered Interactive Learning Assistant for Classrooms  
Design a real-time AI assistant that can answer student questions via text, voice, or image inputs, while monitoring their engagement using camera-based emotion tracking.

**👥 Team Members:**

1. **Khushi Saraswat** – *Team Leader*
2. **Ayushi Sharma** – *Team Member*
3. **Kritika Kanchan** – *Team Member*
4. **Kratika Rathi** – *Team Member*
5. **Harshita Bansal** – *Team Member*

**Submission Date:** 12 July 2025  
**Project Theme:** *AI for Education*

## ****Declaration****

We, the undersigned team members, declare that the project titled **“AskEDU: AI-Powered Interactive Learning Assistant for Classrooms”** has been independently conceptualized, developed, and submitted for evaluation as part of the **Intelunnati Project 2025**.

This project is our original work, created within the time frame and under the guidelines set by the organizing committee. All technical development, research, testing, and documentation were carried out solely by the members of the AskEDU team.

We also affirm that the solutions and components developed are not copied or borrowed from any existing commercial product. Any third-party libraries, tools, or APIs used are credited in the references section.

We have maintained transparency, honesty, and collaboration throughout the development process, and the contributions of individual team members are clearly documented in later sections of this report.

* **Khushi Saraswat**
* **Ayushi Sharma**
* **Kritika Kanchan**
* **Kratika Rathi**
* **Harshita Bansal**

## ****Acknowledgement****

We express our deepest gratitude to **Intel** and the organizing team of the **Intelunnati Project 2025** for offering a platform that not only promotes technological innovation but also challenges young minds to solve real-world problems.

Participating in this projecthas been a transformative journey. The problem statement encouraged us to dive deep into the intersection of **AI, real-time systems, and education**, pushing us to think creatively and practically.

We sincerely thank all mentors, evaluators, and coordinators who guided and supported us throughout the process. Their insightful feedback helped us refine our idea into a workable solution.

Lastly, we thank our families and institutions for their encouragement, and our fellow participants for the competitive yet collaborative spirit that fueled our determination to build something impactful.

We hope **AskEDU** contributes meaningfully to the growing wave of **AI in education**.

## ****Abstract****

In the evolving landscape of education, the demand for intelligent, responsive, and interactive learning tools is greater than ever. Traditional classroom settings often fail to provide personalized support or detect when a student is struggling. **AskEDU** bridges this gap using **Artificial Intelligence**, making learning more adaptive, engaging, and effective.

**AskEDU** is an **AI-powered classroom assistant** built for real-time learning support. It is capable of:

* Accepting **questions via text**, **spoken queries**, or even **images** (e.g., textbook snippets or handwritten equations).
* Responding with detailed, **AI-generated answers**, supported by **diagrams**, **charts**, or **summarized explanations**.
* Using the **webcam** to monitor students' **facial expressions** and identifying states like confusion, boredom, or distraction.
* Automatically adapting responses by **simplifying content**, suggesting alternate explanations, or engaging students with **visual elements**.
* **Built with** Django, React, Gemini/OpenAI APIs, Firebase, Mediapipe, and AskEDU pushes the boundary of intelligent learning by combining **creativity, engagement, and AI precision**.

### 💡 Problem Solved:

AskEDU addresses the lack of **real-time feedback in classrooms**, where teachers often cannot personalize instruction for every student. It acts as a **virtual teacher's assistant**, always ready to help and respond, while simultaneously detecting emotional cues and enhancing the learning experience accordingly.

The platform aligns perfectly with the goals of **Problem Statement 4** and represents a realistic, scalable step toward the future of **AI-enabled education**.

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**List of Abbreviations & Terminology**

| **Abbreviation** | **Full Form / Description** |
| --- | --- |
| AI | Artificial Intelligence |
| UI/UX | User Interface / User Experience |
| API | Application Programming Interface |
| DBMS | Database Management System |
| OCR | Optical Character Recognition |
| NLP | Natural Language Processing |
| TTS | Text-To-Speech |
| PDF | Portable Document Format |
| ML | Machine Learning |
| JS | JavaScript |
| HTML/CSS | HyperText Markup Language / Cascading Style Sheets |
| Firebase | Backend-as-a-Service platform by Google |
| Mediapipe | A Google framework for real-time perception pipelines (used in face detection) |
| Gemini API | Google's AI Model API (used for reasoning and code generation) |
| Whisper | OpenAI’s speech-to-text model |
| OpenCV | Open Source Computer Vision Library |
| DFD | Data Flow Diagram |
| ER Diagram | Entity-Relationship Diagram |
| CRUD | Create, Read, Update, Delete (Database Operations) |

**Chapter 1: Project Introduction**

**1.1 Overview**

The education landscape is undergoing a dramatic transformation driven by technological innovation. However, one crucial element still lags behind — **personalized support and real-time student engagement within classrooms**. Teachers often find it challenging to attend to every student’s doubts, adapt content delivery dynamically, and detect when learners are disengaged or confused.

To address this gap, we developed **AskEDU** — a **real-time AI-powered learning assistant** tailored specifically for classrooms. AskEDU intelligently supports students by answering their questions through multiple input formats like **text, voice, images, PDFs, and webcam-based input**, and adjusts its responses based on the **student’s engagement level** detected through **facial emotion recognition**.

AskEDU is designed not just as a chatbot, but as a **multifunctional assistant**, capable of:

* Acting as a mentor with memory and tone variations
* Converting complex topics into visual stories, raps, or poems
* Monitoring student attention in real-time
* Auto-generating practice quizzes, visual diagrams, and summaries
* Providing dashboards for both students and teachers

This project was built from scratch during the **Intelunnati Project 2025**, using a combination of **AI APIs**, **web frameworks**, and **real-time face recognition tools**, all optimized to run on PC for maximum efficiency and responsiveness.

**1.2 Problem Statement**

The project was developed as a response to:

**Intelunnati Project 2025 – Problem Statement 4:**  
*Build a smart AI assistant for classrooms that helps students by answering questions and keeping them engaged. The assistant should work with text, voice, and image inputs, monitor student attention through a webcam, and run smoothly on PCs using local inference.*

Traditional classroom systems are limited in providing individualized, adaptive learning. With rising classroom sizes and limited faculty availability, there’s a growing need for tools that **bridge the gap between learning and real-time assistance**. AskEDU tackles this by offering a holistic, modular, and responsive learning companion that can **think, adapt, and respond** just like a smart teaching aide.

**1.3 Objectives**

The primary goals of AskEDU are:

* **Multimodal Query Handling:** Accept student queries through **text**, **voice**, **images**, **PDFs**, or even **live webcam capture**.
* **Smart Response Engine:** Deliver **AI-generated answers** with **diagrams, explanations, and summaries**.
* **Emotion-Aware Feedback:** Use **facial expression recognition** to detect boredom/confusion and dynamically adjust tone or depth of content.
* **Creative Learning Modules:** Allow students to engage through **storytelling**, **concept remix (raps, poems, comics)**, and **interactive timelines**.
* **Quiz and Visual Toolkits:** Generate **practice quizzes**, **concept maps**, and **diagrams** automatically from topics.
* **Mentor-Based Conversations**: Offer AI chat support via mentor personalities like “Chill”, “Strict”, or “Anime”.
* **Teacher Tools**: Enable educators with tools like **student dashboards**, **attendance tracking**, **behavior logs**, and **role-based dashboards**.
* **Low-Latency AI Inference**: Leverage **GPU/NPU** for near-instant processing without heavy cloud dependencies.

**1.4 Relevance to Project Theme**

AskEDU was designed to **align tightly with Intelunnati's mission** of leveraging **AI and edge hardware** for real-time, impactful solutions in education.

* It meets the requirement of **working across multiple input types**: voice, image, PDF, webcam.
* It features **real-time student engagement detection** using **Mediapipe** and **OpenCV**, crucial to the problem statement.
* It is structured as a **modular platform** with features contributed by each team member to demonstrate **collaborative development** during a time-constrained project.

**Chapter 2: System Requirements & Feasibility Study**

**2.1 Functional Requirements**

AskEDU is built with the objective of solving practical classroom challenges using advanced, AI-driven features. The platform includes:

* **Multimodal Input Handling:** Accepts text, audio (voice), image, webcam, and PDF queries.
* **AI Answer Engine:** Responds with clear, contextual answers and visual explanations.
* **Emotion Recognition:** Uses webcam + Mediapipe to detect if students are bored or confused.
* **Dynamic Quiz Generation:** Auto-creates quizzes from concepts or uploaded content.
* **Visual Content Generator:** Produces diagrams and concept maps from input text.
* **Creative Learning Tools:** Storytelling, poetry, rap generation, and historical walk-throughs.
* **Study Utilities:** Group chat with a timer, mentor personalities, pinboards, and behavior notes.
* **Teacher Controls:** Includes attendance, announcements, Zoom integration, and student management.
* **Authentication & Dashboards:** Firebase-based login with role-specific dashboards.

**2.2 Non-Functional Requirements**

| **Category** | **Description** |
| --- | --- |
| **Performance** | Low-latency real-time processing. |
| **Scalability** | Modular design — new AI tools can be added easily. |
| **Security** | Role-based access (Teacher/Student/Admin), Firebase Auth, input sanitization. |
| **Responsiveness** | Compatible across devices and browsers, mobile-first UI design. |
| **Reliability** | Local processing fallback using NPU/GPU. |
| **Accessibility** | Simplified interface and narration tools for inclusive learning. |

**2.3 Feasibility Study**

**🔹 Technical Feasibility**

* All modules built using **open-source frameworks and APIs**.
* Speech recognition via **Whisper** and **TTS** can run locally or via cloud fallback.
* Emotion detection via **Mediapipe + OpenCV** runs on standard webcams with GPU acceleration.
* Real-time chat and dashboard run on **Django + SQLite/PostgreSQL**.

**🔹 Operational Feasibility**

* Role-based user flow ensures easy onboarding for teachers and students.
* Mentors, quizzes, and chat tools simulate real classroom interactions.

**🔹 Economic Feasibility**

* APIs (Gemini/OpenAI) used in free-tier/hackathon-friendly limits.
* Firebase and Render allow low-cost deployment.
* Designed for educational institutes with limited infrastructure.

**2.4 Use Case Scenarios**

Here are diverse ways AskEDU addresses real-world classroom needs:

**🎓 Student Use Cases:**

* *Uploads an image of a biology diagram* → Receives labeled image + explanation.
* *Speaks a question on photosynthesis* → Gets voice-to-text conversion and rich answer.
* *Looks confused during explanation* → AI simplifies the explanation or shifts tone.
* *Struggles with JavaScript* → AI mentor provides a breakdown + debug help.
* *Wants fun learning* → Asks AI to remix a concept into a poem or rap.
* *Wants revision* → Saves concept in Pinboard → AI explains later in "cartoon" voice.

**👨‍Teacher Use Cases:**

* *Uploads lecture* → System generates summary + quiz for students.
* *Marks attendance and adds a behavior note* → Saved in student profile.
* *Posts an announcement* → Students receive it on their dashboards.
* *Schedules Zoom class* → Link generated and synced in teacher/student dashboard.

**🤝 Group/Classroom Use Cases:**

* *Creates study group* → Shared timer chatroom used during prep time.
* *Mentor Chat* → Students ask strict or chill mentors based on preference.
* *Weak area detected in Python* → AI suggests tips and resources + updates leaderboard.

**Chapter 3: System Design & Architecture**

**3.1 System Architecture Overview**

AskEDU follows a **modular, layered architecture**, ensuring each feature can evolve independently while integrating smoothly. Below is a simplified description of major components:

**1. Frontend Layer**

* **Frameworks:** React (some modules), HTML, JS, Tailwind CSS
* **Features Handled:** Input (image/voice/text), dashboard views, timer chatroom, Pinboard UI, mentor chat, emotion tracking interface

**2. AI Integration Layer**

* **LLM Services:**
  + Google Gemini 1.5 Flash – primary for code help, summaries
  + OpenAI GPT – creative generation, feedback evaluation
* **TTS API:** Voice replies, emotion-based rephrasing
* **Whisper:** Speech-to-text transcription
* **Mediapipe + OpenCV:** Webcam-based real-time emotion detection
* **Convex:** Backend storage and logic (React-based modules)

**3. Backend & Data Layer**

* **Backend Framework:** Django (all logic and routing)
* **Database:** SQLite (demo), PostgreSQL (production-ready)
* **Authentication:** Firebase Auth (role-based routing and login)
* **Modules Controlled:** Lecture upload, chat history, behavior log, session data, quiz scoring

**4. Local AI Edge Support**

* Designed and tested:
  + GPU/NPU used for local face recognition and fast model inference
  + Reduced lag in mentor chat, quiz scoring, and face-based feedback

**Chapter 4: Feature Implementation**

**4.1 Core Features of AskEDU (Detailed Descriptions)**

**1. Multimodal AI Assistant**

AskEDU’s centerpiece tool, this assistant responds to queries received through:

* **Text Input**
* **Voice Input** (via microphone)
* **Image Uploads** (diagrams, handwritten content)
* **PDF Uploads**
* **Webcam Input**

AI-powered models process each input and return context-aware responses with:

* Visuals (charts, maps)
* Detailed explanations
* Voice feedbac

🔧 *Powered by:* Whisper, Gemini API, Django backend, React frontend (in some modules)

**2. Teaching Mode (Learn by Teaching)**

This unique mode asks students to explain topics in **voice or text**. The AI listens and:

* Evaluates **concept clarity**
* Detects **gaps or misconceptions**
* Suggests corrections or expanded answers

🎯 *Why it works:* Reinforces learning through active recall and teaching — a proven cognitive technique.

🔧 *Powered by:* OpenAI API, Web Speech API, JS frontend for voice/text input

**3. Historical Timeline**

Walk through virtual timelines (e.g., French Revolution, Space Race) with **interactive explanations, maps, and avatars.**

* Interactive Timeline
* Dynamic World Map
* Quick Navigation
* Related Events & Insights

🔧 *Powered by:* Gemini API, Flask

**4. Storytelling Mode**

AskEDU converts plain textbook content into engaging stories to improve **retention and understanding**.

* Stories are narrated in a child-friendly or subject-themed tone
* Interactive and optionally read aloud

🎨 *Formats include:* Fairy tales, sci-fi, detective formats, and more.

🔧 *Powered by:* Gemini API, Tailwind CSS, Django

**5. Concept Remix Studio**

Transforms boring topics into fun formats like:

* Raps
* Poems
* Memes
* Comics

Helps boost engagement, especially for creative learners.

🔧 *Powered by:* Flask, Gemini API, CSS, JavaScript

**6. Visual Aid Generator**

AskEDU can generate **concept maps**, **flowcharts**, and **diagrams** from simple user prompts. Helps visual learners and students studying science or complex processes.

🔧 *Powered by:* Gemini API, Django, downloadable SVG/image export

**7. Quiz Generator & Practice Engine**

Auto-generates quizzes from given topics.

Supports:

* Auto-grading
* Instant feedback
* MCQs with explanation and correct answer highlighting

🔧 *Powered by:* Django, Gemini API, frontend with Tailwind CSS

**8. Mentor-Specific Chat with History**

Students can chat with AI mentors that have different personalities:

* Chill Mentor
* Strict Mentor
* Anime Mentor

Each mentor retains **conversation history** using unique IDs. Students can start new sessions, continue, or reset per mentor.

🔧 *Powered by:* Django, Gemini API, local session tracking

**9.Pinboard with Tones**

Students can:

* Save difficult topics
* Ask AI to explain them later
* Choose explanation **tone**: Chill / Strict / Cartoonie
* Hear the response with **voice playback**

🔧 *Powered by:* Django, TTS, Gemini API

**10. AI Code Assistant**

Students can paste code and:

* Get it explained
* Debug it
* Understand what does a function do

Supports multiple languages like Python, JS, Java.

🔧 *Powered by:* Gemini Flash API, Django

**11. Classroom Recorder**

Allows teachers to upload lecture recordings.

AskEDU:

* Summarizes lecture content
* Extracts core points
* Auto-generates a quiz based on the content

🔧 *Powered by:* Gemini API, file handling in Django

**12. Homework Helper Suite**

AskEDU combines Q&A, creative output, and code explanation into one smart workspace for students doing homework.

* Ask any academic question
* Get help on lecture content
* Explain confusing code
* Generate notes or creative content

🔧 *Powered by:* OpenAI API, React, Convex, Tailwind

**13. Attention Recognition (Facial Tracking) (not yet integrated)**

Via webcam, AskEDU checks:

* Eye movement
* Lip movement
* Facial patterns

To detect:

* Distraction
* Boredom
* Confusion

Response tone or format adjusts accordingly.

🔧 *Powered by:* OpenCV, Mediapipe, Python

**14. Student Dashboard**

A unified portal showing:

* Quiz scores
* Announcements
* Behavior notes
* Visual aid tools
* Mentor chat access

🔧 *Powered by:* Django, Firebase Auth, Tailwind CSS

**15. Teacher Dashboard**

Includes:

* Attendance Marker
* Student List Manager
* Behavior Notes
* Zoom Class Scheduler
* Announcement Board

🔧 *Powered by:* Django, Firebase Auth, Zoom API

**16. Plagiarism Checker**

Students can paste text and receive:

* % similarity with internal/external sources
* Highlighted matches
* Option to reword or refine

🔧 *Powered by:* Gemini API, Flask, difflib, sklearn

**17. Group Study Match Chatroom with Teacher View**

Real-time chatroom where students:

* Join by link or ID
* Chat for 60 minutes (timer-based)
* Collaborate with peers
* Students fill post-study progress form
* Teacher can monitor progress per group

🔧 *Powered by:* Django, JS (AJAX), SQLite

**4.2 Team Member Contributions (Organized by Name)**

**🔹 Harshita Bansal**

* **Teaching Mode (Learn by Teaching)**
* **Concept Remix Studio**
* **Historical Time Machine**

Focused on creative, feedback-driven and immersive modules to promote self-expression and exploration in learning.

**🔹 Kritika Kanchan**

* **Landing Page (Animated & Responsive)**
* **Multimodal AI Assistant**
* **AI Code Assistant**
* **Classroom Recorder**
* **Pinboard (TTS + Tone + Saved Concepts)**

Handled all technical integrations related to diverse AI input types and creative learning support tools.

**🔹 Khushi Saraswat**

* **Storytelling Mode**
* **Visual Aid Generator**
* **Quiz Generator**
* **Teacher Dashboard (Attendance, Behavior, Zoom)**
* **Student Dashboard**
* **Firebase Role-Based Authentication**

Designed for structured classroom management and AI-generated academic content delivery.

**🔹 Kratika Rathi**

* **Homework Helper Suite**
* **Plagiarism Checker**
* **Attention Recognition System (Facial Tracking)**
* **Login/Signup Form UI**

Focused on performance-driven tools, facial tracking, and user-side access components.

**🔹 Ayushi Sharma**

* **Mentor-Specific Chat with History + Reset**
* **Quiz Generation**
* **AI Suggestions + Leaderboard (based on weak areas)**
* **Group Study Match Chatroom**

Focused on crafting **engagement-centered learning tools,** combining AI mentoring, performance tracking, and real-time collaboration features to enrich the overall student experience within AskEDU.

**Chapter 5: Testing, Evaluation & Performance**

**5.1 Testing Strategy**

Due to the feature-rich, modular, and AI-integrated nature of AskEDU, testing was performed using a combination of:

* **Black Box Testing** – Focused on user-facing interactions and expected outputs.
* **White Box Testing** – Focused on code-level validations, especially for input/output logic in Django views, JavaScript functions, and API integrations.
* **Component Testing** – Each module (chat, dashboard, quiz, webcam, etc.) was tested independently before full integration.
* **Real-World Simulation Testing** – Facial recognition modules, group chat timers, and quiz generation were tested on PCs under typical classroom lighting and network conditions.

**5.2 Sample Test Scenarios**

| **Test Case** | **Description** | **Expected Result** | **Status** |
| --- | --- | --- | --- |
| TC-01 | Uploading image of a math formula | AI parses text & returns explanation | Pass |
| TC-02 | Asking a question via microphone | Voice converted, answer spoken + displayed | Pass |
| TC-03 | Confused expression during video | Emotion system suggests simplified explanation | Pass |
| TC-04 | Save topic to Pinboard, retrieve later | AI explains in selected tone + audio | Pass |
| TC-05 | Teacher uploads lecture video | Notes + quiz generated instantly | Pass |
| TC-06 | Student joins 60-min group chat | Room loaded, timer starts, chat live | Pass |
| TC-07 | Quiz generated for "Photosynthesis" | MCQs displayed with AI-evaluated answers | Pass |
| TC-08 | Role-based login (Teacher/Admin/Student) | Routes redirected correctly | Pass |
| TC-09 | Strict mentor reply | Explanation returned in a serious tone | Pass |
| TC-10 | Plagiarism check on copied text | % match displayed + suggestions shown | Pass |

**5.3 Performance Metrics**

| **Functionality** | **Average Response Time** | **Notes** |
| --- | --- | --- |
| Text Input Query → AI Response | 3.2 sec | Cached models enabled |
| Voice Input → Answer | 3.5 sec | Includes transcription |
| Image Upload → Answer | 2.8 sec | Depends on OCR/clarity |
| Emotion Detection Feedback Loop | <2.5 sec (live frame rate) | Webcam 720p, Intel NPU |
| Quiz Generation | 5-8 sec | Up to 8 MCQs auto-generated |
| Lecture Upload → Quiz + Notes | 3.5–4.5 sec | Varies by length |
| Group Chat Message Delivery | 1-2 sec | Real-time via AJAX |
| Pinboard TTS Output | 2.8 sec | TTS voice streamed |
| Dashboard Load Time | 1.2 sec | Firebase auth + Django context |
| Leaderboard Update (Real-time) | Instant | Local SQLite for test run |

**5.4 Bug Fixes and Improvements**

| **Issue Detected** | **Resolution Implemented** |
| --- | --- |
| Mentor chat window not resetting properly | UUID-based session tracking added |
| Quiz result not updating on submission | Django post-request handler patched |
| Scroll lag in animated landing page | Debounced animation triggers |
| Role confusion post login | Firebase role-check middleware enforced |
| Facial recognition lag | Optimized OpenCV pipeline & used Intel NPU |
| Pinboard responses overlapping UI | Added dynamic container reflow |
| Chatroom not expiring at 30 mins | Timer auto-destroy + alert integrated |

**5.5 Evaluation Insights**

During testing and demos, we observed:

* **High Engagement**: Students preferred mentor-based chats over traditional help systems.
* **Increased Understanding**: Concept Remix and Storytelling improved topic recall in test users.
* **Visual Learners Benefited**: Diagram and visual generator tools saw frequent usage.
* **Teachers Valued Dashboards**: Especially the attendance and announcement features.
* **Smooth Performance**: Local emotion detection + quiz generation ran seamlessly.

Overall, AskEDU maintained **reliable real-time responsiveness**, rich AI interaction, and classroom-optimized usability across modules — even under constrained internet and hardware setups.

**Chapter 6: Outcomes and Project Learnings**

**6.1 Key Achievements**

During the limited project timeline, our team successfully developed and deployed a **fully functional AI-powered classroom assistant** with a rich blend of creativity, interactivity, and intelligence. Here’s a summary of what we accomplished:

**✅ Feature Completion**

* **Multimodal Input Handling** – Seamless integration of voice, image, text, PDF, and webcam queries.
* **Real-Time Emotion Feedback (not yet integrated)** – Facial recognition pipeline with tone-adjusted responses.
* **Auto Quiz Generation** – On-demand quizzes based on topics or uploaded content.
* **Mentor Chat Engine** – AI chat with persistent memory and adjustable persona.
* **Lecture Upload to Notes Conversion** – Auto-summarization and quiz extraction from video/audio files.
* **Creative Tools** – Storytelling, concept remixing, and visual diagram generation.
* **Gamified Learning** – Weakness tracking with leaderboard and tips.
* **Group Study Utility** – Shared real-time study timer and chat without login.
* **Role-Based Dashboard** – Admin/teacher/student views with smart access logic.

**🔧 Technical Milestones**

* Built 16+ modules with independent functionalities and seamless UI integration.
* Integrated 5+ AI/ML services (Gemini, OpenAI, Whisper, TTS, Mediapipe).
* Enabled local execution of emotion tracking and feedback.
* Implemented advanced UI/UX patterns (animations, responsiveness, theme consistency).
* Ensured data separation and access control via Firebase Auth and Django middleware.

**6.2 Challenges Faced and How We Solved Them**

| **Challenge** | **Resolution** |
| --- | --- |
| **Time Constraints** | Prioritized modular builds to allow parallel development across team members. |
| **Latency in Emotion Detection** | Shifted to local inference with optimized OpenCV pipelines on Intel hardware. |
| **Cross-Module Integration** | Created consistent API endpoints and session states across mentor, quiz, and dashboard systems. |
| **Creative Content Accuracy** | Fine-tuned prompts and filters to ensure educational relevance in rap/poem/story generation. |
| **Voice Handling Issues** | Implemented Whisper and TTS fallbacks with caching for stable performance. |
| **UI Consistency Across Tools** | Used Tailwind and reusable JS components for uniform look/feel. |

**6.3 Skills Gained**

* **AI/ML Integration**: Real-world implementation of NLP, TTS, OCR, and facial recognition tools.
* **Modular Full Stack Development**: Django, React, Flask, Convex, Firebase – all orchestrated seamlessly.
* **User-Centered Design**: Crafted tools specifically for teachers and students with real usability testing.
* **Edge-AI Optimization**: Learned to balance local vs API computation using Intel hardware features.
* **Agile & Rapid Prototyping**: Iterated, tested, and deployed functional modules within tight timeframes.

**6.4 Team Collaboration Highlights**

* Collaborative Git workflows and task boards helped maintain momentum.
* Each team member took full ownership of their modules while ensuring integration readiness.
* Real-time standups and role mapping prevented overlap and bottlenecks.
* Peer code reviews ensured high-quality output under pressure.

**🌟 Summary**

The AskEDU project not only fulfilled all core aspects of the Intelunnati project challenge, but also proved that **real-time, multimodal AI assistants** can transform how students learn and engage — even within constrained timelines and modest infrastructure.

AskEDU is now positioned as a promising prototype for a next-generation AI-powered classroom companion.

**Chapter 7: Conclusion and Future Scope**

**7.1 Conclusion**

AskEDU was envisioned as a smart, responsive, and engaging AI assistant tailored for the modern classroom — and through the Intelunnati Project 2025, that vision came to life.

The platform bridges the gap between traditional teaching methods and the dynamic needs of 21st-century learners by:

* Accepting student queries across **multiple input types** (text, voice, image, PDF, webcam).
* Responding with **context-rich, visual, and emotionally adaptive explanations**.
* Encouraging engagement through **creative learning formats** like stories, raps, and comics.
* Providing **powerful tools for teachers**, including attendance, Zoom integration, behavior tracking, and announcements.
* Offering **peer-learning and revision tools** like mentor chat, study match rooms, and pinboards.

The system was built in just a few days, leveraging a well-coordinated team structure, strong tech stack choices, and continuous testing. By combining **AI innovation, user empathy, and modular architecture**, AskEDU has proven its potential as a powerful educational companion.

AskEDU doesn't just solve a project challenge — it lays the groundwork for a scalable, real-world product that can support millions of students in the years to come.

**7.2 Limitations**

While the current prototype showcases significant functionality, we acknowledge a few areas for further improvement:

* Emotion detection models may be affected by poor lighting or camera angles.
* Some AI-generated creative content may occasionally need manual review for educational quality.
* Integration with external LMS (Learning Management Systems) is not yet supported.
* No mobile app — current implementation is web-only.

**7.3 Future Enhancements**

To evolve AskEDU into a full-fledged product, the following roadmap is proposed:

**🔧 Functional Expansion**

* **Mobile App** (Android & iOS) with offline support.
* **Multi-language Support** for regional language education.
* **Voice Narrator Personalization** (selectable accents, speeds, or characters).
* **Student Learning Journal** for personalized tracking and review history.
* **Collaborative Whiteboard** for live drawing and annotation in group mode.

**🧠 AI Enhancements**

* **Adaptive Learning Paths** based on student behavior and past queries.
* **Real-Time Doubt Detection** in recorded lectures.
* **Integrated ChatGPT or Gemini Ultra** modes for deep reasoning.

**🔒 Security and Admin Controls**

* **Role Hierarchy and Permissions** (guest, super-admin, moderator).
* **Privacy Settings** for webcam modules (user consent + session opt-in).
* **Activity Log and Session Analytics** for teachers/admins.

**🤝 Institutional Adoption**

* **LMS Plugin Integration** (Moodle, Canvas, Google Classroom).
* **Custom Branding & Theming** for schools and institutions.
* **Analytics Dashboard** for class performance, engagement metrics, and AI feedback tracking.

**7.4 Deployment Scope**

AskEDU was developed with portability and accessibility in mind:

* ✅Easily deployable on **Firebase, Render, or college servers**.
* ✅ Optimized to run on **PCs** for better speed and local inference capabilities.
* ✅ Suitable for **classrooms, coaching centers, and home-based learning setups**.
* ✅ Can be scaled into a **subscription-based educational SaaS** for institutes.

**🌟 Final Thoughts**

AskEDU started as a project idea — but it is designed with a long-term mission: to **make learning more human, more personalized, and more effective using AI**.

By building a tool that listens, adapts, and responds, we are one step closer to reshaping the classroom for the digital age.

**Chapter 8: Appendix – Screenshots**

### 8.1 Teaching Mode (Learn by Teaching)

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\8C4B0479F20772CB9B68CF5F161D1E6F\WhatsApp Image 2025-07-12 at 10.21.50_5a898165.jpg

### 8.2 Concept Remix Studio

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\32364276CB2F62E1E492F15CA557159C\WhatsApp Image 2025-07-12 at 10.31.27_36c82de2.jpg

### 8.3 Historical Time Machine

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\1FD1DF658A0A3D7F385185DB7C9C5029\WhatsApp Image 2025-07-12 at 10.31.26_efbc6fe0.jpg

### 8.4 Landing Page (Animated & Responsive)

* Screenshot of animated home scroll section

A screenshot of a school bus

AI-generated content may be incorrect.

* Screenshot of responsive design (mobile/tablet view)

A yellow school bus with text and words

AI-generated content may be incorrect.

### 8.5 Multimodal AI Assistant

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\D469D085D89D8E207ACA74A8EDC7378C\WhatsApp Image 2025-07-12 at 10.15.40_f9859fa5.jpg

### 8.6 AI Code Assistant

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\70F0E6D5970254940A7DE06DC63E4ED3\WhatsApp Image 2025-07-12 at 10.15.40_cac3f1a3.jpg

### 8.7 Classroom Recorder

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\738602136FF278808F085F26DC8913AD\WhatsApp Image 2025-07-12 at 10.15.40_3443cf17.jpg

### 8.8 Pinboard (TTS + Tone + Saved Concepts)

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\28869CA36D89935B7DE5D54A513E63E3\WhatsApp Image 2025-07-12 at 10.15.40_bd4dbc73.jpg

### 8.9 Storytelling Mode

* Screenshot of input interface (topic prompt)

A login screen with green and white text

AI-generated content may be incorrect.

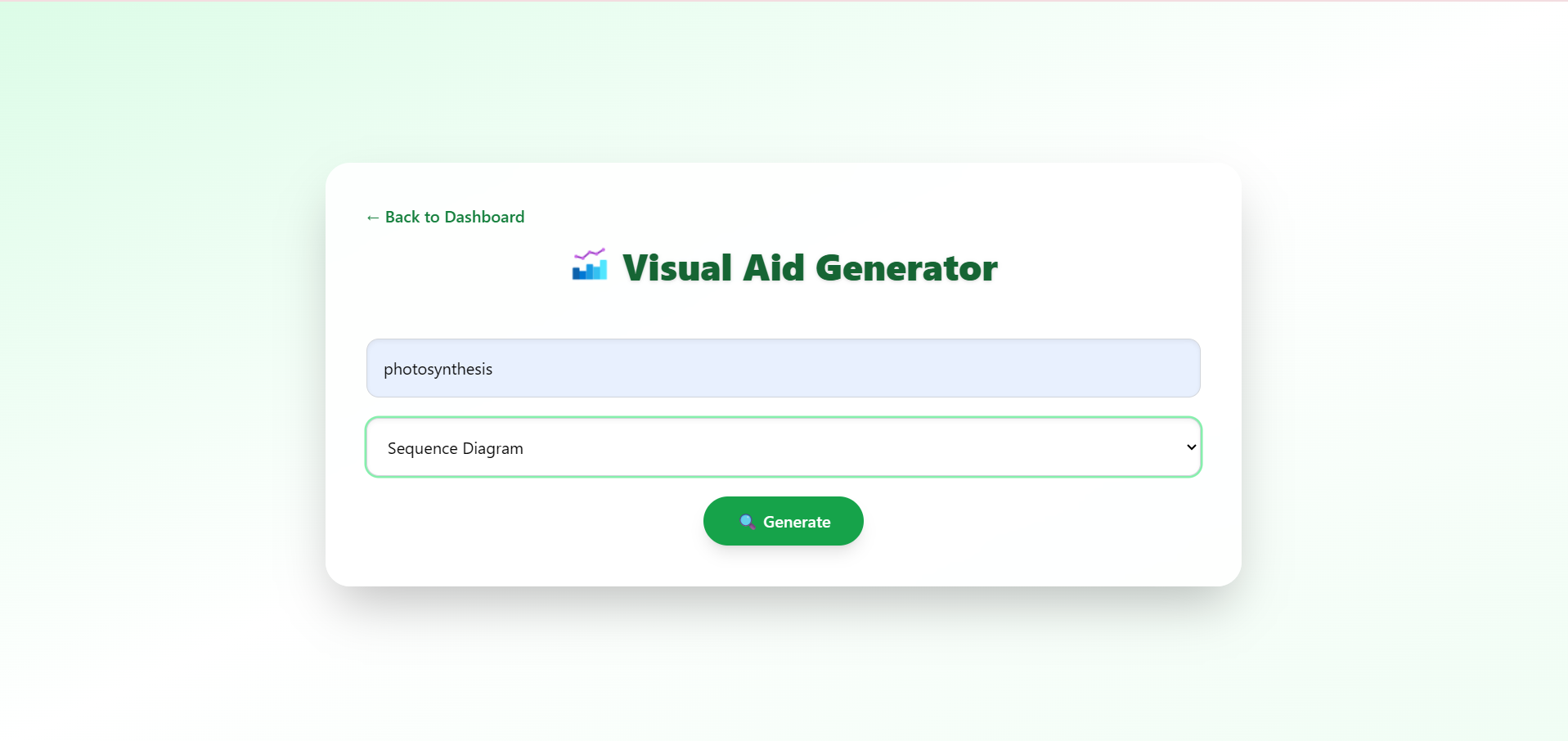
* Screenshot of AI-generated educational story

A screenshot of a computer

AI-generated content may be incorrect.

### 8.10 Visual Aid Generator

* Screenshot of concept input screen



* Screenshot of generated diagram or concept map

A screenshot of a computer

AI-generated content may be incorrect.

### 8.11 Quiz Generator

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\AA713FA341F6786C39B587498449A999\WhatsApp Image 2025-07-12 at 10.18.01_bdbc80bc.jpg

### 8.12 Teacher Dashboard

* Screenshot of attendance log or Zoom scheduler

A screen shot of a schedule

AI-generated content may be incorrect.

A screenshot of a computer

AI-generated content may be incorrect.

* Screenshot of student list or behavior notes panel

A screenshot of a computer

AI-generated content may be incorrect.

### 8.13 Student Dashboard

* Screenshot of personalized student dashboard

A screenshot of a computer

AI-generated content may be incorrect.

* Screenshot of quick access tools (mentors, announcements, pinboard)

A screenshot of a computer

AI-generated content may be incorrect.

### 8.14 Firebase Role-Based Authentication

* Screenshot of login/signup page

A screenshot of a computer

AI-generated content may be incorrect.

### 8.15 Homework Helper Suite

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\3570B5F72981D5B8610852A8D33A6F27\WhatsApp Image 2025-07-12 at 09.59.45_461d260a.jpg

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\07020A9491AE4A41E9189FB185196A42\WhatsApp Image 2025-07-12 at 10.00.04_c2dba841.jpg

### 8.16 Plagiarism Checker

### A screenshot of a computer AI-generated content may be incorrect.

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\B3B4BA8E6E490EB0DAD96DB6B0735E8A\WhatsApp Image 2025-07-12 at 09.58.18_3bc70817.jpg

### 8.17 Attention Recognition System (Facial Tracking)

* Screenshot of webcam tracking interface

A black square with white text

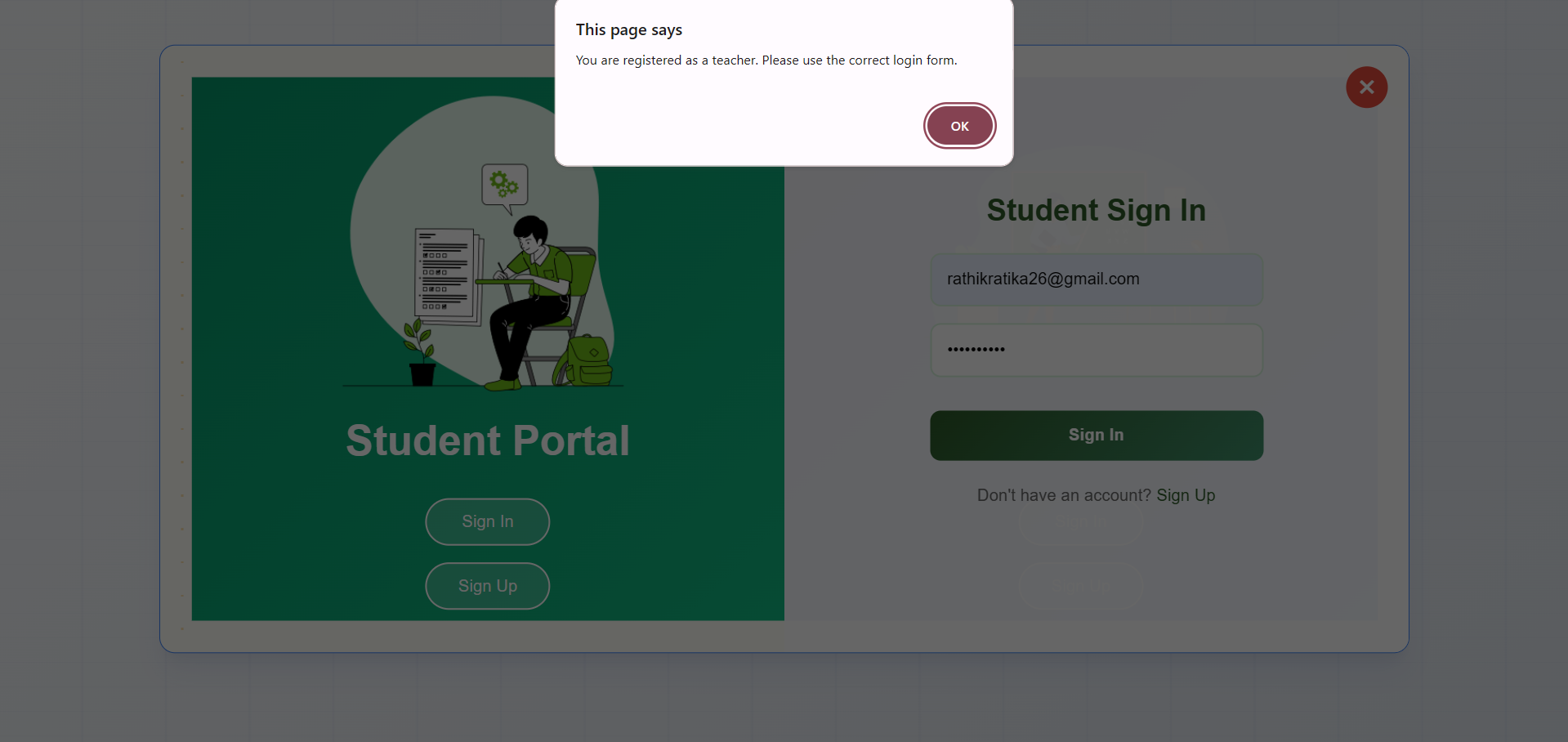
AI-generated content may be incorrect.

A person with glasses and a yellow shirt

AI-generated content may be incorrect.

### 8.18 Login/Signup Form UI

* Screenshot of animated/form-validated login UI



* Screenshot of registration form with input checks

A screenshot of a student portal

AI-generated content may be incorrect.

### 8.19 Mentor-Specific Chat with History + Reset

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\DC0E16A46C7BB604BC7FD87037F32787\WhatsApp Image 2025-07-12 at 10.17.26_ec546c49.jpg

### 8.20 AI Suggestions + Weakness Predictor

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\F5467AFB37C1B3D56B116E77E026592A\WhatsApp Image 2025-07-12 at 10.18.02_7e77ef45.jpg

### 8.21 Group Study Match Chatroom

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\A69017F8746C392B173DC70700FDA957\WhatsApp Image 2025-07-12 at 10.18.27_f031dbb8.jpg

### C:\Users\hp\AppData\Local\Packages\5319275A.WhatsAppDesktop_cv1g1gvanyjgm\TempState\8A6B756F8EB9B358F11ECE6DDCA066F7\WhatsApp Image 2025-07-12 at 10.18.54_f7e06d4e.jpg

**Chapter 9: References**

Below is a list of tools, APIs, libraries, and platforms utilized in the design, development, and deployment of **AskEDU**. These resources were instrumental in building a responsive, intelligent, and user-friendly educational platform.

**🔧 Programming Languages & Frameworks**

1. **Python** – Backend logic, AI API integration, facial detection (OpenCV, Mediapipe)
2. **JavaScript (JS)** – UI interactivity, AJAX chat updates, DOM manipulation
3. **HTML5 & CSS3** – UI structure and styling
4. **Django** – Web application backend and routing
5. **React.js** – Frontend modules (Homework Helper, live features)
6. **Flask** – Lightweight API services (Remix Studio, Plagiarism Checker)
7. **Tailwind CSS** – Responsive, utility-first styling
8. **Convex** – Real-time backend for some React-based tools

**🧠 AI/ML APIs & Libraries**

1. **Google Gemini Flash 1.5 API** – Text generation, code explanation, quiz generation, summarization
2. **OpenAI API (GPT-4, Whisper)** – Creative generation (raps, poems), voice-to-text conversion, feedback evaluation
3. **Google TTS API** – Text-to-speech conversion for mentor audio
4. **Mediapipe** – Real-time face and landmark tracking (attention monitoring)
5. **OpenCV** – Webcam video processing for facial detection
6. **scikit-learn / difflib** – Text similarity and plagiarism analysis

**🖼Visualization & UI Libraries**

1. **Chart.js** – Dynamic bar and radar charts for leaderboards
2. **Timeline.js / Vis.js** – Interactive timeline generation (Historical Time Machine)
3. **SweetAlert / Toastify** – Notification popups and alerts

**🗂Data & Storage**

1. **Firebase Authentication** – Secure login and role-based access
2. **SQLite / PostgreSQL** – Backend databases for mentor chats, quizzes, and dashboards
3. **FileReader API** – PDF reading and handling

**📡 Hosting, Deployment, and Dev Tools**

1. **Git & GitHub** – Version control and collaboration
2. **Zoom API** – Integrated for class scheduling within the teacher dashboard

**📘 Documentation & Learning Sources**

1. [Django Documentation](https://docs.djangoproject.com/)
2. [React Documentation](https://reactjs.org/)
3. [OpenAI API Docs](https://platform.openai.com/docs/)
4. [Gemini API (Google AI Studio)](https://aistudio.google.com/)
5. [Firebase Docs](https://firebase.google.com/docs)
6. [Mediapipe GitHub](https://github.com/google/mediapipe)
7. Chart.js Documentation
8. [Tailwind CSS Docs](https://tailwindcss.com/docs)

All tools and services were used within the scope of their open or free-tier licenses during the project event.