EDUBRIDGE:

Empowering Visually and Hearing Impaired Students

Project GitHub Link

By Team - **TECHTUSKERS**

Problem Statement

Millions of **visually and hearing-impaired students** face **difficulties in accessing mainstream educational content** due to **lack of inclusive formats**. **Traditional teaching methods fail** to **accommodate their needs**, leading to **learning gaps** and reduced opportunities. There's an **urgent need for an inclusive digital learning platform** that makes **complex educational content accessible and engaging** for all **learners, regardless of ability**. Many visually and hearing-impaired students struggle with inaccessible learning formats, **limiting their educational growth**. There's also a **lack of personalized tools and parent-friendly systems** to support and monitor their learning progress.

Ideation

Proposed Solution

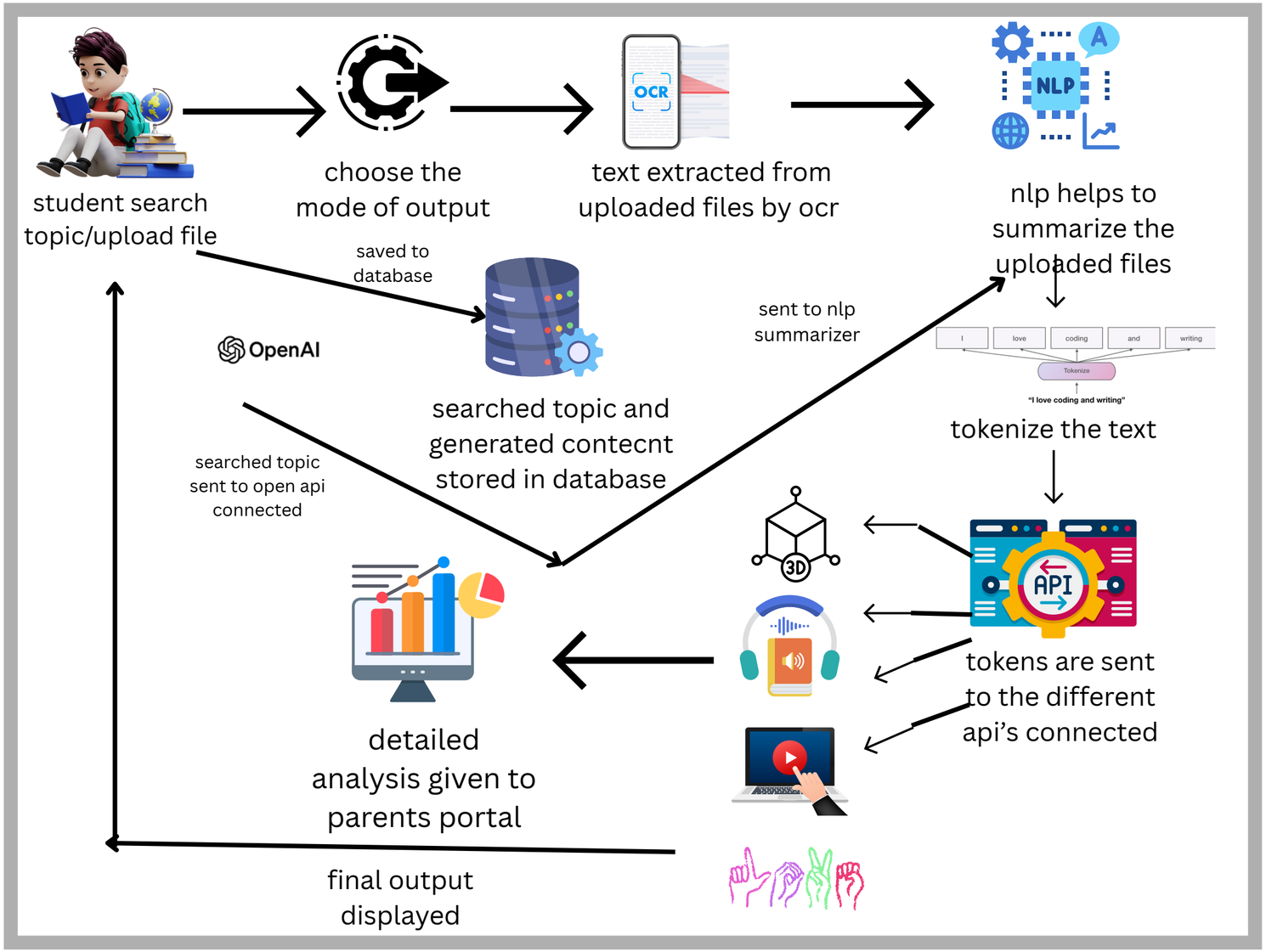
EduBridge is an AI-powered inclusive learning platform that transforms textbooks and complex concepts into:

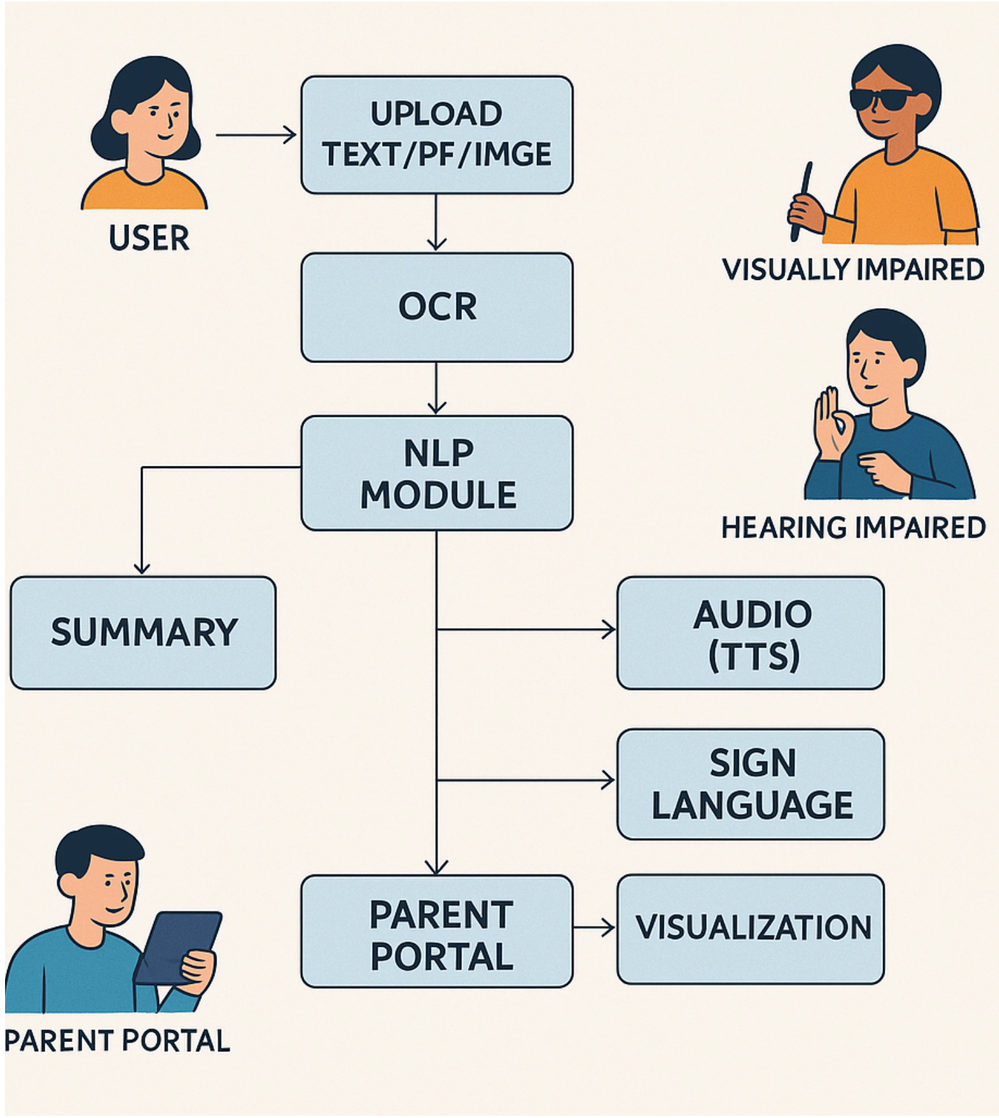
- **Explainable audio** for **blind students.**
- **Sign language videos** for **deaf students.**
- **Summarized content** using **NLP for quick understanding**.
- **3D visualizations, flowcharts, and animated videos** for **conceptual clarity**
- **Parent portal** with progress tracking, scanner-based login using unique ID
- The system uses a seamless UI to **upload documents and receive personalized learning output.**
- **Multiple language support** , helping students from different regions.
- Chatbot support for the users.

Innovation and Uniqueness

- ***Dual Accessibility:*** Supports both blind and deaf learners via explainable audio and sign language generation.
- ***Multi-format Learning:*** Converts raw text into visual animations, charts, and summaries.
- ***Personalized Dashboards:*** For students and parents to monitor learning.
- ***Real-Time OCR & NLP:*** Extracts, summarizes, and explains printed text.
- ***Voice-to-Explanation Engine:*** Users can upload voice recordings to get relevant topic explanations.
- ***E-Learning Platform:*** Helps students learn topics using interesting graphics.

Architecture And Workflow





TechStack

- **Frontend:** *React Native*
- **Backend:** Express.js/Nest.JS and Flask
- **NLPSummarization:** *HuggingFace Transformers / OpenAI*
- **TTS:** *Google TTS / Amazon Polly / pyttsx3*
- **Sign Video Generator:** *SignAll SDK / AvatarSign API*
- **Storage:** *Firebase / MongoDB*

Scalability & Real-World Impact

Our inclusive educational platform is designed to adapt and grow seamlessly across multiple domains. Here's how it scales and impacts the real world:

✅ 1. **Inclusive Education at Scale**

- Blind Students: Explainer audio with enriched context, auto-pause/play based on interaction.
- Deaf Students: Auto-translated sign language videos from text using AI/ML models.
- Normal Students: Flowcharts, 3D visualizations, and summarized content boost understanding.

✅ 2. **Parent Portal & Monitoring System**

- Enables parents/guardians to track student progress.
- Generates reports and recommends personalized learning paths.
- Supports multi-child accounts under one guardian profile.

✅ 3. **Personal QR & Scanner-Based Access**

- Every student gets a unique QR code.
- Use scanner for quick access to personalized dashboard, reports, or topic summary.
- Works anytime, anywhere for flexibility and independence.

✅ 4. **Cross-Language Support**

- Content can be adapted into regional languages to ensure local accessibility.
- Audio and visual content will be translated via multilingual NLP models.

✅ 5. **Integration with Schools and Institutions**

- Compatible with Learning Management Systems (LMS).
- APIs allow schools to plug-in content, monitor student usage, and receive progress analytics.

✅ 6. **Offline Access for Rural Areas**

- Downloadable content modules with audio/sign language support.
- Enables access in low-connectivity or remote zones where internet is a challenge.
- Let me know if you want me to convert this into a slide format or insert it directly into your presentation.

Anticipated Challenges

- Lack of large datasets for text-to-sign translation.
- Generating natural and context-aware audio explanations.
- Smooth UX on low-end devices and in low-connectivity areas.
- Synchronizing real-time feedback to parent portals.

- Rendering visual animations without overloading the client side.

- Building accurate and real-time sign language translation for varied topics using AI requires large datasets and precise gesture mapping, which can be computationally intensive.

- Ensuring that NLP models generate meaningful and educationally accurate summaries without losing core concepts remains a challenge.

Research Work & Supporting Studies

🎓 *Inclusive Education Needs*

According to the UNESCO Institute for Statistics, nearly 93 million children worldwide live with disabilities, and most face barriers to quality education due to lack of inclusive content.
A report by World Bank (2021) emphasized the importance of assistive technologies, recommending audio and sign language tools to bridge educational gaps.

📊 **Effectiveness of Visual & Audio Learning**

A study published in the Journal of Educational Psychology found that students retain 65% more information through multimodal learning (visual + audio) compared to traditional text-based methods.
Research from Harvard Graduate School of Education shows that audio explanations increase comprehension for students with learning disabilities by up to 40%.

🤖 *Sign Language via AI*

Projects like SignAll and Google's AI for Accessibility have proven the viability of AI-powered sign language interpreters using computer vision and NLP.
Open datasets like RWTH-PHOENIX-Weather 2014T are now being used for training deep learning models for real-time sign language generation.

🌐 *Global Push for EdTech Accessibility*

The Global Education Monitoring Report (UNESCO, 2020) advocates for universal access through digital transformation in education, especially for differently-abled learners.
AI in EdTech is projected to reach a market size of $25.7 billion by 2030, indicating both feasibility and need for scalable, intelligent education platforms.

Related Links And Demos

Frontend Link - Get a view of the UI

Backend Link - Get a View of the backend work in the postman

Important note

We have insufficient funds and the integration of api's we face difficulty in output after integrating all the frontend and backend so we have made the demo videos of our work along with the code base we have shared the github link (In the first page of the ppt).