ShikshaNetra — Final Project Report

🎓 *AI-Driven Mentor Evaluation Using Multimodal Analysis & Generative AI*

(Problem Statement: PS2 – Mentor Scoring AI)

1. Executive Summary

✨ **ShikshaNetra** is an AI-powered platform designed to **objectively, fairly, and scalably evaluate teaching performance** using recorded instructional videos. Unlike traditional mentor evaluation systems that rely heavily on subjective human judgment, ShikshaNetra leverages **multimodal artificial intelligence (audio, video, and text)** combined with a **fairness-first bias correction layer** and **LLM-based coaching feedback**.

🚀 The platform delivers:

- 📊 Standardized performance scores
- 🧠 Personalized AI-generated feedback
- 📈 Visual insights for continuous mentor improvement

ShikshaNetra is built to support **institutions, EdTech platforms, and training organizations** at scale.

2. Problem Statement

Current mentor evaluation methods face multiple challenges:

❌ Subjective and inconsistent human judgment
❌ No standardized scoring framework
❌ Accent and language bias (especially in Indian contexts)
❌ Inability to track engagement, emotion, gestures, and interaction
❌ Generic feedback without actionable guidance

⚠️ These issues make existing systems **unfair, inaccurate, and difficult to scale**.

3. Proposed Solution

✅ ShikshaNetra introduces a **fully automated AI-driven evaluation pipeline** that:

🎥 Accepts recorded teaching videos
📢 Analyzes audio clarity, confidence, and fluency
🎭 Evaluates engagement through facial expressions and gestures
📖 Measures technical depth and topic relevance from transcripts
⚖️ Applies fairness and bias correction
🤖 Generates AI-based coaching feedback
📊 Visualizes results on an interactive dashboard

4. Multimodal AI Architecture

📢 Audio Analysis

- 🎙️ Whisper V3 for speech-to-text
- 📐 Librosa for fluency, pauses, fillers
- 🔍 PyAnnote for speaker diarization
- 📈 Confidence and tone stability scoring

🎥 Video Analysis

- 🖼️ OpenCV for frame extraction
- 👁️ MediaPipe for eye contact and gesture tracking
- 😊 FER / DeepFace for emotion recognition
- 📊 Engagement scoring from visual cues

📖 Text & NLP Analysis

- 🧩 Transformer / BERT-based models
- ✓ Concept correctness & technical depth validation
- 🧠 Topic relevance and interaction analysis

5. Fairness & Bias Correction (Key Differentiator)

🌍 ShikshaNetra is built with a **fairness-first philosophy**:

- 🗣️ Accent normalization using SpeechBrain LID
- 🎵 Pitch and linguistic normalization
- 👥 Demographic calibration across regions and languages

✅ Mentors are evaluated on **teaching quality**, not accent or speaking style.

6. Scoring & Generative AI Feedback

🔢 Scoring Engine

A weighted fusion model generates **0–100 scores** for:

- 🖍️ Clarity
- 💪 Confidence
- 🎯 Engagement
- 📘 Technical Depth
- 🤝 Interaction

🤖 AI Coach Feedback

Using advanced LLMs (GPT-5 / Gemini-2.5-pro), the system provides:

- 📝 Personalized improvement tips
- 🧭 Teaching style explanation
- 🌐 Multilingual summaries
- 🎯 Actionable coaching insights

7. Memory-Aware & Scalable Design

Inspired by large AI systems, ShikshaNetra uses **multi-level memory**:

⏱️ Batch-level (minute-wise) analysis

🗂️ Session summaries (short-term memory)

👤 Teacher profiles (long-term trends)

⚡ Cached computations for performance

🚀 This enables:

- Faster processing
- Progress tracking across sessions
- Personalized feedback over time

8. Frontend & User Experience

🛠️ Technology Stack

- ⚛️ Next.js 14 (App Router)
- 🟦 TypeScript
- 🎨 Tailwind CSS
- 📊 Chart.js

🎯 Key UX Features

- 🔐 Auth-based navigation
- ⏳ Progressive analysis status indicator
- 📡 Timeline & radar charts
- 🔄 Session comparison (↑ ↓ → trends)
- 🧩 Insight-first reports
- 🎬 Secure video playback

The UI is designed to feel calm, fast, and coach-like, similar to modern AI assistants.

9. Backend & ML Infrastructure

🔧 Backend

- 🧠 Next.js API routes
- 🗄️ MongoDB
- 🔐 JWT authentication
- ☁️ Supabase storage

🤖 ML Service

- 🐍 Python FastAPI microservice
- 🔬 Modular AI processors
- 🧠 LLM-powered feedback engine

✅ Fully deployment-ready using cloud infrastructure.

10. Challenges & Mitigation

⚠️ Challenge	✅ Mitigation
Accent & language bias	Fairness normalization
Subjective scoring	Multimodal metrics
Technical correctness	Transformer validation
Latency	Batch processing & caching
Privacy	Secure storage & minimal retention
Scalability	Stateless APIs & workers

11. Impact & Use Cases

🏫 Educational institutions
📚 EdTech platforms
🎓 Training & mentorship programs
👩‍🏫 Individual mentors

📈 Enables **measurable teaching improvement** and **fair evaluation at scale**.

12. Roadmap

- 🔹 Phase 1: Core multimodal AI pipeline
- 🔹 Phase 2: Fairness & explainable metrics
- 🔹 Phase 3: Generative AI coaching
- 🔹 Phase 4: Conversational AI mentor coach
- 🔹 Phase 5: Institution-level scaling

13. Team Contributions

👨‍💻 **Frontend & UI/UX —** Vikas Saini

🤖 **AI & Model Development —** Asmit Yadav

⚙️ **Backend & Integration —** Om Jha

📚 **Research & System Design —** Mudit Chourasiya

14. Conclusion

✨ ShikshaNetra is not just a scoring tool — it is an **AI-powered mentor improvement system**. By combining **multimodal intelligence**, **fairness-first evaluation**, and **human-like coaching feedback**, it offers a **practical, ethical, and scalable solution** to modern educational assessment.

🏆 **Technically robust, socially relevant, and deployment-ready**, ShikshaNetra stands as a strong contender for top recognition in competitive innovation challenges.