Project Documentation

Conversational AI for Education (Metterian) - Hindi

A GPT-2 based chatbot for Hindi learners with voice recognition, quizzes, and speaking practice.

1. Project Overview

This project aims to build a Conversational AI chatbot to support Hindi language learners by enabling interactive conversation, quizzes, and speaking practice. The chatbot leverages pretrained GPT-2 for natural language generation, integrates speech recognition for spoken inputs, and provides text-to-speech for responses.

2. Objectives

- Develop an AI-powered educational assistant for Hindi learners.
- Provide real-time interaction via text and voice.
- Enhance speaking and comprehension skills with practice sessions.
- Integrate quiz-based learning for grammar and vocabulary.
- Make the chatbot accessible across devices.

3. Technologies Used

- Python 3.9+ - Core programming language
- PyTorch / TensorFlow - Framework for GPT-2 fine-tuning
- Hugging Face Transformers - Pretrained GPT-2 model & tokenizer
- SpeechRecognition - Voice input (speech-to-text)
- gTTS / pyttsx3 - Text-to-speech output (supports Hindi TTS)
- Flask / FastAPI - Backend API for chatbot service
- React.js / Streamlit - Frontend user interface
- SQLite / Firebase - User data & quiz score storage
- Docker - Containerization for deployment
- Heroku / AWS / GCP - Cloud hosting for production

4. System Architecture

Workflow:
1. User Input (Text or Speech in Hindi)
2. Preprocessing (Tokenization & cleaning, Hindi script handling)
3. GPT-2 generates response in Hindi
4. Post-processing
5. Output (Text + Hindi TTS)
6. Database Update (Logs, quiz scores, progress)

5. Step-by-Step Guide

1. Step 1: Environment Setup (Python virtual environment, install dependencies)
2. Step 2: Load GPT-2 Model fine-tuned for Hindi or multilingual support
3. Step 3: Add Speech-to-Text functionality (Google STT or IndicSTT for Hindi)
4. Step 4: Add Text-to-Speech functionality (gTTS with Hindi language support)
5. Step 5: Integrate Quiz Module (Hindi vocabulary and grammar questions)
6. Step 6: Build UI (Streamlit / React.js frontend with Hindi font support)
7. Step 7: Deploy (Docker, Heroku/AWS/GCP)

6. Features Implemented

- Conversational chatbot using GPT-2 (Hindi support)
- Text & voice input supported in Hindi
- Text-to-speech response output in Hindi
- Vocabulary & grammar quiz module (Hindi)
- Progress tracking & database logging
- User-friendly interface with Hindi fonts

7. Process & Methodology

- Requirement Analysis – Defined use cases for Hindi learners.
- Model Selection – Chose GPT-2/multilingual GPT-2 for fluency in Hindi.
- Integration – Combined GPT-2 with STT (SpeechRecognition) & TTS (gTTS Hindi).
- Quiz Development – Designed Hindi vocabulary and grammar MCQ quizzes.
- Testing & Evaluation – Conducted user testing for fluency & accuracy in Hindi.
- Deployment – Packaged chatbot for web/mobile use.

8. Limitations

- GPT-2 has limited context (short memory).
- May produce grammatically incorrect or irrelevant answers sometimes.
- Speech recognition for Hindi may have accuracy issues depending on accent.
- Quiz database currently limited in scope.

9. Next Steps / Future Work

- Fine-tune GPT-2 on Hindi learning datasets (NCERT, Hindi textbooks).
- Add IndicBERT or multilingual BERT for grammar correction.
- Enhance quiz variety: listening, comprehension, speaking tasks in Hindi.
- Build mobile app version (React Native / Flutter with Hindi UI).
- Integrate personalized learning paths (AI tracks weak areas).
- Upgrade to GPT-3.5 / GPT-4 with multilingual capabilities for better fluency.