



BTP-2 :Grammar Language Modeling for Automated Educational Assessment

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Objective

Develop a robust grammar checker application powered by machine learning, designed to support educational institutions in enhancing students' grammatical proficiency and speech pronunciation.

Key Features

- **Automated Grammar Evaluation with MCQ-Based Assessments:** The app includes multiple-choice questions (MCQs) that assess students' grammar skills by requiring them to pronounce complete sentences, filling in blank spaces.
- **Jumbled Sentence Exercises for Grammar Checking and Learning:** Students are presented with a set of jumbled words to rearrange into a grammatically correct sentence.
- **Speech Pronunciation Assessment:** After sentence formation, users pronounce the rearranged sentence, and the app provides real-time feedback based on pronunciation accuracy.
- **Feedback Mechanism:** The app identifies grammatical mistakes and pronunciation issues, offering specific, actionable feedback to support student improvement.

Progress Since Mid-Evaluation

Completed Features:

- **Jumbled Sentence Exercise:**

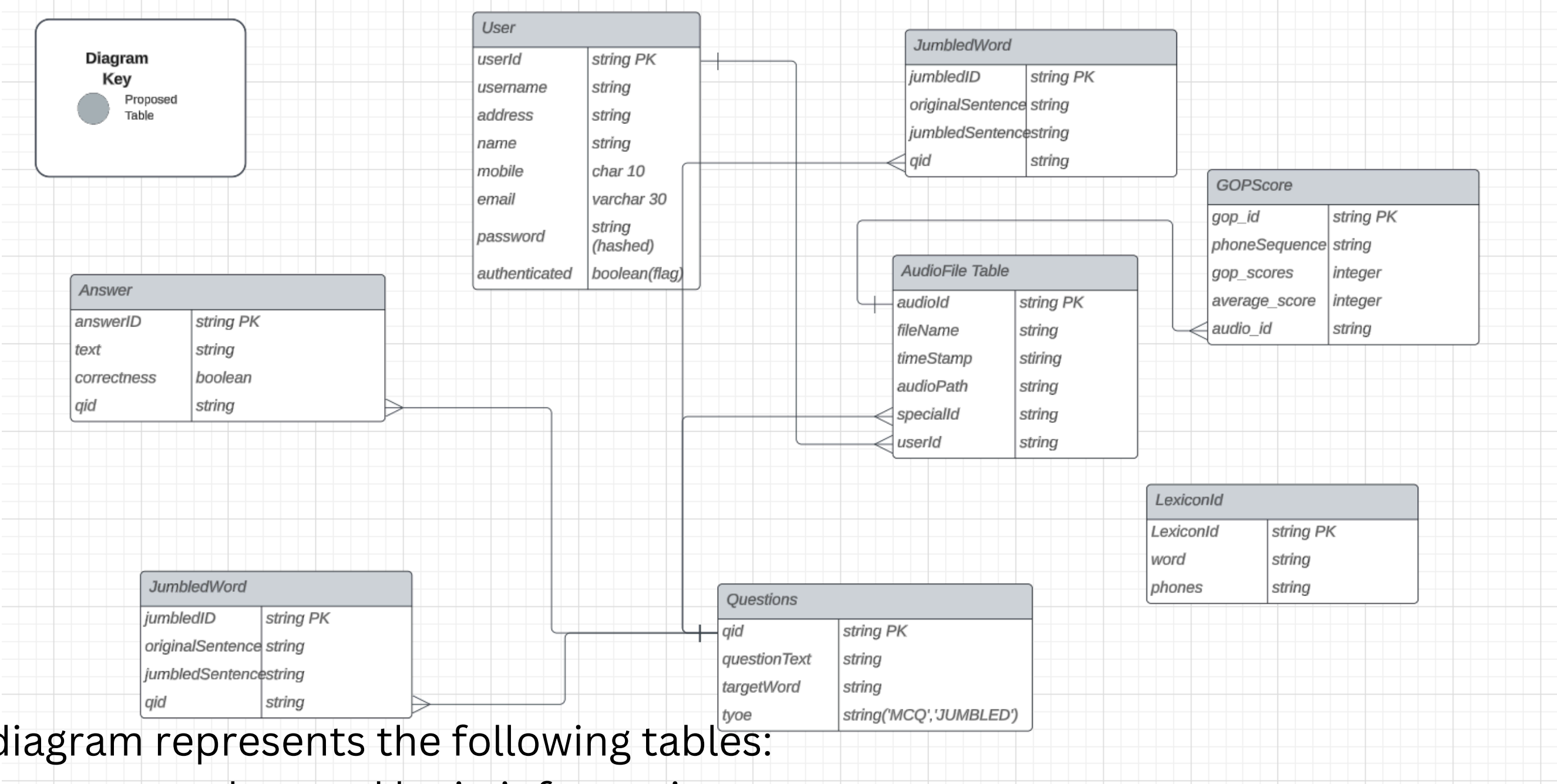
- Added functionality for sentence formation, where students view a jumbled sentence and must rearrange and pronounce it in the correct order.
- Example: A sentence like "on / sat / mat / the / the / cat" is rearranged and pronounced as "The cat sat on the mat."

- **Speech Processing Integration:**

- Incorporated Goodness of Pronunciation (GoP) scores to validate spoken sentences against target sentences, assessing pronunciation accuracy.
- **GOP Extraction Functionality:** A custom function `extract_word_gops` calculates per-word GoP scores using Kaldi's phoneme alignments.
- **Validation Logic:** Sentences are validated by analyzing each word's GoP score, with a minimum threshold of 8.5 for pronunciation accuracy.

- **UI & Feature Enhancements:**
 - Navbar and UI Improvements: The application now includes a responsive Navbar and an enhanced login page UI, providing a smoother, more user-friendly experience.
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- **ER Diagram Addition:**
 - An ER diagram has been added to illustrate the application's database structure and relationships for future modifications.
- **Enhanced Model and Data Processing:**
 - Integrated Kaldi for speech processing to enable precise pronunciation assessment.
 - Developed functions to calculate GoP scores for jumbled sentences, ensuring the correct order and pronunciation of words.
- **Backend Enhancements:**
 - **Data Folder Creation** - The system dynamically organizes audio files and transcriptions for each question, ensuring efficient data management.
 - **Audio Processing** - Utilizes ffmpeg for converting uploaded audio into a WAV format compatible with Kaldi for processing.
 - **API Endpoints** - Two FastAPI endpoints handle the jumbled sentence assessment, including file upload and question processing.

Proposed ER Diagram



The proposed ER diagram represents the following tables:

- **User Table:** Manages user data and login information.
- **AudioFile Table:** Stores the uploaded audio files and links them to specific questions.
- **Question Table:** Contains details of all questions, including type (Jumbled or MCQ) and the correct answer.
- **Answer Table:** Holds the provided answers and their correctness.
- **JumbledWord Table:** Stores jumbled and correct sentences.
- **GOPScore Table:** Keeps track of GoP scores for pronunciation checks.

Technical Challenges and Solutions

- **Challenge:** Achieving Accurate Pronunciation Assessment with GoP Scores
- **Solution:** Developed an algorithm that calculates GoP scores at the phoneme level, improving accuracy through lexicon-based phoneme matching.

- **Challenge:** Managing Diverse Audio Formats and Ensuring Consistent File Structure
- **Solution:** Automated audio conversion and dynamically organized data directories to ensure consistent and efficient processing.

- **Challenge:** Handling Variability in User Pronunciation
- **Solution:** Implemented threshold adjustments and flexible phoneme matching to account for accent variations and pronunciation differences among users

- **Challenge:** Balancing Real-Time Feedback with System Performance
- **Solution:** Optimized the speech processing pipeline to reduce latency by streamlining the GOP extraction process and preloading essential model data.

Conclusion

- The Grammar Checker Application has evolved into a comprehensive tool for students to practice and improve their grammar and pronunciation.
- We aim to continue refining the app for broader adoption in educational environments, offering students an effective learning tool that bridges grammatical knowledge and speech proficiency.

Code –

https://iiitaphyd-my.sharepoint.com/:u:/g/personal/ishit_bansal_students_iiit_ac_in/EdjOB97GIJpDtwkgZWmgAGABMTM4Ku8bkQMP7TKCR7CnDA?e=ObfCtt

Presentation –

https://iiitaphyd-my.sharepoint.com/:v:/g/personal/ishit_bansal_students_iiit_ac_in/EdR44IptwPdJjrraChns9TQBACUxb8ELtsaqVhH14YOOIA?referrer=Outlook.Web&referrerScenario=email-linkwithembed



THANKS

FOR YOUR ATTENTION

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