

Reading Aid for Individuals with Learning Disabilities Using Text to Speech Technology

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Abstract: This project centers on the development of a web-based platform aimed at enhancing accessibility for individuals with specific needs by integrating two key functionalities: a text-to-speech (TTS) feature for individuals with dyslexia and a hearing ability assessment tool. Dyslexia is a prevalent learning disability that impacts a person's ability to read, spell, and process written information. To address this, the TTS functionality allows users to input or paste reading materials into the website, which are then converted into spoken audio. This assists individuals with dyslexia by reducing the cognitive load associated with reading, thus improving comprehension and overall access to information. The TTS tool supports multiple text formats and offers customizable settings such as speech speed, voice selection, and language preference to accommodate diverse user needs.

In addition to the TTS feature, the platform includes a hearing ability assessment tool designed to raise awareness of auditory health. This tool provides a series of interactive, audio-based tests that evaluate various aspects of a user's hearing, including their ability to detect different frequency ranges. By integrating both accessibility and health assessment tools into a single, user-friendly platform, the project promotes inclusivity and empowers individuals with dyslexia or potential hearing impairments. Personalized settings and an intuitive interface ensure that users can navigate the platform with ease, encouraging independence and improving quality of life for people with specific needs.

Index Terms - dyslexia, text-to-speech, hearing assessment, accessibility.

I. INTRODUCTION

In today's digital age, accessibility is a critical factor in ensuring that individuals with disabilities can engage with information effectively. Among these, learning disabilities such as dyslexia and hearing impairments significantly impact a person's ability to read, comprehend, and interact with digital content. Dyslexia affects a person's ability to read fluently, recognize words, and process written text, while hearing impairments make it difficult to perceive auditory information, affecting communication and learning. To address these challenges, assistive technologies play a crucial role in enhancing accessibility. One such technology is Text-to-Speech (TTS), which converts written text into spoken words, helping individuals with dyslexia understand content more easily. Additionally, hearing assessment tools can assist users in identifying potential hearing difficulties at an early stage, allowing them to seek medical intervention when necessary.

This project, "Reading Aid for Individuals with Learning Disabilities Using Text-to-Speech Technology," aims to develop a web-based platform that integrates both TTS and a Hearing Ability Assessment tool. The platform enables users to: Convert text into speech in both Hindi and English, allowing better comprehension for individuals with learning disabilities. Conduct a self-assessed hearing test by playing different sound frequencies (250Hz to 4000Hz) and determining if the user can hear them. Based on their responses, the system suggests whether they should consult a doctor. By providing an easy-to-use, interactive, and web-based solution, this project aims to bridge the accessibility gap for individuals with learning disabilities and hearing impairments. The system will serve as a cost-effective, preliminary screening tool while also enhancing the reading experience for users who struggle with text-based content.

II. LITERATURE REVIEW

[1] This base paper discusses an advanced system that uses Natural Language Processing (NLP) to perform Text-to-Speech (TTS) and Speech-to-Text (STT) conversion. The system is designed to better understand the meaning and context of language, which helps it produce more natural-sounding speech and accurate transcription of spoken words.

[2] This paper introduces a novel approach to Text-to-Speech (TTS) synthesis that incorporates lip synchronization to enhance the realism of generated speech in video content. The proposed method focuses on aligning textual input with corresponding video frames to ensure that the synthesized speech matches the lip movements of the speaker in the video

[3] This paper explores how Text-To-Speech (TTS) tools, especially online services like iSpeech, can be used to create customized listening materials for teaching English. Teachers input text into the tool, select voice options (male/female, UK/US accents), and generate audio files. These can be played in class or shared with students for flexible learning. The author highlights that this method helps students improve their listening and pronunciation skills and also allows teachers to create materials suited to different learning needs.

[4] This study explored whether text-to-speech (TTS) technology can help students—especially those with dyslexia—stay focused while reading. Mind wandering is when a student's thoughts drift away from the reading task, which often reduces their understanding of the text. The study included both dyslexic and typically developing students. They were asked to read content in two ways: silently at their own pace, and with TTS support. The researchers found that when using TTS, both groups had better reading comprehension and were less distracted. Students with dyslexia, in particular, showed a noticeable improvement—they paid more attention and understood the content better when TTS was used. This suggests TTS can help reduce cognitive load and support students with learning difficulties by keeping them engaged.

[5] This study explored how Text-to-Speech (TTS) technology helps dyslexic children improve their reading-related skills. Over 10 weeks, researchers used a specially designed TTS learning module to support phonemic awareness (understanding sounds in words) and orthographic knowledge (understanding how words are written). Students who used TTS showed significant improvement compared to those who received only traditional lessons. The research confirms that TTS is effective for language learning and can help overcome difficulties related to dyslexia. This study strongly supports our project's goal by proving that TTS can improve learning outcomes for students with disabilities, especially in reading and writing skills.

[6] This paper introduces a system designed to assist blind individuals by converting visible text into speech. A camera mounted on spectacles captures images, and an algorithm called EAST (Efficient and Accurate Scene Text Detector) detects the text within them. Then, Tesseract OCR is used to recognize the text, which is finally read aloud using the pyttsx3 text-to-speech engine. The paper also explores enhancements through a modified EAST model to improve detection accuracy. Although our project targets users with learning and hearing difficulties rather than visual impairments, this study highlights how combining text detection and TTS can significantly improve accessibility. It showcases the practical applications of TTS for real-world needs.

III. PROBLEM STATEMENT

Many individuals with dyslexia struggle with reading comprehension. Existing Text-to-Speech (TTS) tools are often complex and not user friendly. Hearing impairments often go undiagnosed due to a lack of accessible testing. People need to visit a clinic for a proper hearing assessment, which may not always be convenient. There is a need for a simple, web-based tool that integrates TTS and hearing assessment for better accessibility.

IV. PROPOSED SYSTEM

User friendly interface - Simple and intuitive design for easy navigation.
Clear and understandable voice - This feature helps individuals with dyslexia access information more efficiently, reducing the cognitive strain associated with reading and enhancing their overall comprehension.
Multi language support - Potential to include multiple languages for diverse users.
Hearing test with different audio frequencies - Uses different sound frequencies to assess hearing ability.

Web based and accessible - No installation required. Accessible on multiple devices.

[3.1] MODULE DESCRIPTION

Module description outlines the various components or modules of the system and their functionalities. **READING AID FOR INDIVIDUALS WITH LEARNING DISABILITIES USING TEXT TO SPEECH TECHNOLOGY** mainly has 5 modules which describe the site completely. These modules are the main fundamental features of this system. The modules are:

1. Overview Page Module
2. Text-to-Speech (TTS) Module
3. Hearing Ability Assessment Module:
4. User Setting and Customization Module
5. Results & Reports Module:

1. OVERVIEW PAGE MODULE

This is the main entry point where users can choose between two core functionalities: Text-to-Speech (TTS) or Hearing Ability Test. It provides a simple and accessible user interface with two clearly labeled buttons leading to their respective features.

2. TEXT TO SPEECH (TTS) MODULE

Allows users to input or paste text that will be converted into speech. It supports multiple text formats and customization options such as speech speed, voice selection, and language preferences. It includes a play, pause, and stop button for user control. It also allows users to browse for files they want converted to TTS.

3. HEARING ABILITY ASSESSMENT MODULE

This provides interactive audio-based hearing tests to evaluate the user's hearing capabilities. Includes tests such as frequency range detection and tone differentiation. Offers recommendations based on results, such as consulting a specialist if hearing issues are detected. Displays test results to help users assess their auditory health.

4. USER SETTING AND CUSTOMIZATION MODULE

Allows users to personalize their experience by adjusting speech settings, language preferences, and test parameters. Provides accessibility options such as dyslexia-friendly fonts, high-contrast themes, and text size adjustments and saves user preferences for future visits.

5. RESULTS & REPORTS MODULE

Stores and displays past hearing test results for users who want to track changes over time. Gives insights and recommendations based on test performance.

V. RESULTS AND DISCUSSION

The results show that a web-based assistive tool combining TTS and hearing evaluation has strong potential in educational and healthcare settings. While it does not replace professional diagnosis, the system offers a valuable preliminary aid. Its accessibility via browser also makes it usable on a wide range of devices. Further improvements such as AI support, and detailed hearing analytics can enhance its reach and functionality.

The interface starts with a screen(fig-1). To explore the TTS feature click “Text-To-Speech”.

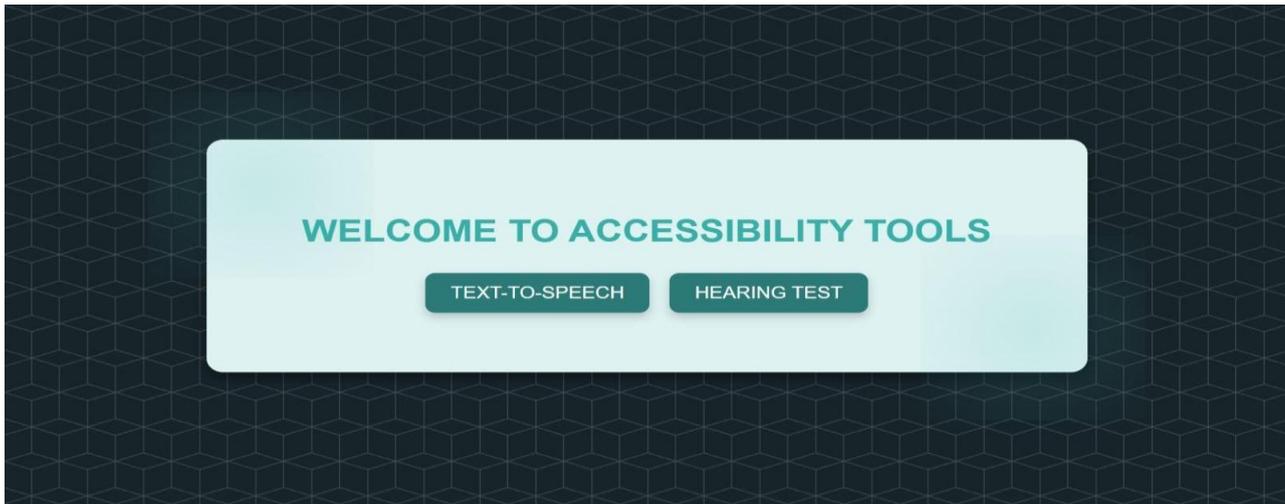


fig-1

It will take you to the Text-To-Speech page(fig-2). You may either copy and paste the text or upload a file that you would like to convert into a Text-to-Speech format. You can also choose the language you want converted to speech."

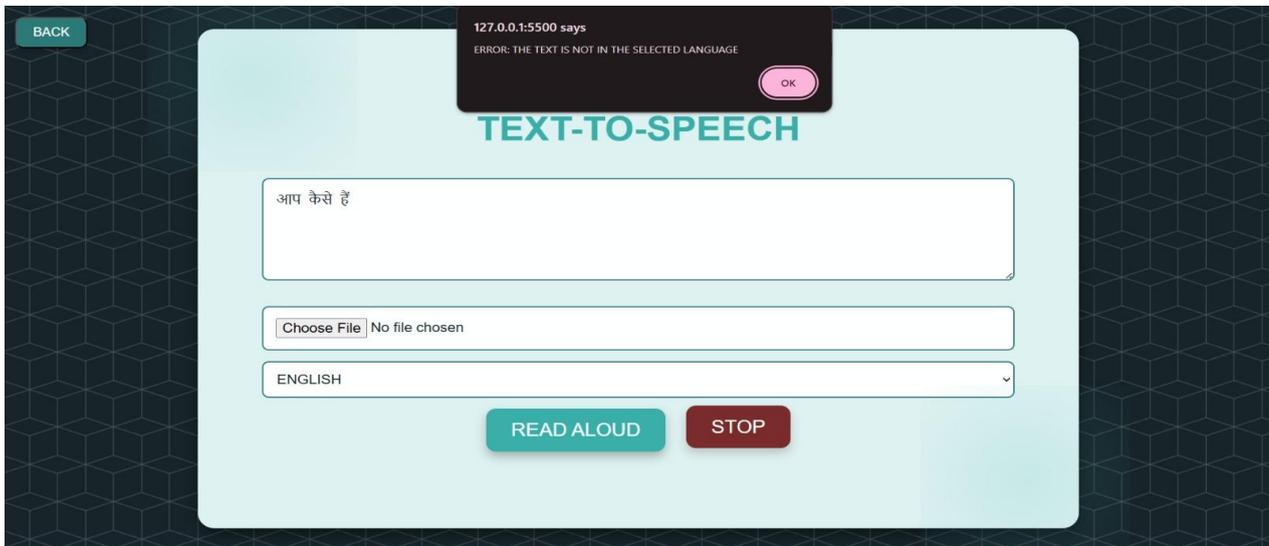


fig-2

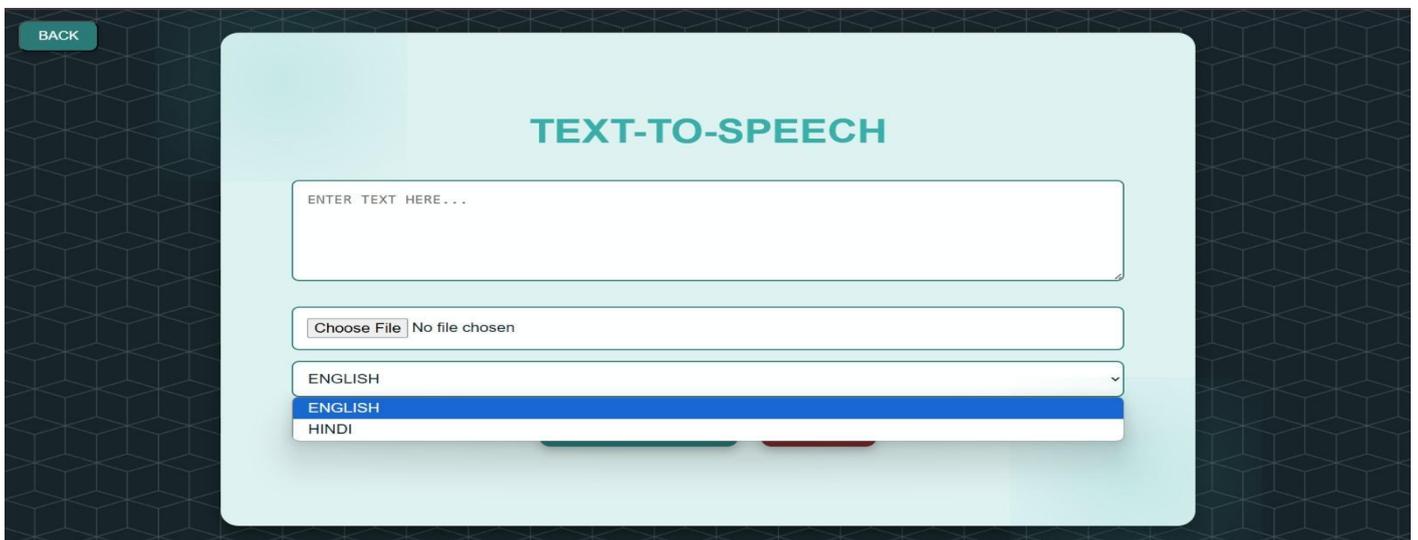


fig-3

To return to the homepage, click the 'Back' button. Then, select the 'Hearing Test' option to begin the hearing ability assessment, during which a series of frequencies at varying volumes will be played.(fig-4)

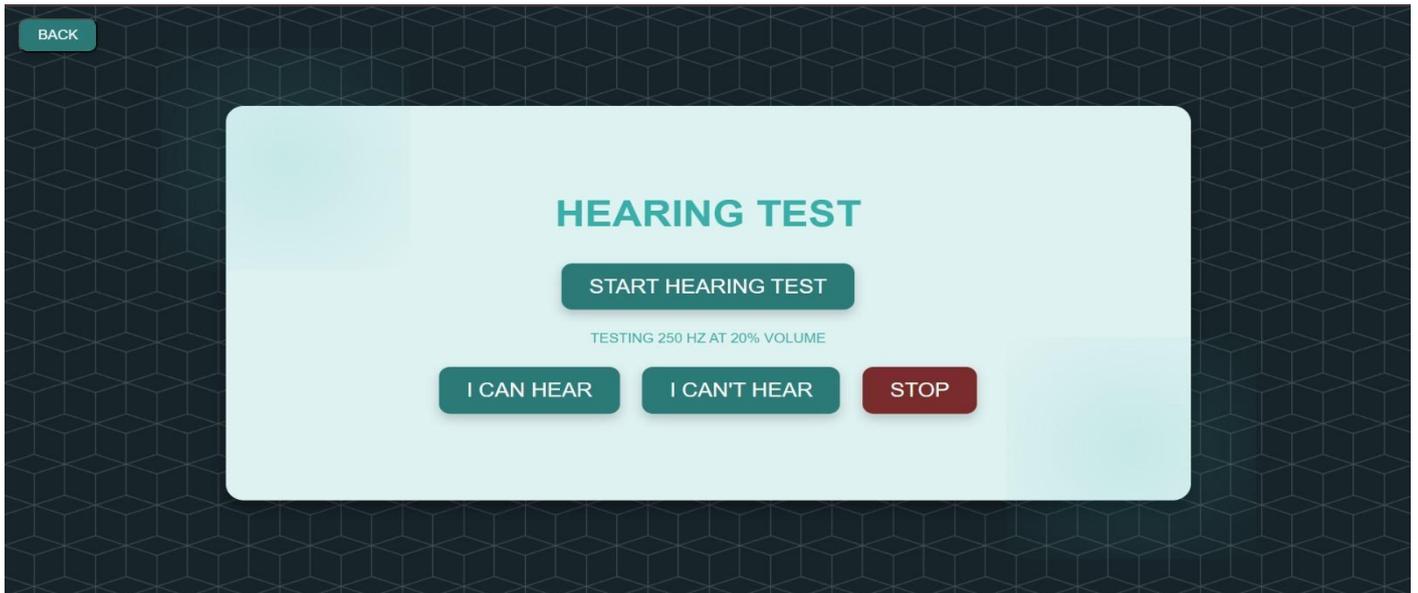


Fig-4

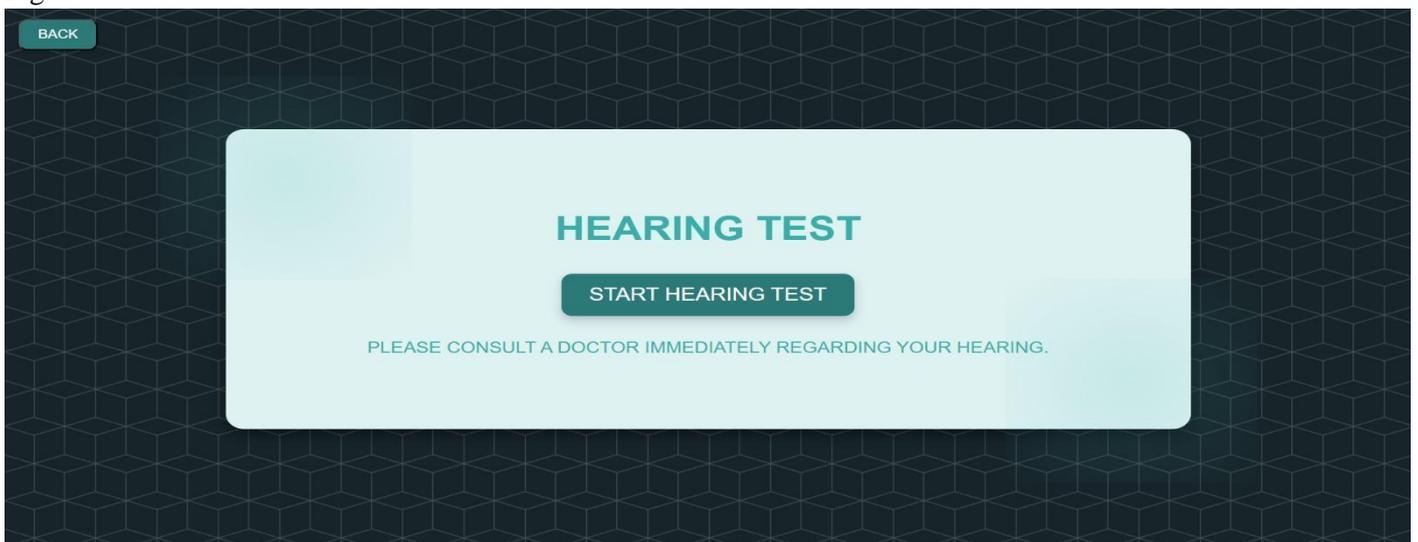


fig-5

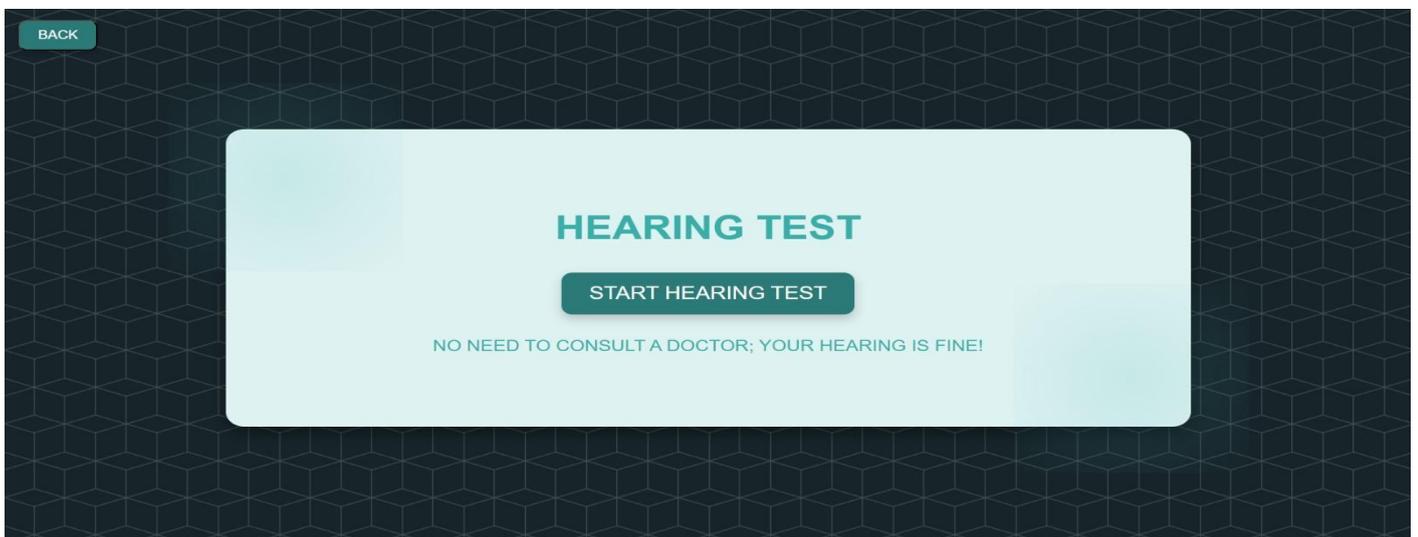


Fig-6

VI. CONCLUSION

"Reading Aid for Individuals with Learning Disabilities Using Text-to-Speech Technology", was developed to support individuals who face challenges in reading and hearing. The platform is designed as a user-friendly web application that requires no backend or installation, making it easily accessible on any device. It offers two key features: a Text-to-Speech (TTS) system that converts English or Hindi text files into spoken audio, and a Hearing Assessment Tool that plays specific frequencies (250 Hz to 4000 Hz) to help users self-assess their hearing capabilities. If a user is unable to hear a frequency even at full volume, the tool advises a medical consultation. The TTS function makes reading more accessible by allowing users to listen to the content rather than struggle with visual text. The hearing test provides a simple, at-home method for identifying potential hearing issues, eliminating the need for immediate clinic visits. Overall, the project highlights the value of assistive technology in enhancing learning and accessibility for individuals with special needs. It shows how simple yet thoughtful tools can make a meaningful difference in improving the quality of life for those with learning or hearing difficulties

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