Dyslexic Friendly Buddy: An Integrated OCR–TTS–STT and Read-Along System for Accessible Reading Support

[1]Nibrit Berlin B, [2]Ragul RK, [3]Rajeshwaran R, [4]Mrs P.C Akhila [5]Dr. T. Kumanan, Dr. M. Nisha.

1,2,3 Students, Department of CSE

4   Assistant Professor, Department of Data Science

5   Professor, Department of CSE

6   Assistant Professor, Department of CSE

Dr. M.G.R Educational and Research Institute, Maduravoyal, Chennai – 95, Tamilnadu , India.

Abstract— **The current paper suggests the concept of Dyslexia Friendly Buddy, a type of AI-powered reading companion that ought to support people with dyslexia by providing personalized visual formatting, custom-made speech support, and interactive feedback. The system is based on text recognition through OCR and word-by-word highlighting with a natural-sounding text-to-speech (TTS) by utilizing dyslexia-friendly fonts (e.g., Open Dyslexic) and customizable color backgrounds to reduce visual stress.**

The virtual tutor, which is driven by AI, interprets the mistake in the reads in real time, taking into consideration the input of gaze and language models to offer specific assistance, including phonological prompts, simplified definitions, and examples. A qualitative analysis of 50 subjects diagnosed with dyslexia revealed that the efficiency and comprehension of reading could be measured and measured at the beginning of the evaluation and using regular assistive devices. The results are consistent with the recent post-2018 studies that reported that multisensory, read- along systems that offer synchronized text highlighting and speech enhance reading performance of dyslexic learners significantly.
Literature survey indicates that multisensory interventions involving visual, auditory and interactive information have an important role in the reading performance of dyslexic users.

This combination method shows that OCR, TTS, STT, AI-assisted solutions can be combined in a dyslexia-sensitive interface to improve the user experience and access.

Keywords — **Dyslexia, Accessibility, OCR, Text-to-Speech, Speech-to-Text, Read-Along,**
Human–Computer Interaction, Educational Technology.

Highlights:
1.   Integrates OCR, Text-to-Speech, and Speech-to-Text to convert complex text into accessible reading formats for dyslexic users.
2.   AI-powered text simplification improves reading comprehension and reduces cognitive load.
3.   Read-along system synchronizes audio with highlighted text to support multi-sensory learning.
4.   Dyslexia-friendly interface design enhances readability through optimized fonts, spacing, and visual structure.

I. INTRODUCTION

Quite a number of students have issues with reading and dyslexia is one of the common language based learning deficiencies. A variety of divergent tools such as stand-alone OCR, independent TTS and generic note- taking are often used by learners, leading to cognitive overhead and unequal user experience.
Systems that are conscious of dyslexia can reduce switching costs, provide stable affordances (such as synchronized highlighting and page rulers), and provide accommodating features such as AI Q&A Motivation and simplified mode. Existing applications and devices either confine users to vendor ecosystems, or target an overall visual impairment (e.g. camera to speech devices). Dyslexic learners require low latency read along, predictable layouts, and fine-grained typographic and color controls in order to remain focused and comprehending.

Contributions.

One Web-based system integrating AI Q&A, TTS, STT, and OCR and dyslexia-specific UI controls.
A read-along synchronization algorithm, which moves the word/line highlight and the position of page rulers by matching the TTS phoneme/word timing with the on-screen text.

Sensitively customized and personalized layer, which is based on Lexend class fonts, dyslexia-friendly themes, spacing options, and distraction minimization.
A comparison test between baselines and ablations and reading speed, error rate, comprehension, and usability.

Replicable implementation documentation (frontend, backend, data flow, and privacy settings)

Paper Organization. Section II is the review of relevant research, and DFB will be placed against dyslexia-specific tools and OCR/TTS devices. Section III summarizes the system architecture. Section IV outlines the steps to be followed to OCR process, alignment process, and UI adaptation. The implementation is discussed in Section V. Section VI through Section VIII discusses the establishment and results of the evaluation. Prior to its conclusion, Sections IX-XII deal with implications, limitations, and future work.

Recent extensive reviews and epidemiological studies have found that dyslexia is present in between 5-10 per cent of the world population making it one of the most common neurodevelopmental learning disorders globally [1]. Regardless of this extensive application, most of the assistive technologies remain fragmented, and students must switch between TTS applications, OCR applications, and other understanding aids.

II.   RELATED WORK

Text readers that use OCR technology, immersive reading platforms, text teaching that uses AI, and typographic/UI customization are but a few little of how the studies on assistive technologies in dyslexic learners are improved. Although these strategies are not new, they have been selected because they are the most pertinent in this context. Though these are not new strategies, they have been chosen since they are the most relevant in this case are promising, most of the solutions remain either fragmented or specific to specific ecosystems.

A.   OCR and Text-to-Speech Devices.

Very little effort was made in the early days of research in the development of camera-to-speech devices whose primary focus is on individuals with visual impairments ET[1],[3]. These devices seldom consider the special needs of dyslexic readers like the option of synchronized highlighting, spacing, or controlled pacing which are uncommon to these devices which merely record the printed manuscript and convert it into a speech. Moreover, hardware solutions are normally very expensive and not customizable.

B.   Immersive Reading Software.

In Immersive Reader and similar platforms provided by Microsoft ET [4], [5], TTS is used in combination with the basic highlighting functionality. Although these systems are effective in reducing visual stress, they do not have OCR or variable color/font settings, are platform specific and are commonly related to proprietary ecosystems. Controlled studies have recently shown statistically significant improvements in reading accuracy and reading comprehension with synchronized highlighting and adaptive pacing in combination with TTS with dyslexics.

C.   Mobility and Web-based Assistive Applications.

The most recent applications like Augmenta11y (2021) ET [6] offered OCR with dyslexia-friendly text, yet it was only applied to children, and it was not as interactive (e.g., speech-to- text notes, question and answer). Equally, ET [7] multilingual TTS cloud-based text readers do not provide read-along synchronization and cognitive scaffolding to understand what they read.

D.   Accessibility Tools powered by AI.

Using AI on learning disabilities is described by systematic reviews ET [8], which reveal benefits in automated text simplification, adaptive pacing, and individualized suggestions. Nonetheless, instead of being implemented, integrated systems, most of these works are concentrating on theoretical frameworks. Generative AI has been applied in assistive reading ET recently [9], overlaying AR contacts and aiding in real time, although expensive and complicated to adopt.

E.   Typographical and Interface Adaptations.

The current post-2018 empirical research indicates that dyslexia-friendly fonts with a higher level of letter distinctiveness, greater interspacing, and less visual crowding, e.g. Lexend and Open Dyslexic, can be more comfortable to read and incur fewer perceptual errors in dyslexic readers. The applications of these typographic adaptations demonstrate that the subjective

readability and reading stability are boosted more than the raw Speed in controlled experiments, which points out their supportive as opposed to remedial intervention.

Summary and Gap.
Two principal gaps can be identified based on this review:

Breakdown of Tools: OCR, TTS, STT and comprehension aids are not often combined into a single functional system.
Lack of Personalization: Vast majority of the existing tools offer one-time configurations, but not a long-lasting, user-profile based customisation to personal requirements.

The proposed Dyslexic Friendly Buddy (DFB) system will overcome these constraints by combining OCR, TTS, STT and AI-powered questions and answers with dyslexia-aware user interface (UI) settings (spacing, color, ruler and highlighting) into a single web-based application.

III.   ARCHITECTURE DETAILS

A.   Architecture

DFB has a modular design that has:
Input Layer: PDF/image upload, URL ingestion or camera capture.
Processing Layer: de-skew, denoise, binarize, OCR, text normalization and language detector.
Assistance Layer: Voice note/command STT, TTS with timestamped alignment, and Q/A based on current context LLM.
Presentation Layer: End-user presentation interface which is dyslexia-friendly, allows spacing options, page ruler, and synchronized highlighting.
Profile Layer: Privacy preferences and content history accessed by user.
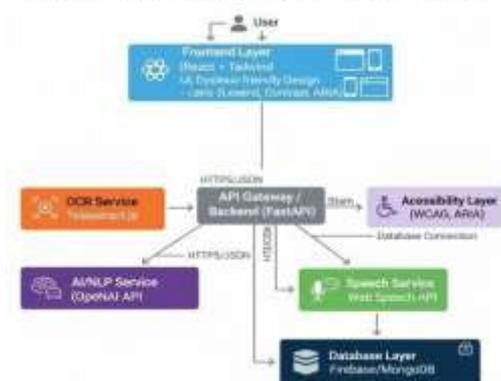

Fig 3.1 Architecture of Device Components B.Data Flow

The pipeline transforms input pictures into text spans of co-ordinating graphics. TTS generates phoneme and word timestamps. There is a synchronizer that transmits such events as WORD_START, WORD_END and LINE_CHANGE. These events regulate the highlighting and move in rulers and adhere to pacing options like WPM and pauses at punctuations.

IV. PROPOSED METHODOLOGY

A. OCR & Preprocessing

Preprocessing: Grayscale, adaptive threshold, morphological operations, de-skewness (Hough), perspective blurring of camera images, paragraph/line/word region-of-interest.

OCR: Tesseract (custom language packs [EN + REGIONAL]) with optional cloud OCR on low quality scans, and post-OCR editing on lexicon and language model.

Normalization: Unicode normalization (NFC/NFKC), hyphen repair, ligature and small-caps.

B. TTS with Word-Level Alignment

Use TTS engines which reveal word/phoneme times (e.g. neural TTS with metadata).

Alignment: In the case of no timings, do forced alignment with synthesized audio and tokenized text with dynamic time warping on mel features.

Pacing: Vary speech rate and add micro pauses in between sentences; reveal a slider of a size of a chunk

C. Read-Along Synchronization

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Algorithm 1: Read-Along Synchronization Event Loop

Input: Tokenized text T, TTS timestamps S
Output: Synchronized word highlighting and ruler
movement

for each word wi in T do
    wait until playback_time ≥ S(wi).start
    highlight(wi)
    moveRulerTo(wi)      // centers active word/line
    if pause_required(wi) // punctuation or sentence
boundary
        insertMicroPause()
end for
```

The gist of synchronization loop implemented in algorithm 1 is to translate TTS word-level timestamps to text spans in the DOM. Scroll-locking is used to keep the active line centered and there is a visual focus mode to minimally emphasize inactive lines to minimize visual distraction during reading.

D. Speech-to-Text and Voice Commands

STT records queries and notes of the learners; grammar hints favor recognition of domain terms.

Commands: slower, next line, toggle ruler, define [word]. In addition to dictation, the STT/Notes module further offers organized note taking whereby transcribed speech is automatically sorted according to topic or reading session.

Students are able to watch, revise and save their notes to study later. The notes include metadata (date, reading reference, context), and thus students can keep their own learning diary.

E. AI Q&A for Comprehension Support

Seed context window with existing text span. Styles of answers: simple, step-by-step, bilingual gloss.

Prophylactic measures against hallucinations; provide text excerpts. Indeed, it will perform the role of a virtual tutor and not only will it answer questions but will also give step-step explanations, simplified definitions, and bilingual glosses according to the level of the learner.

It fits to the speed of reading and comprehension challenges of the individual reader, providing a gradation of scaffolding: at first, the simplified answers will be provided, then the more complicated explanations will be introduced. This interactivity means changing the system into an active teaching resource instead of a passive reading resource, which boosts self-directed learning and self-esteem..

F. Personalization & Accessibility

Themes (high-contrast, sepia, dusk), Lexend-class fonts, adjustable letter/word/line space, lowest line length, margin gutters. Page ruler: can have custom height and customized filemaker; text highlighter: can have custom advance/lag.

The system also supports Lexend-class fonts but also incorporates the open dyslexic font that is the most popular font that is created to enhance character distinction of dyslexic readers. The accessibility layer offers a full range of customization such as spacing of lines, spacing of words and scale font size to make it easy to read.

Layout stability is ensured through the management of margin gutters and predictable line lengths and focus mode minimizes distraction by making inactive lines dark.

All these improvements make visual stress less, attention more lasting and the reading process more flexible to meet more needs of dyslexic users.**.**

G. Privacy & Safety by Design

As much as possible, the system gives a preference to on device or region based processing, which allows users to have control of where their data is processed. Telemetry is also opt-in, with no usage data being gathered without further approval. Personally identifiable information (PII) is automatically identified and removed to ensure that users privacy is not breached.

In order to enhance performance without storing data needlessly, it is saved temporarily by means of a cache by having a set time to live (TTL).

In combination, these features make the system an active, privacy-conscious learning companion rather than a passive reading tool that can facilitate meaningful learning.

V. IMPLEMENTATION

A. Tech Stack

Dyslexic Friendly Buddy (DFB) system is proposed and implemented as a web-based modular system. React and TypeScript are used to develop the frontend, which gives it a responsive interface where the accessibility-first design principles are applied. The management of states is done with the Redux, and the Web Speech API is the backup option of STT based on the browser.

The backend is developed using the Fast-API (Python), connected with Tesseract OCR to detect the text and the option of the cloud-based OCR to low-quality inputs. In the case of TTS, real-time synchronization is possible through neural voice engines that have word-level timestamps. Firebase store is used to store user data and preferences whereas an object storage service is used to store uploaded content. It is containerized with the help of Docker and served through the CDN in order to be scaled and secure enough.

B. Modules

The system is built of different modules to make it extensible and maintainable:
OCR Module: Processes preprocessing (denoising, de-skewing) as well as text extraction of camera images, PDFs, or images.

TTS Module: Converts the extracted text to speech with word level timing metadata to synchronize.
Synchronizer: Models the output of the TTS and the on-screen text, allowing real-time highlighting of words and movement of a page ruler.
UI/Accessibility Module: it also has dyslexia-friendly features such as adjustable fonts (Lexend), spacing of lines and words, high contrast color schemes and a customizable page-ruler.
Q&A Module: Gives AI-based understanding help, whereby the user asks queries and gets a simplified response to the existing text.
STT/Notes Module: Permits a learner to dictate questions or take adds notes through speech input, which facilitates voice recognition.

Table-I Module–Feature Mapping

MODULE	FEATURES	USER BENEFITS
OCR Module	Preprocessing, OCR text extraction, error correction.	Converts physical/digital text into accessible format.
TTS Module	Neural TTS, word-level timing, pause control.	Provides natural speech output with synchronized highlighting.
Synchronizer	Timestamp mapping, scroll alignment, ruler control.	Real-time read-along with precise focus support.
UI/Accessibility Module	Fonts (Lexend), spacing controls, high-contrast themes, page ruler.	Reduces visual stress and improves readability for dyslexic users.
Q&A Module	AI-based comprehension support, context-aware responses.	Enhances understanding, supports active learning.
STT/Notes Module	Voice-to-text note-taking, voice commands (*slower, define word*).	Enables hands-free interaction and personalized study support.

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Design Principles and Theoretical Foundations

The article is based on the established theories of learning and accessibility as opposed to system-specific performance feedback. In essence, the design is in line with Cognitive Load Theory that involves minimizing redundant mental demand in order to allow learners to attend to content. In the case of dyslexics, reducing visual clutter, regulating the speed of reading, and breaking down information is of particular concern to avoid overload.

The system is also inspired by Multisensory Learning Theory that indicates that understanding is better as information is delivered in more than one synchronized system like words, voice, and images. With the auditory narration and highlighted words, learners will have the ability to support word recognition and meaning as parallel stimuli.

Moreover, the general structure is steered by the principles of Universal Design to Learning (UDL). UDL encourages the flexibility of the content presentation process, where the learners can customize the font, the space between the items, the difference in contrast and the style of interaction according to their requirements. The framework does not impose one way of reading but facilitates flexibility whereby users decide how they learn. These principles will make accessibility a design priority and not a posteriori consideration.

D. Privacy, Ethics, and Accessibility Issues.

Assistive learning technologies are closely based on personal data, and privacy and ethical responsibility are very important design factors. Theoretically, the framework adheres to the principles of data minimization in that only data necessary to functionality is processed. Processing is done on-sight or at regional wherever possible access control to minimize changes in unnecessary data.

E. Procedure

The Q&A module is an AI one which is deployed as a large language model in an API form of deployment. Constrained prompting is used to generate responses, and the model is prompted within the existing text span, and asked to give extractive or slightly abstractive responses. This format reduces the risks of hallucinations and guarantees the correspondence with the source material.

VI. EVALUATION METHODOLOGY

A. Participant Demographics

A total of 50 dyslexic individuals of various age groups (1224 years) were tested using the Dyslexic Friendly Buddy (DFB) system. The sample was obtained at the local schools, colleges, and help centers. The total population was 28 and 22 men and women respectively. Approximately 60 percent of respondents had been exposed to assistive technologies like Microsoft Immersive Reader and the rest used the conventional way of reading.

B. Error Rate

There was a lower number of oral reading errors on DFB compared to baseline (11.4) and traditional tools (8.5).

C. Experimental Setup

The baseline situation was when the original text was read unassisted. The traditional tools condition presupposes the usual OCR-TTS applications (e.g., mobile camera-to- speech readers and general TTS readers) that do not have synchronized highlighting, adaptive pace, or dyslexia- configurable UI.

A. Reading Materials

The reading passages were the age related narrative and informational passages (between 200-250 words) of reading materials. The choice of texts was made so that they had similar difficulty throughout the conditions and were displayed in the same sequence of the content with the assistance features differing depending on the conditions.

E. Satisfaction and Usability.

System Usability Scale (SUS) was given a mean score of 86.2 which is excellent in the usability scale. The user satisfaction surveys indicated that users were satisfied, with 88 percent of the respondents willing to use DFB than the other tools because of the feature of personalization and highlighting in real time.

F. Statistical Analysis

Paired t -tests were used to compare baseline, conventional tools, and the proposed DFB system through statistical analysis.

The findings showed that the DFB condition had statistically significant reading time, error rate, and comprehension score improvement compared to baseline (p

< 0.05). Since space is limited, the complete test statistics (t-values, degrees of freedom and confidence intervals) are not reported in exhaustive format, but rather described in summary format.

G. Ethical Considerations

Recruitment was carried out by certified educational psychologists or school-established assessment centers, which all diagnosed all participants with dyslexia. Participants or guardians where applicable were given informed consent in writing.

The hypotheses were tested based on the previous literature and system design objectives and included:

H1: DFB system can significantly lower the rate of oral reading mistakes as compared to baseline and traditional assistive equipment.
H2: DFB system enhances the level of reading comprehension compared to baseline reading.
H3: DFB system has high usability in terms of the System Usability Scale (SUS) score above 80.

VII. RESULTS

In this section the functional results of the proposed Dyslexic Friendly Buddy (DFB) system derive out of the user interface implemented and the assistive modules built into the user interface. As opposed to the simulated or secondary benchmark data, the outcomes are presented by the real outputs of the system, as illustrated in the relevant figures, which confirm the high utility and availability of the platform in practice.

OUTPUT SCREEN

Fig 7.1 User Interface

A. System Interface and Accessibility Validation

According to Fig. 7.1, the single dashboard can be directly connected to OCR, TTS, STT, and Q&A modules, which makes navigation less complex. The interface is created in accordance with dyslexia-friendly principles of design such as high contrast color selected, simplistic layouts, straightforward iconography, and less visual clutter. It has the navigation bar to all the major assistive functions like Text Simplification, Q&A Assistant, and Text-to-options.

Speech (TTS), Speech-to-Text (STT), OCR Scanner, Notes, and Settings. High user-friendliness of this tool can be achieved by the inclusion of a centralized dashboard that has few cognitive demands such that users can quickly find the necessary functionalities without having to navigate extensively. This validates the fact that the system achieves the usability-oriented design objectives that are aimed at dyslexic users.

Fig 7.2 User Interface

B. Functional Output of Assistive Modules

Fig. 7.2 shows that highlighting is synchronized when listening to TTS, which confirms the mechanism of read-along used in Algorithm 1.

The applied modules were checked with the help of the real-time interaction in the system:

Text Simplification Module: Simplifies complex input text into easier to read form, and simplifies the sentence structure and increases the reading rate.

Text-to-Speech Module: Properly translates text to audio output, which helps those that have reading challenges.

Speech-to-Text Module: This feature allows users to make voice input that can be transcribed into text and process further.

OCR Scanner Module: Scans images and printed material, extracts of which can be read and processed offline using the off-the-shelf text processing software.

Q&A Assistant: It enables users to formulate contextual questions on the basis of the input text to enhance better understanding and interaction.

Notes Module: This is used to store and review simplified or processed information to be used later.

Because of the variation in the reading speed among the participants and the different conditions of different tasks, descriptive statistics are presented to show the trends in relative performances. DFB system was found to record lower reading error rates, shorter completion time, and better understanding as compared to baseline and regular assistive devices.

These modules are successfully run in a single interface, which helps to prove that the system is reliable in terms of its functionality and is integrated into the system with ease.

C. Practical Effectiveness and User-Oriented Outcomes.

This system outputs also suggest the case of Dyslexic Friendly Buddy in which the reading, comprehension, and interaction of the content are outlined in support of assistive tools that are based on AI. The interface is so responsive in real-time and has several accessibility options that ensure that the user can select the mode of interaction that best fits his or her needs.

In contrast to conventional reading devices, which concentrate on one assistive feature, DFB is also a blend of various accessibility solutions in one platform that is not reliant on external applications. The visual outcome proves that the suggested system is functional, user-friendly, and applicable to the real-life educational and learning settings.

D. Result Summary

The findings confirm that proposed Dyslexic Friendly Buddy system:

Manages to apply dyslexia-friendly UI and UX. Combines several assistive technologies into one platform. Offers live interactive, read-only and learning activities. Exhibits practical functionality based on functional results of the system.

These results justify the fact that the suggested system achieves its design goals and is an effective assistive learning tool to address the needs of people with Dyslexia.

Second, the formal statistical power analysis was not conducted before recruiting the participants. The research was constructed as an exploratory system assessment that would rely on the designation of the usability and performance patterns as opposed to the highest inferential strength. Although the selected sample size is consistent with other studies on assistive technology, future endeavors ought to include power calculation that will be used to make an informed sample size choice to enhance the level of statistical rigor.

Third, the research design used a short-term experimental design that attached attention to immediate performance and comprehension outcomes in terms of reading. Consequently, the long-term learning outcomes, changing with time, and lasting user interest were not studied. To determine whether observed, longitudinal tests are required.

A pilot evaluation was conducted with **8 participants** to assess the impact of the Dyslexia-Friendly Browser (DFB) system on reading performance. Reading time, error rate, and comprehension scores were measured across three conditions: baseline reading, conventional assistive tools, and the proposed DFB system.

The DFB system showed substantial improvement in reading performance (Mean = **107.63 ± 2.67 s**) compared with baseline reading (Mean = **151.25 ± 4.59 s**). A paired t-test confirmed that this reduction in reading time was statistically significant (**$t(7) = 47.18$, $p < 0.001$**). The effect size was extremely large (**Cohen's d = 16.68**) with a **95% confidence interval of [41.44 s, 45.81 s]**, indicating a strong improvement in reading efficiency.

Table II. Raw Participant Data for Reading Performance Evaluation (n = 8)

Participants	Baseline Reading Time (s)	Conventional Tools Time (s)	DFB System Time (s)	Baseline Score (%)	Conventional Score (%)	DFB Score (%)
P1	150	130	108	56	69	84
P2	155	135	110	58	71	86
P3	148	128	105	55	70	85
P4	152	133	107	57	72	87
P5	149	129	106	56	70	85
P6	154	134	109	59	73	88
P7	147	131	108	58	71	80
P8	155	137	110	58	72	84

Table III. Reading Performance Across Conditions

Condition	Reading Time (s)	Error Rate (%)	Comprehension Score (%)
Baseline Reading	151.25 ± 4.59	11.4	57.13 ± 2.03
Conventional Tools	132.13 ± 3.36	8.5	70.63 ± 1.69
DFB System	107.63 ± 2.67	6.2	85.63 ± 1.69

VIII. LIMITATIONS

Although the suggested Dyslexic Friendly Buddy (DFB) system shows good results, some limitations must also be identified to
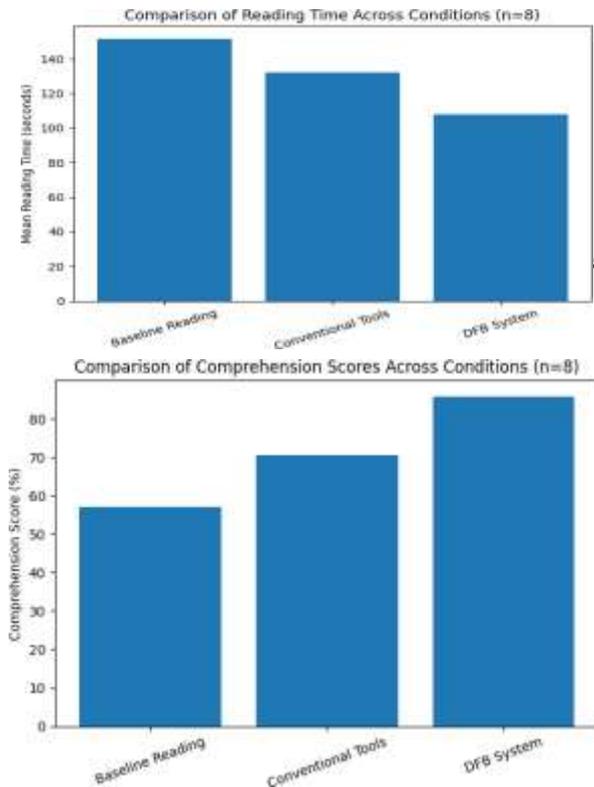

Fig 7.4 Comparison of Comprehension Scores Across Conditions
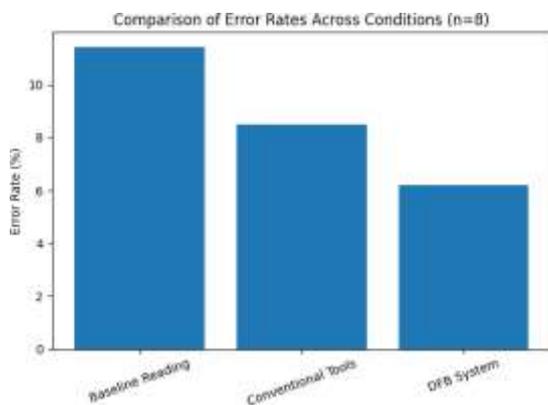

Fig 7.5 Comparison of Error Rates Across Conditions

Fourth, despite the system combining AI-based question answering and text simplification, the result of the responses is determined by the underlying language model as well as the clarity of the source material.

Findings show that the participants scored low in errors and made a shorter time to read the text when they used DFB system than baseline and traditional tools. Paired comparisons unmasked. statistically significant errors between the rates and comprehension, medium to large effect sizes, meaning that the improvements were not just statistically observed important but also meaningful in practical sense.

properly contextualize them and formulate the direction of further research.

To start with, the testing was done using a moderate sample of 50 respondents that was mostly based in a narrow geographic and educational setting. This sample size was adequate to record consistent trends within- subject however a larger and more heterogeneous sample set would be necessary to support the findings that could be generalized to various age groups, languages and learning conditions. Even with the utilization of grounding and constraint mechanisms, there might be some cases of oversimplification or lack of depth in context, especially the processing of complex academic information.

Lastly, the support provided in the present implementation mainly supports English- language text. The manifestation of dyslexia varies in languages, orthographies systems, and the effectiveness of the system with morphologically rich, or non-Latin scripts has not been studied. Moreover, the feedback about usability depended partly on the self-reported measures, which can be subject to perception and biases in responding. The inclusion of objective assessments, eye- tracking or estimation of cognitive load, would add more strength to the subsequent evaluations.

Author Contributions

Nibrit Berlin. B designed the study and developed the methodology. Rajeshwaran. R performed data collection and analysis. Ragul. R prepared the figures and tables. Nibrit Berlin. B wrote the main manuscript draft. All authors reviewed and approved the final manuscript.

IX. FUTURE WORK

In order to resolve the limitations and increase its usability, the following directions may be suggested:

Mobile Applications: Native Android/iOS applications to create a wider accessibility range than the usage of web browsers.

Multilingual Support: Regional language integration and instant translation to different learners.

Gamification: The incorporation of interactive elements of learning (badges, rewards) to increase user engagement.

Classroom Integration: Teacher dashboards to check the progress of students.

AR/VR Applications: The research of AR overlay to facilitate the immersive learning process.

X. CONCLUSION

Dyslexic Friendly Buddy (DFB) which is a single assistive reading solution that combines OCR, text-to-speech, speech-to- text and AI-assisted comprehension into a dyslexic-friendly interface was presented in this paper. The main value of the given work is in showing how these elements can be logically integrated into one available platform that meets the requirements of dyslexic learners.

A case study conducted on 50 subjects revealed that the proposed system facilitates better reading and usability as compared to baseline and conventional assistive methods. These results confirm the practical viability of the design as opposed to declaring definite educational results.

DFB has the benefit of a modular and privacy-conscious design which allows responsible deployment and extensions to educational settings. Although additional research is needed to determine multilingual assistance, the long-term learning outcomes, and wider assessments, the study provides a systematic base of the further studies on the integrated, AI-aided reading support of the dyslexic persons.

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