1. Problem Statement

Dyslexia affects an estimated **10–15% of learners worldwide**, creating persistent challenges in reading fluency, confidence, and academic engagement. Traditional digital learning tools offer static, one-size-fits-all exercises that fail to adapt to each learner's pace, pronunciation patterns, or attention fluctuations. As a result, dyslexic students often disengage, and educators lack real-time insights needed to offer individualized support.

Key limitations of existing solutions include:

- No adaptive difficulty or personalized learning pathways

- No measurement of engagement metrics such as eye gaze, focus, or fatigue

- Limited accessibility—most advanced assistive tools are costly or unavailable in many regions

- Lack of real-time, human-like feedback that motivates and guides struggling readers

To address these limitations, we propose an **AI-powered assistive reading system** that delivers dynamic, multisensory support tailored to each learner's abilities, behavior, and progress.

2. Objective

Design and prototype an AI-driven reading assistant that can:

- **Detect pronunciation accuracy** using modern ASR (e.g., Whisper, Google Speech API)

- **Analyze learner attention** using webcam-based gaze and focus tracking

- **Adapt reading difficulty** through machine learning models that respond to performance

- **Provide multisensory support**, such as text-to-speech, color cues, and instant corrective hints

- **Introduce an AI persona** that delivers warm, personalized, motivational feedback based on performance patterns, attention, and reading fluency

This system aims to improve fluency, comprehension, engagement, and confidence among dyslexic learners.

3. Proposed Solution

The platform will function as a web or mobile application that integrates four major AI modules, plus a new personalized AI feedback system.

1. Listen : Speech Analysis Module

- Convert spoken audio to text using ASR models (Whisper, Google Speech API, Azure Speech).

- Detect mispronunciations, skipped words, phonetic errors, and fluency disruptions.

- Provide real-time corrective feedback and replay examples.

2. Observe : Attention & Engagement Analysis

- Use MediaPipe or OpenCV-based eye-tracking to monitor:

  - Gaze direction

  - Blink rate

  - Focus level

  - Engagement patterns

- Detect signs of distraction or fatigue during reading sessions.

3. Adapt : Dynamic Difficulty Engine

- Apply machine learning (regression, clustering, reinforcement learning) to model:

  - Reading pace

- ○ Error frequency

- ○ Engagement levels

- ○ Progress over time

- Automatically adjust:

  - ○ Word difficulty

  - ○ Sentence complexity

  - ○ Font size and spacing

  - ○ Reading speed

  - ○ Assistance frequency

4. Assist : Multisensory Learning Layer

- Provide text-to-speech narration for support.

- Use visual cues such as color highlights, syllable segmentation, and animated prompts.

- Offer instant hints and pronunciation models.

5. Mentor Persona - Personalized AI Feedback Coach

A dedicated conversational AI persona acts as the learner's supportive coach. It can:

- Analyze reading performance, attention patterns, and errors.

- Offer **personalized encouragement**, not generic responses.

- Explain mistakes gently, using tone appropriate for children or teens.

- Recommend skill-building exercises tailored to the learner's needs.

- Adapt its personality (friendly, teacher-like, calm) based on user preference.

- Provide session summaries such as:

- ○ "You improved your 'th' pronunciation by 20% today!"

- ○ "I noticed you got tired near the end. Let's take a short break and try again."

- ○ "Great job staying focused for 7 minutes straight—keep it up!"

This feature brings emotional intelligence and motivation into the learning experience, helping dyslexic learners feel supported, understood, and encouraged.