HALO

HACK
UMASS
0000 1101

BY ALLEN, ATHULYA, BALA

Project Aim

1.   Photosensitive Epilepsy Protection Realtime video flash detection that prevents potentially dangerouscontent from triggering seizures

2.   ADHD/ADD Reading Assistance AI-powered text summarization with calming background audio to help users

FLASH WARNING CALCULATION

🎥 Frame Sampling

- Captures each video frame using an offscreen 640×360 canvas.
- Reads pixel data via getImageData() (skips CORS-restricted frames).
- Samples ~25% of pixels (every 16 bytes) to reduce CPU load.
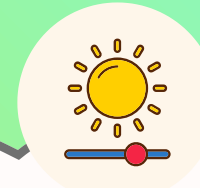
💡 Luminance (brightness)

Converts RGB → linearized (WCAG gamma correction).
Computes relative luminance: $0.2126R + 0.7152G + 0.0722B$.
- Averages sampled pixels → frame brightness (0–1 scale).
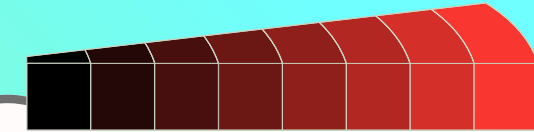
🔴 Red Saturation

- Detects red dominance: $R > 200$, $G < 100$, $B < 100$.
- Calculates % of saturated red pixels per frame.
- Ignores frames with brightness < 0.05 (too dark to count as flash).

⚙️ Flash Detection Logic

Compares consecutive frames:
- $|\Delta L| > 0.1$ and $\Delta L / \max(prevL, 0.01) >$ threshold.
- Both frames must be bright.
- Records timestamps for luminance or red flashes.
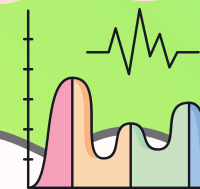
⏱️ Frequency Check (1-sec Window)

- Keeps flash timestamps within the last 1000 ms.
- If ≥ 3 flashes/sec, threshold is exceeded → triggers warning.

🚨 Warning Trigger

Pauses video instantly.
Optional TTS alert (speakWarning()).
Sends update messages to background/popup.
Displays overlay: hazard info, flash stats, and user choices:
Pause Video or Continue Anyway.

WCAG 2.1 COMPLIANCE – FLASH WARNING ALIGNMENT
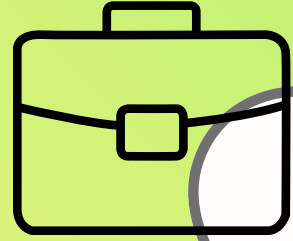
💭 What is WCAG 2.1?
Web Content Accessibility Guidelines (WCAG 2.1) are global standards from the W3C Web Accessibility Initiative.
They define how to make digital content accessible for people with disabilities, including those with photosensitive epilepsy.

⚠️ Key Rule: Success Criterion 2.3.1 – "Three Flashes or Below"
Content must not flash more than three times per second.
Also applies if flashes exceed color or brightness thresholds.
Special focus on red flashes, which are more likely to trigger seizures.

🔍 How the Detector Follows WCAG Principles
Counts flash events in a 1-second rolling window and warns when ≥ 3 flashes/sec.
Uses WCAG luminance formula (sRGB → linear → weighted sum) for brightness analysis.
Tracks saturated red frames separately with higher sensitivity.
Ignores very dark frames and warm-up frames for accuracy.

⚙️ Practical Adaptation
Implements a real-time approximation of WCAG testing.
Balances precision with performance for live video monitoring.
Maintains user safety by pausing playback and showing a clear warning overlay.
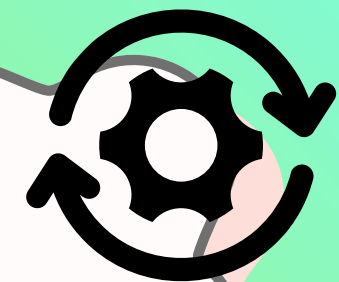
✨ **Key Features Overview**

⚡ Flash Detection & Alerts
- Real-time flash detection following WCAG 2.1 safety standards.
- Immediate pop-up flash warning when the threshold is exceeded.
- Audio alert via text-to-speech for instant notification.

📊 Interactive Statistics
- Displays detailed flash statistics: rate, luminance levels, and timestamps.
- Tracks maximum flashes / second and total flash count.

🤖 AI Integration
- Gemini API for advanced AI processing and smart content generation.
- ElevenLabs API for lifelike, multi-voice text-to-speech (TTS) output.

📝 Smart Text Summarizer
- Built-in AI summarizer that condenses long text automatically.
- Autofill feature provides quick, context-aware summaries.

📄 Easy Export Options
- Copy or Download summaries instantly for sharing or documentation.

🔊 Audio Enhancement Tools
- Integrated white-noise generator with multiple ambient audio tracks.
- Supports 10 realistic voice options for reading summaries aloud.