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**Gamification and Eye Health: Developing a User-Friendly  
Application to Alleviate Computer Vision Syndrome**

A Dissertation by

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## Abstract

Computer Vision Syndrome (CVS) is a prevalent disorder in the computer age due to prolonged exposure to screens, leading to eye fatigue, headache, and other associated discomforts. Existing technological remedies provide general advice without actual observation and customized interventions, and it is challenging for users to adopt effective preventive measures. The absence of an enjoyable and user-friendly tool to track and reverse CVS's effects highlights the need for a more effective solution that integrates technology and proactive health tracking.

This study employs real-time image processing techniques to develop a CVS detection system. The system employs a pre-trained model, i.e., `shape\_predictor\_68\_face\_landmarks`, in facial landmark extraction and computation of the Eye Aspect Ratio (EAR). Through OpenCV and Dlib, the application constantly monitors EAR values for detecting signs of eye strain. The backend using Flask enables effortless communication with a React frontend and real-time video streaming as well as data processing. The system employs additional features such as blink rate monitoring, screen time recording, and adjustment in low-light conditions using gamma correction and histogram equalization. Through observation of both EAR and blink frequency with time, the system is in a better position to make a more accurate decision on detecting eye inflammation. Alerts and reminders further increase user involvement through gamification features by inducing improved screen behaviors.

The system's effectiveness was evaluated with actual-time EAR recordings and blink rate. To assess its ability to monitor eye strain, important parameters such as EAR thresholds, consecutive low EAR frames, and blinks per minute were compared. Tests indicate the system's ability to detect CVS symptom patterns correctly and raise alerts appropriately when users are showing symptoms of fatigue. Through real-time detection with behavioral nudges, this research poses an effective and scalable solution against the effects of long screen time.

### Subject Descriptors:

- Human-centered computing -> Human-computer interaction (HCI) -> Health informatics
- Computing methodologies -> Computer vision -> Object recognition

**Keywords** - Computer Vision Syndrome (CVS), Eye Strain Detection, Deep Learning, Blink Rate Monitoring, Gamification in Healthcare