Blink Mate: A Smart Screen Control Application to Mitigate Digital Eye Strain in Children

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Abstract:

With the advent of the digital era today, extended screen time (primarily when viewing television) has been linked to eye strain and visual fatigue. The proposed system of screen control uses the feature of the human eye blinking, by blacking out the television screen for few milliseconds at regular interval. The system is designed to lessen the persisting optical burden on the eyes of the viewer with the objective of offering ocular relief without having some influence on the perceiving process. The application can be adjusted, allowing parents or guardians to set the interval, blank screen duration and session duration according to a child's screen habits. Based on initial simulation results, it could give some reduction to digital eye strain, especially, under conditions of protracted viewing. This technology can find an application currently within the realm of consumer electronic devices, such as smart TVs and streaming devices, to promote eye-health in an environment of growing screen use in everyday life.

Keywords: Screen blinking, digital eye strain, eye health, parental control, visual fatigue.

1. Introduction

The use of televisions and smart displays has changed the children use of media in the modern digital world. As virtual learning, as well as online entertainment and education, is a part of the current routine, young people tend to spend reasonable amounts of time on screen. The use of digital media provides many cognitive and developmental strengths, it also poses some serious eye health issues. Digital eye strain being a major concern, which manifests as dry eyes, blurred eyes and eye fatigue.

One key factor contributing to this is the reduction in natural blinking rates during screen viewing. Blinking is essential for moisturizing and protecting the eyes. Blink Mate proposes a unique solution that leverages screen-based interruptions to emulate blinking, aiming to reduce digital eye strain effectively.

Blink Mate, a smart screen control application developed using Android Studio. The application is designed to mimic the natural blinking process by automatically dimming or blinking the television screen for a few milliseconds at regular intervals. These brief screen interruptions help relieve visual strain, encourage natural blinking, and promote healthier screen viewing habits. In addition to its core blinking feature, Blink Mate includes customizable blinking intervals, blinking duration settings, and session-based control, ensuring responsible screen time.

1.1 Objectives

The specific objectives of the project include:

- Simulate natural blinking by automatically dimming or blinking the TV screen for a few milliseconds at regular intervals to reduce eye strain.
- Allow customizable settings, enabling parents to set the blinking interval and blinking duration based on their child's screen usage habits.

2. Literature Review

The paper presented by Zainab Iftkhar et. al.[1] conducted a review of parental control tools designed for monitoring and regulating children's Internet usage over the past decade. It synthesizes existing design guidelines, identifies gaps in the literature, and highlights future opportunities for the Human-Computer Interaction (HCI) community. While it focuses on the design of these tools, it emphasizes the importance of empowering parents to manage their children's screen time effectively to mitigate potential online harms.

S. Vijayalakshmi et. al.[2] focuses on developing a user-friendly solution that includes personalized recommendations, a time banking system, and real-time monitoring to help parents manage their children's screen time effectively. The aim is to empower parents and promote healthier screen time habits while balancing the benefits and drawbacks of technology in children's lives

The study by S.Y. Jeyam et. al.[3] proposed a system for monitoring children's phone usage, addressing concerns like impaired attention and mental health issues, while ensuring covert operation and safety from harmful content by employing RSA and AES algorithms.

H. Negreyroset. Al. [4] developed a real-time eye blink detection system using the Viola-Jones algorithm, achieving over 90% precision at 10 frames per second. This system aims to mitigate computer vision syndrome by monitoring blink frequency during screen exposure.

R. Vijayalakshmi et. al.[5] designed a VGG16-based deep learning model for real-time eye state detection, achieving 98% accuracy in classifying open and closed eyes, making it suitable for adaptive real-time eye-blink detection systems, particularly for diagnosing dry eye and drowsiness.

Irina Andreea Pavel et al. [6] presented significant recent research on computer vision syndrome, focusing on environmental, ocular, and musculoskeletal causes, therapeutic strategies, and the impact of prolonged digital device use, emphasizing the need for eye care practitioners to provide evidence-based management options.

3. Current Research and Developments

There are several popular software tools that attempt to reduce digital eye strain, mostly by altering screen brightness or color temperature:

f.lux: An application that automatically adjusts a device's color temperature based on the time of day. By shifting the screen to warmer tones in the evening, f.lux reduces blue light exposure and helps prevent eye fatigue and sleep disruption.

Night Shift (iOS): A built-in iOS feature that shifts display colors to the warmer end of the spectrum after sunset. While effective in reducing blue light, it does not prompt users to take visual breaks during screen sessions.

While both f.lux and Night Shift offer passive support for eye health, they lack interactive measures to enforce break-taking or blinking, especially among children, who may not recognize signs of eye fatigue or take voluntary action.

4. Proposed Methodology

4.1 Flow of proposed approach

The diagram in Figure 1 indicates the flow of the proposed system. It depicts how the blinking session is established by setting the blinking interval and black screen duration.

Figure 1 Flowchart For Proposed Screen Control Application
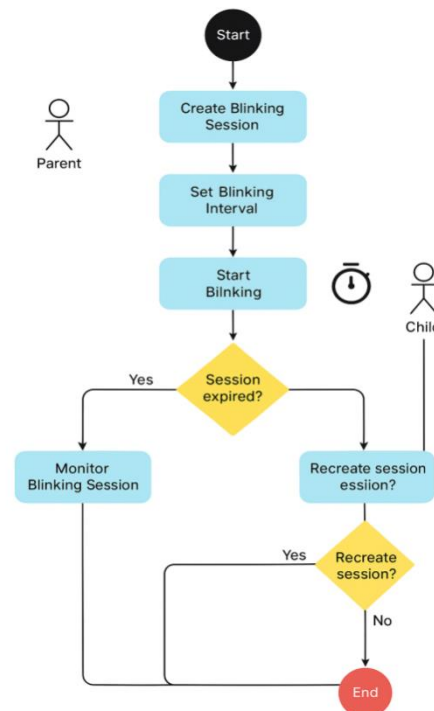
The core functionality of the Blink Mate application revolves around mimicking the natural blinking process by periodically blinking or dimming the television screen for a few milliseconds. The application will feature a customizable interface, allowing parents to define specific blinking intervals and blinking durations based on their child's viewing patterns. In addition to the blinking mechanism, a session-based control system will be implemented. Once a session begins, the blinking remains active for the defined duration. Upon session expiry, the screen will automatically switch to a black display, prompting the user to manually reactivate the next session. This ensures children take necessary breaks and develop a habit of structured screen use.

4.2 Tools & Technologies used

Blink Mate has been developed based on the use of Android Studio, which is the official Integrated Development Environment (IDE) for creating application in the Android platform. The technologies used include:

Android Studio:

Strong development environment that offers an efficient way for constructing and testing android applications. It allows languages such as Java and Kotlin, enabling Android TVs and emulators to initiate applications consistently.

Java (Programming Language):

The core language used for implementing the application's logic, UI interactions, session controls, and screen-blinking behavior.

Android TV Emulator:

Used for testing the application on virtual TV devices, ensuring compatibility with large-screen interfaces and remote-control navigation.

XML:

Used for designing the UI layouts in a structured and scalable way tailored for TV screens.

5. Experimentation And Results

5.1 Snapshots of the implementation

Figure 2 Home Screen
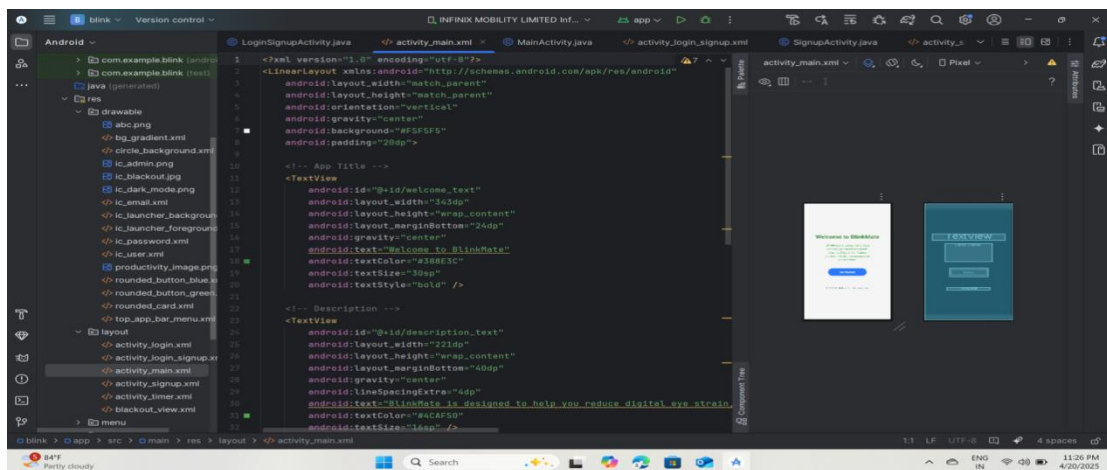
Figure 3 Login Code
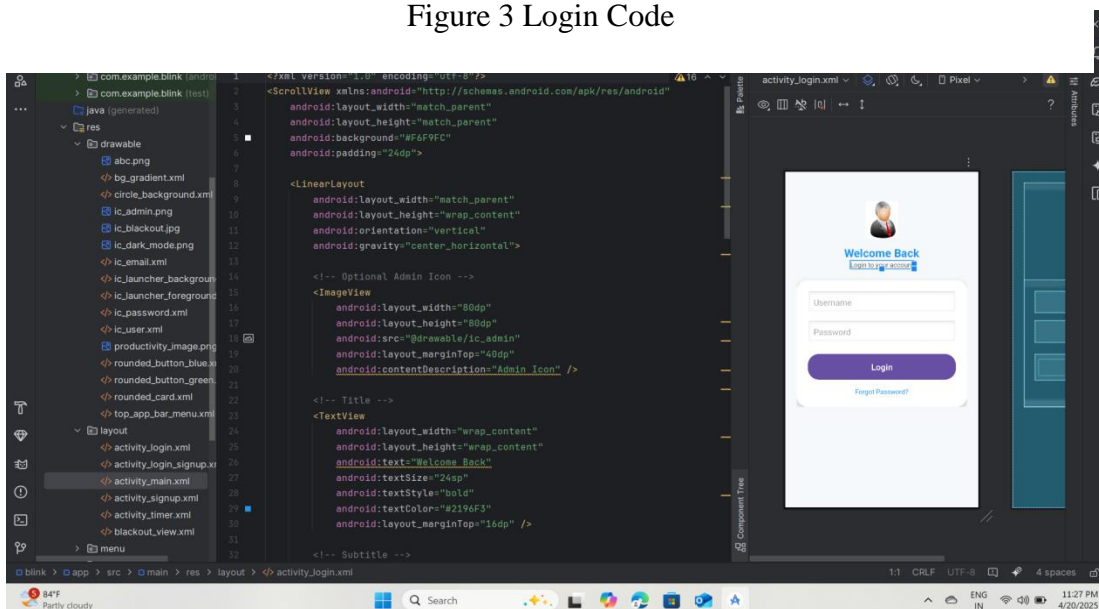
Figure 4 Set Timer
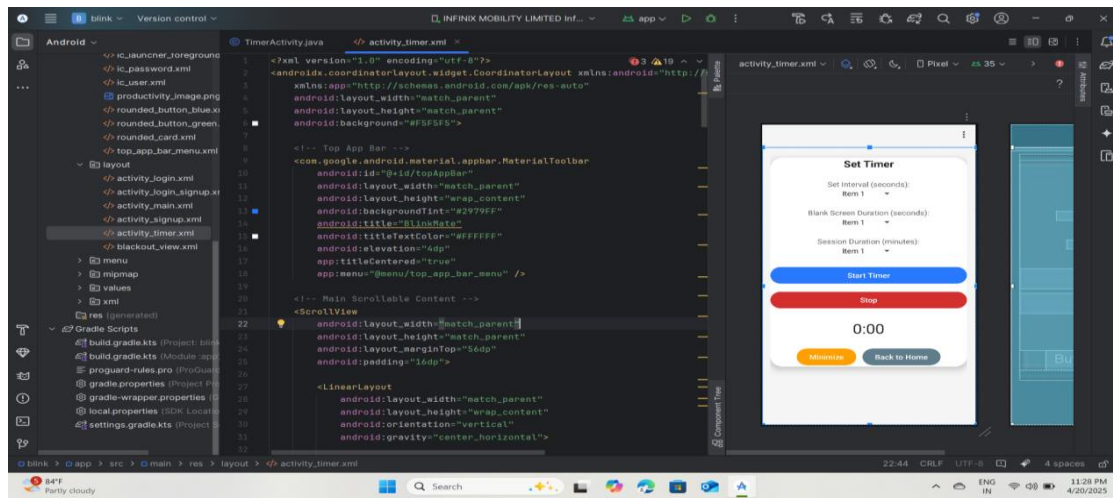
5.2   Snapshots of the application

Figure 5 Home page
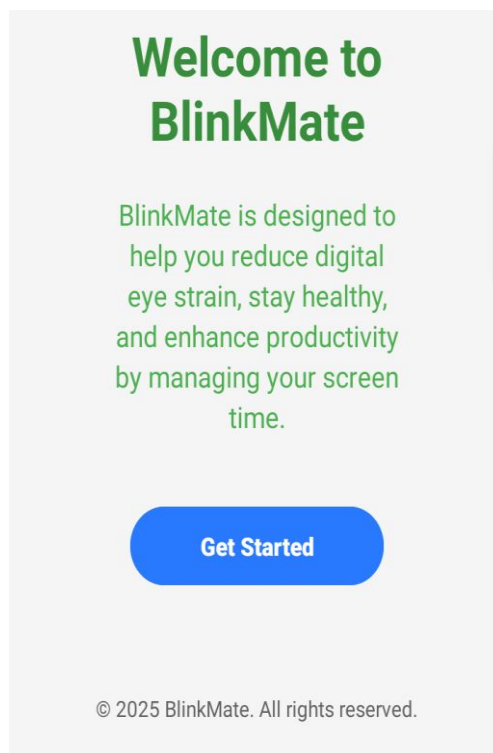
Figure 6 Login/Signup Activity
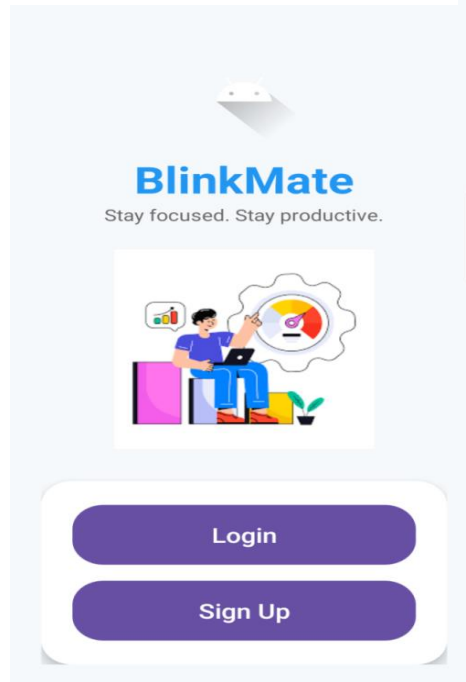
Figure 7 Signup page

Figure 8 Login Page

Figure 9 Set Timer
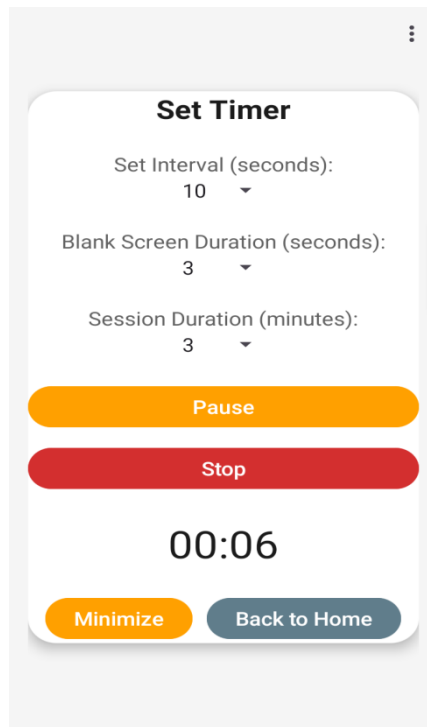
Figure 10 Start Timer
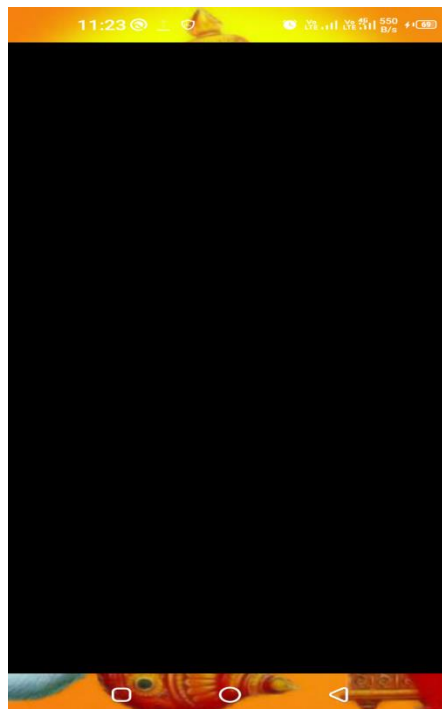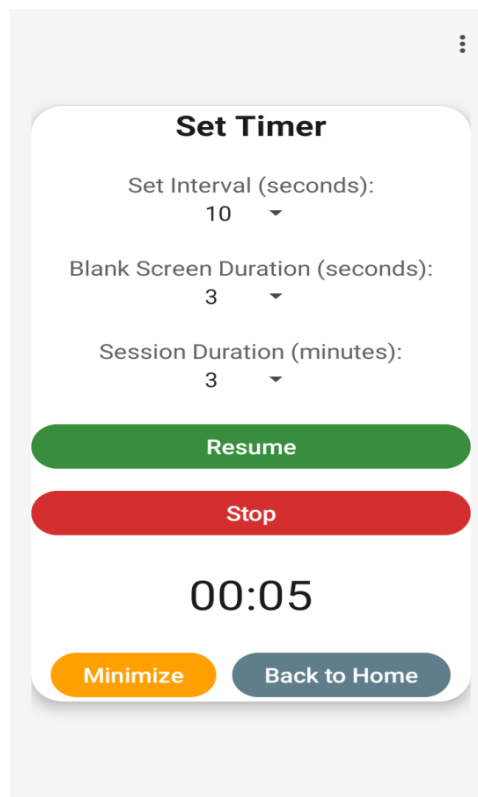

Figure 11 Blackout Screen

Figure 12 Resume & Stop Interface

6. Conclusion & Future Scope

Blink Mate is a unique solution to deal with the issue of digital eye strain among children. It combines session-based blinking with wider parental-control, thus enabling more healthy use of screen without creating negative user experience. Effortless integration with Android TV ensures the uniformity of the performance on several streaming devices and compliance with strict privacy and security standards. Blink Mate gives the parental control to take active measures regarding monitoring and controlling the amount of time their child spends on the screen, and yet prioritizing the child as the main subject of concern in the environment that becomes more and more screen-based. The further improvement of the platform can lead to the extension of the impact through gamified mechanics of engagement, interactive learning tools, and feedback on the level of granularity in usage analytics. To conclude, Blink Mate shows how thoroughly planned interventions may play a positive and substantial increment towards child health and responsible media usage.

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