Mrs. A.K. Nivedha M.E, 2026, 14:2
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science,
Engineering and Technology
An Open Access Journal

Smart Vision Care System Using Ai Based Eye Activity Recognition Air Blower Control

Mrs. A.K. Nivedha M.E.,[1],S.Pappathi [2], J. Priyadharshini [3], K.Sivapriya [4] ,B. Subasini.[5]
[1] Assistant Professor, [2,3,4,5] Final Year Students Department of Biomedical Engineering,
Dhanalakshmi Srinivasan Engineering College (Autonomous), Perambalur – 621 212.

Abstract- The rapid increase in digital device usage has led to significant eye-related problems such as eye strain, dryness, and reduced blinking rate. Continuous exposure to screens without proper eye care can negatively impact human vision and overall health. To address this issue, this project proposes an AI-based Smart Vision Care System that monitors eye activity in real time and provides automatic relief mechanisms. The proposed system utilizes a camera to continuously capture the user's eye movements and applies image processing techniques using artificial intelligence to detect eye states such as blinking frequency and eye closure duration. By analyzing these parameters, the system can identify signs of eye fatigue or strain. When abnormal eye activity is detected, the system automatically activates an air blower to provide cooling and relaxation to the eyes without requiring any manual intervention. The system is developed using software tools such as Python and OpenCV for eye detection and recognition, along with hardware components including a microcontroller, camera module, and air blower. This integration of AI and embedded systems ensures accurate monitoring and timely response. The main objective of this project is to reduce eye strain, improve user comfort, and promote healthy screen usage habits. The proposed system is cost-effective, efficient, and suitable for students and professionals who spend long hours in front of digital devices. In the future, the system can be enhanced by integrating alert notifications and mobile applications for better user interaction and monitoring.

Keywords: Artificial Intelligence (AI), Eye Activity Recognition, Computer Vision, OpenCV, Eye Strain Detection, Smart Vision Care System, Automation, Health Monitoring System, Embedded Systems, Microcontroller

I. INTRODUCTION

In recent years, the use of digital devices such as computers, smartphones, and tablets has increased significantly, leading to various eye-related problems among users. Prolonged screen exposure can cause eye strain, dryness, irritation, and reduced blinking rate, which negatively affect eye health. Most individuals tend to ignore these issues, which may lead to serious vision problems over time. Therefore, there is a growing need for an intelligent system that can continuously monitor eye activity and provide timely relief.

This project proposes an AI-based Smart Vision Care System that focuses on real- time eye activity recognition and automatic response. The system uses a camera to capture eye movements and applies image processing techniques through OpenCV to detect eye states such as blinking and closure. Based on the analysis, the system identifies signs of eye fatigue and automatically activates an air blower to reduce strain and provide comfort to the user.

The main objective of this system is to ensure better eye care by combining artificial intelligence with embedded systems. Unlike traditional methods that rely on manual reminders, the proposed system provides an automated and efficient solution for maintaining eye health. This system is especially useful for students and professionals who spend long hours working in front of screens.

II. LITERATURE SURVEY

- In 2016, Soukupová and Čech proposed an eye blink detection method using facial landmarks and eye aspect ratio (EAR). Their approach was simple and effective for detecting blinking patterns, but it lacked real-time response mechanisms for reducing eye strain.
- In 2017, Tereza Soukupová and Jan Čech further improved real-time eye tracking techniques using computer vision. These methods used tools like OpenCV for eye detection, but they were mainly focused on monitoring rather than providing automated solutions.
- In 2018, Abtahi et al. developed a system for detecting eye fatigue based on blinking patterns and eye closure duration. Although their system improved detection accuracy, it was primarily used for analysis and did not include any automatic relief system.
- In 2019, Park et al. proposed a driver drowsiness detection system using machine learning techniques. The system effectively detected fatigue using eye closure data, but its application was limited to driver safety rather than general eye care.
- Between 2020 and 2021, Wang et al. introduced AI-based eye monitoring systems that analyzed real-time eye activity using deep learning algorithms. These systems improved accuracy significantly, but they still relied on alert-based responses instead of automated physical actions.
- In 2022, Li et al. studied the impact of prolonged screen usage and proposed intelligent monitoring systems for detecting eye strain. However, their approach mainly focused on detection and lacked immediate intervention mechanisms.
- From 2023 to 2025, recent works by Zhang et al. focused on advanced deep learning models for precise eye activity recognition. These systems achieved high accuracy but were often complex and expensive, making them less suitable for everyday users.
- Despite these advancements, most existing systems focus only on detection and alerts, with limited implementation of automatic response systems. To overcome these limitations, the proposed AI- based Smart Vision Care System integrates real-time eye activity recognition with an automated air blower control mechanism, providing immediate relief and improving overall eye care efficiency.

III. PROPOSED METHODOLOGY

The proposed system is an AI-based Smart Vision Care System designed to monitor eye activity in real time and reduce eye strain caused by prolonged screen usage.

The system uses a camera to continuously capture the user's eye movements and applies computer vision techniques to analyze blinking patterns and eye closure.

Based on the analysis, the system detects signs of eye fatigue such as reduced blinking rate or long eye closure. When such conditions are identified, the system automatically activates an air blower to provide cooling and relaxation to the eyes. This reduces eye strain without requiring any manual intervention.

Unlike existing systems that only provide alerts, the proposed system introduces an automated response mechanism, making it more efficient and user-friendly. The system is cost-effective and suitable for continuous usage by students and professional

1. Image Acquisition

A camera module is used to capture real- time video of the user's face, focusing on the eye region.

2. Eye Detection

The captured video frames are processed using OpenCV to detect the face and locate the eyes using facial landmark techniques.

3. Eye Activity Analysis

The system analyzes eye states such as blinking frequency and eye closure duration. Parameters like Eye Aspect Ratio (EAR) are used to determine whether the eyes are open or closed.

4. Fatigue Detection

If the system detects abnormal patterns such as low blinking rate or prolonged eye closure, it identifies the presence of eye strain or fatigue.

5. Control Mechanism

Once fatigue is detected, a signal is sent to the microcontroller, which activates the air blower automatically.

6. Air Blower Activation

The air blower provides cooling to the eyes, helping to reduce strain and improve comfort for the user.

Use Cases:
Capture Eye Activity Detect Eye Movement Analyze Eye Condition Identify Eye Strain Activate Air Blower;
USER
| v
Smart Vision Care System
| | |
v v v
Capture Eye Detect Analyze Eye Activity Eye Condition
Movement
| v
Identify Eye Strain
| v
Activate Air Blower

IV. SOFTWARE REQUIREMENTS.

The proposed AI-based Smart Vision Care System utilizes the following software components for implementation:

Python

Python programming language is used for developing the core logic of the system, including image processing and eye activity analysis.

OpenCV

OpenCV is used for real-time image processing and eye detection. It helps in capturing video frames and identifying
eye movements such as blinking and closure.

NumPy

NumPy library is used for numerical operations and handling arrays during image processing tasks.

Dlib (Optional)

Dlib library is used for facial landmark detection, which helps in accurately locating the eye region and calculating eye parameters.

Arduino IDE

Arduino IDE is used to program the microcontroller and control the air blower based on the signals received.

Operating System

A computer system with Windows, Linux, or macOS is required to run the software and execute the program.

Hardware Requirements

The proposed AI-based Smart Vision Care System requires the following hardware components for implementation:

◆ **1. Camera Module**

A camera is used to capture real- time video of the user's face, especially the eye region. This input is essential for detecting eye movements and blinking patterns.

◆ **2. Microcontroller (Arduino)**

A microcontroller such as Arduino is used to control the overall hardware operations. It receives
signals from the processing unit and controls the air blower accordingly.

◆ 3. Air Blower (Mini Fan)
An air blower or small fan is used to provide cooling to the eyes. It gets activated automatically when eye strain is detected.

◆ 4. Power Supply
A stable power supply is required to operate the microcontroller, camera, and air blower efficiently.

◆ 5. Connecting Wires
Wires are used to establish connections between the components such as microcontroller, blower, and power supply.

◆ 6. USB Interface / Laptop
A system or laptop is required to run the AI model, process the camera input, and communicate with the microcontroller

V. RESULT AND DISCUSSION

The proposed AI-based Smart Vision Care System was successfully implemented and tested under different conditions to evaluate its performance. The system effectively captured real-time eye activity using a camera and processed the input using computer vision techniques. Eye states such as blinking and eye closure were accurately detected, and parameters like blinking rate were analyzed to identify signs of eye strain.

During testing, the system was able to detect reduced blinking frequency and prolonged eye closure with good accuracy. When eye fatigue was identified, the microcontroller successfully activated the air blower without any delay. This automatic response helped in providing immediate relief to the user, thereby reducing eye discomfort.

The system showed consistent performance under normal lighting conditions and was able to function efficiently for continuous monitoring. Compared to traditional systems that only provide alerts or reminders, the proposed system offers a direct physical solution through automation, which improves user comfort and usability.

However, the system has some limitations. Its performance may be affected under poor lighting conditions or if the camera is not properly aligned with the user's face. Additionally, the accuracy of detection depends on the quality of the camera and processing speed.

Overall, the results demonstrate that the proposed system is effective, reliable, and user-friendly for real-time eye strain detection and reduction. The integration of artificial intelligence with hardware control makes the system more practical and beneficial for daily use.

VI. CONCLUSION

The proposed AI-based Smart Vision Care System provides an effective solution for monitoring eye activity and reducing eye strain caused by prolonged screen usage. The system successfully utilizes computer vision techniques to detect eye movements such as blinking and eye closure in real time. Based on the analysis, it identifies signs of eye fatigue and automatically activates an air blower to provide immediate relief.

The integration of artificial intelligence with embedded hardware components makes the system efficient, reliable, and user-friendly. Unlike traditional methods that rely only on alerts or reminders, this system offers an automated physical response, improving user comfort and eye health.
The results demonstrate that the system performs well under normal conditions and is suitable for continuous usage by students and professionals. Although there are minlimitations such as dependency on lighting conditions and camera positioning, the overall performance of the system is satisfactory.

In conclusion, the proposed system contributes to the development of smart healthcare solutions by promoting better eye care practices. Future

ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science,
Engineering and Technology
An Open Access Journal

enhancements can further improve its efficiency and usability

REFERENCES

1. Tereza Soukupová and Jan Čech, “Real- Time Eye Blink Detection using Facial Landmarks,” 2016.
2. S. Abtahi, B. Hariri, and S. Shirmohammadi, “Driver Drowsiness Monitoring Based on Yawning Detection,” IEEE, 2018.
3. Y. Wang et al., “Real-Time Eye State Detection using Deep Learning,” IEEE Access, 2020.
4. X. Li et al., “Digital Eye Strain and Its Detection using AI Techniques,” Springer, 2022.
5. Z. Zhang et al., “Advanced Eye Activity Recognition using Deep Learning Models,” 2023.
6. OpenCV, “Open Source Computer Vision Library Documentation,” 2023.
7. Arduino IDE, “Arduino Official Documentation,” 2023.
8. P. Viola and M. Jones, “Rapid Object Detection using a Boosted Cascade of Simple Features,” 2001.
9. D. E. King, “Dlib-ML: A Machine Learning Toolkit,” 2009.
10. IEEE, “IEEE Standards for AI- based Health Monitoring Systems,” 2021.
11. S. Srivastava et al., “Computer Vision-Based Eye Tracking System,” 2019.
12. R. Patel et al., “Smart Health Monitoring using Embedded Systems,” 2020.