



RESULT ON COMPREHENSIVE SMART EYE RELIEF SYSTEM USING HEAT & VIBRATION

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Abstract:

Digital eye strain has become more common because people use computers, smartphones, and other digital screens for a long period of time. This leads to problems like tired eyes, dryness, irritation, blurry vision, and discomfort [6], [12], [13]. Earlier research shows that warming the eyelids can help make the eyes feel more comfortable and improve the quality of tears. Also, massaging the eyes or using vibration can help relax the eyes and reduce discomfort [1], [2], [3]. Especially, studies on eye masks that use both heat and vibration have shown improvements in dry-eye symptoms and some eye-related measurements. This supports the idea that combining heat and mechanical stimulation could be a good, non-invasive way to help relax the eyes [3], [8]. Based on this, this paper introduces a Vision Relief Embedded Eye Relaxation System. It's a small, portable, and rechargeable device that looks like an eye mask. It uses controlled heat and vibration to help relax the eyes and ease discomfort from using digital screens too much. By combining both therapies into one device, the system offers a practical, easy-to-use, and affordable solution for students, office workers, and others who use digital devices a lot. This idea builds on existing research and aims to provide a simple, integrated way to help with eye relaxation.

Keywords: Digital Eye Strain, Eye Relaxation, Heat Therapy, Vibration Therapy, Wearable Eye Mask, Ocular Massage, Embedded System, Eye Fatigue, Dry Eye, Visual Comfort.



I. Introduction:

The quick rise of computers, smartphones, tablets, and other digital tools has made it common for people to look at screens for long periods during their work and study. Using these devices for too long can cause digital eye strain, also called computer vision syndrome. This condition brings problems like tired eyes, dryness, irritation, blurred vision, headaches, and discomfort when looking at things. Sheppard and Wolffsohn found that digital eye strain includes both issues with focusing and how the eyes work together, as well as symptoms related to dry eyes. This shows the need for better ways to reduce discomfort from using screens [1]. Traditional ways to deal with digital eye strain usually include taking regular breaks, setting up a good workspace, keeping the right distance from the screen, using proper lighting, and changing how people use digital devices [1], [2]. While these methods can help reduce symptoms, they mostly rely on what users do and might not quickly relax in the area around the eyes. Studies have shown that working long hours on computers can lead to visual problems among office workers. This highlights the importance of finding practical solutions to reduce eye fatigue from screens [3], [4]. Besides digital eye strain, dry eyes and a condition called meibomian gland dysfunction (MGD) can also cause discomfort. To help with this, eyelid-warming treatments have been studied. Research on heated eye masks has shown that controlled warming of the eyelids can help with symptoms of dry eyes and improve tear quality [5]– [8]. These studies suggest that using heat can be a useful way to make eyes more comfortable. Also, some research has investigated mechanical stimulation through eye massage and vibration. Mansor and Sudirman studied an eye-massaging device using EEG readings from 35 people to measure relaxation by looking at changes in brain activity [7]. Vigo et al. made an eye mask that uses heat at 42°C and vibration up to 20 Hz. In a small study with 20 people who had MGD, a 15-minute treatment improved tear stability and the thickness of the lipid layer on the eye. Everyone also reported feeling more comfortable [8]. These studies show that using both heat and vibration together might be a good way to relax the eyes and improve comfort. However, most research has focused on specific medical conditions like MGD and dry eyes. There hasn't been much work on creating a small, portable, and affordable system designed for regular eye relaxation and comfort from using screens. Because of this, this study aims to develop a Vision Relief Embedded Eye Relaxation System with Heat and Vibration. The system will include controlled heating and vibration in a wearable device. The goal is to provide an easy-to-use and affordable way to help relax the eyes and reduce discomfort from long screen time.

II. Literature Survey:

1. Amy L. Sheppard and James Stuart Wolffsohn [1] discussed Digital Eye Strain caused by prolonged digital-device use and emphasized prevention through proper workstation setup, suitable viewing conditions, and regular breaks. Their work highlights the importance of reducing visual discomfort associated with extended screen exposure.
2. Mark Rosenfield [2] explained that prolonged digital-screen use can cause Computer Vision Syndrome, including eye strain, dryness, and visual discomfort. The study highlighted the



importance of proper screen positioning, suitable lighting, and appropriate work practices for reducing computer-related visual symptoms.

3. Joan K. Portello, Mark Rosenfield, and Yuliya Bababekova [3] investigated computer-related visual symptoms among office workers and reported that prolonged computer use was associated with tired eyes, headaches, and blurred vision. Their findings emphasized the need for appropriate workplace practices to minimize visual discomfort.

4. Clayton Blehm, Seema Vishnu, Ashbala Khattak, and Richard W. Yee [4] reviewed Computer Vision Syndrome and described its major causes, symptoms, risk factors, and preventive approaches. The study provides a comprehensive understanding of the problems associated with prolonged computer and digital-device use.

5. Miki Uchino and Debra A. Schaumberg [5] discussed dry eye disease and its effects on visual performance and daily comfort. Their work highlighted the importance of effective management and treatment approaches for maintaining ocular comfort and reducing dry-eye-related symptoms.

6. Fatin Afifa Mansor and Sudirman [6] evaluated an eye-massaging device using EEG signals obtained from 35 participants. Relative alpha power at the O1 and O2 locations was analyzed to investigate the possible relaxation effects of eye massage, providing evidence for the use of massage-based stimulation for eye relaxation.

7. Paramdeep Singh Bilkhu, Shehzad Anjam Naro, and James Stuart Wolffsohn [7] investigated the MGD Eye Bag using a randomized contralateral trial involving 25 patients with meibomian gland dysfunction. Heated treatment was compared with a non-heated device, demonstrating the potential benefits of controlled eyelid warming for dry-eye management.

8. Luca Vigo, Marco Pellegrini, Francesco Carones [8] studied an eye mask producing approximately 42°C heat and vibration up to 20 Hz in 20 patients with meibomian gland dysfunction. A 15-minute treatment significantly improved non-invasive tear break-up time and lipid-layer thickness, while all patients reported improvement in ocular discomfort. This study provides important support for combining heat and vibration in an eye-relaxation system.

9. Sonia Trave-Huarte and James Stuart Wolffsohn [9] evaluated a wearable eye mask incorporating heat and vibration for dry-eye management. The study reported improvements in subjective dry-eye symptoms and supported the potential of combining thermal and mechanical stimulation in a wearable eye-care device.

10. Luca Vigo, Marco Pellegrini, Francesco Carones, Vincenzo Scoria [10] investigated the Activa heating and vibrating eye mask combined with intense pulsed light therapy for meibomian gland dysfunction. The treatment showed improvements in tear-film and ocular-surface parameters, supporting the potential of combined thermal and mechanical treatment.

11. Da-Hu Wang, Hua Guo, Wei Xu, and Xin-Quan Liu [11] investigated an eyelid-warming mask for dry-eye and meibomian gland dysfunction. The study demonstrated that controlled warming



could improve symptoms and ocular-surface conditions compared with conventional hot-towel treatment, indicating the usefulness of controlled heat in eye-care applications.

12. Jonatan Olafsson, Erlend Christoffer Sommer Landsend, Snorri Olafsson, Eric Parissi, A. Utheim Raeder, Reza A. Badian, Neil Lagali, Darlene A. Dartt, and Tor P. Utheim [12] compared Thera Pearl and eyelid-warming treatments and reported improvements in tear-film stability and dry-eye symptoms. Their findings support the use of controlled and consistent eyelid warming instead of conventional uncontrolled heating methods.

13. Chia-Yi Lee, Shun-Fa Yang, Ching-Hsi Hsiao, Chi-Chin Sun, Chao-Kai Chang, Jing-Yang Huang [13] studied a steam-warming eye mask among video-display-terminal users. The treatment improved tear-film-related parameters and subjective ocular symptoms, indicating the potential benefits of warming-based treatment for screen-related eye discomfort.

14. Andrew Kwok Cheung Lam, Sandy N. S. Lee, Mason W. S. Mui, and Venus H. Y. Ng [14] investigated short-term digital ocular massage and evaluated changes in intraocular pressure and corneal biomechanics. The study demonstrated temporary physiological changes following ocular massage, providing objective evidence of the body's response to mechanical stimulation around the eye.

15. Irina Andreea Pavel, Camelia Margareta Bogdanici, Vlad Constantin Donica, Nicoleta Anton, Bogdan Savu, Cristina Petronela Chiriac, Cristian Dan Pavel [15] reviewed Computer Vision Syndrome and reported that prolonged digital-device use is associated with eye fatigue, blurred vision, dry eye, headaches, and other visual or musculoskeletal symptoms. The study further emphasizes the need for preventive and relaxation measures for individuals with prolonged screen exposure.

16. Prithwis Manna [16] reviewed digital eye strain from ocular-surface to neurophysiological perspectives and emphasized that digital eye strain is multifactorial. Factors such as tear-film instability, reduced blinking, accommodation, posture, and cognitive factors can contribute to visual discomfort during prolonged digital-device use.

17. Michele A. Williams, Chris O'Dowd, Mary Czerwinski, and Meredith Ringel Morris [17] developed the SWARM wearable system incorporating thermal, vibration, and audio actuators. The study demonstrated the feasibility of combining multiple sensory stimulation methods within a wearable platform, providing a useful reference for the development of multifunctional wearable relaxation systems.

18. Pragadeesh [18] reviewed IoT-based approaches for monitoring posture and eye strain using sensors, microcontrollers, artificial intelligence, and wearable technologies. The study highlighted the potential of smart and personalized systems for monitoring and managing eye strain.

19. KURE LLC [19] proposed a smart eye-mask architecture incorporating monitoring and therapeutic functions. The concept demonstrates the potential for integrating sensing and treatment



capabilities into a compact wearable eye-mask platform.

20. Xuejun Ma and Rui Li [20] developed a smart wearable massage mechanism using vibration assemblies and multiple massage heads. Their work provides a useful reference for integrating controlled vibration into a compact wearable system and supports the feasibility of incorporating vibration-based stimulation into an eye-relaxation device

Table 1 1: Comparative table of literature survey

Ref No :	Paper / Project	System Architecture	Methodology	Key Finding	Advantages	Limitations
1	Mansor & Sudirman (2018) – Eye Massaging Device	Eye massage device + EEG	35 participants; EEG alpha power analyzed before/after massage	Alpha power increased, but relaxation was not statistically confirmed	Portable, compact, objective EEG measurement	Small sample; dizziness and uncontrolled factors
2	Bilkhu et al. (2014)	Heated eye mask	25 MGD patients; heated vs non-heated, 5 min twice daily	Improved efficacy and long-term ocular comfort	Simple, controlled heating	Possible placebo effect; MGD-focused
3	Vigo et al. (2021) – Heat & Vibration Eye Mask	42°C heat + vibration up to 20 Hz	20 MGD patients; 15-min treatment; NIBUT and LLT measured	NIBUT and LLT improved; high patient satisfaction	Automated heat/vibration; short treatment	Small sample; short-term study
4	Vigo et al. (2022) – Activa Mask + IPL	Heat + vibration mask + IPL	30 MGD patients; 3 treatment sessions	NIBUT, LLT, OSDI and other parameters improved	Combined therapies; multiple improvements	Small study; historical control
5	Lam et al. (2025) – Digital Ocular Massage	Digital massage + Corvis ST	58 participants; treated eye vs control eye	Temporary changes in IOP and corneal biomechanics	Objective measurements; controlled design	Young population; no long-term results
6	Pavel et al. (2023) – Computer Vision Syndrome	Digital-eye-strain framework	Review of 56 selected studies	Screen use causes fatigue, dry eye, blurred vision	Broad evidence on CVS	Review; no physical device



7	Wang et al. (2024) Warming Mask	~41°C warming mask	144 patients; mask vs hot towel for 12 weeks	Greater improvement in dry-eye symptoms	Large sample; consistent warming	Heat only; no vibration
8	Wolffsohn (2020) – Aurai Eye Mask	Heat + vibration eye mask	15 participants treatment daily	Dry-eye symptoms improved	Directly combines heat and vibration	Small sample; short duration
9	Olafsson et al. (2021) – Thera Pearl & Blephasteam	Eyelid-warming devices	70 patients; 3- and 6-month evaluation	Both improved tear-film stability and OSDI	Larger sample; long follow-up	Mainly heat-based
10	Lee et al. (2024) – Steam-Warming Eye Mask	Steam-warming mask	Randomized study in VDT users for 2 weeks	Improved tear-film and symptoms	Controlled study; relevant to screen users	Small sample; heat-focused
11	Manna (2026) – Integrative Digital Eye-Strain Review	Ocular, blinking, accommodation and neurophysiology framework	Review of 128 studies	Digital eye strain has multiple contributing factors	Comprehensive approach	Review; no therapeutic device
12	Rosenfield (2016) – Computer Vision Syndrome	Digital - screen / ocular factors	Literature review	Screens cause eye strain, dryness and visual discomfort	Establishes CVS causes	No device testing
13	Sheppard (2018) – Digital Eye Strain	DES assessment and management framework	Literature review	DES involves ocular, accommodative and binocular symptoms	Useful assessment framework	Review-based
14	Portello et al. (2012) – Computer-Related Symptoms	Computer exposure + symptom assessment	520 office workers; questionnaire study	Symptoms increased with computer use	Large sample; directly relevant to screen use	No treatment intervention
15	Blehm et al. (2005)	Ocular, visual and ergonomic framework	Literature review	CVS includes eyestrain, dryness	Foundational CVS reference	Older review; no device
16	Coles-Brennan et al. (2019) – Digital Eye Strain Management	DES management framework	Clinical literature review	DES management requires a holistic approach	Clinically useful	Review; no experimental device

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17	Williams et al. (2015) – SWARM Wearable	Wearable heat, vibration	Prototype development and user testing	Heat and vibration were feasible wearable fe	Strong wearable design reference	Not designed specifically for eye strain
18	Pragadeesh (2025) – IoT Eye-Strain Monitoring	IoT sensors + microcontroller + AI/ML	Review of smart monitoring systems	Real-time monitoring can support eye-strain management	Smart and personalized approach	No heat/vibration treatment
19	KURE LLC (2025) – Smart Eye Mask	Smart eye mask + monitoring/therapeutic components	Patent-based system design	Demonstrates smart eye-mask integration	Useful embedded-system reference	Patent; no clinical validation
20	Ma et al. (2024) – Smart Wearable Massage Device	Wearable vibration/massage mechanism	Patent-based mechanical design	Supports wearable vibration/massage implementation	Multiple massage points; wearable design	Not specifically tested for eye strain

III. Proposed Methodology:

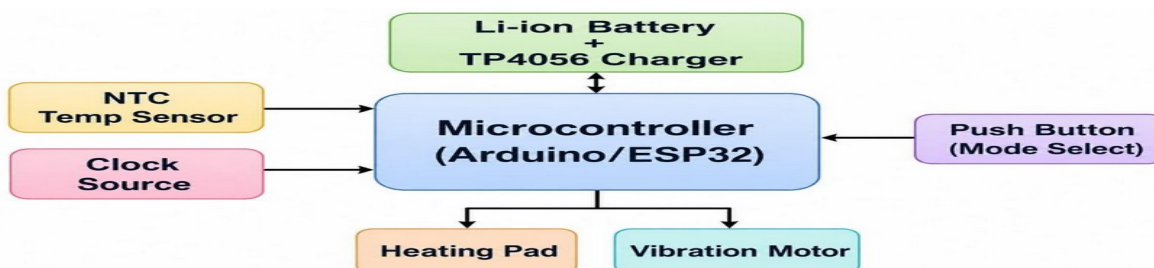


Figure 1 Block Diagram of Proposed System

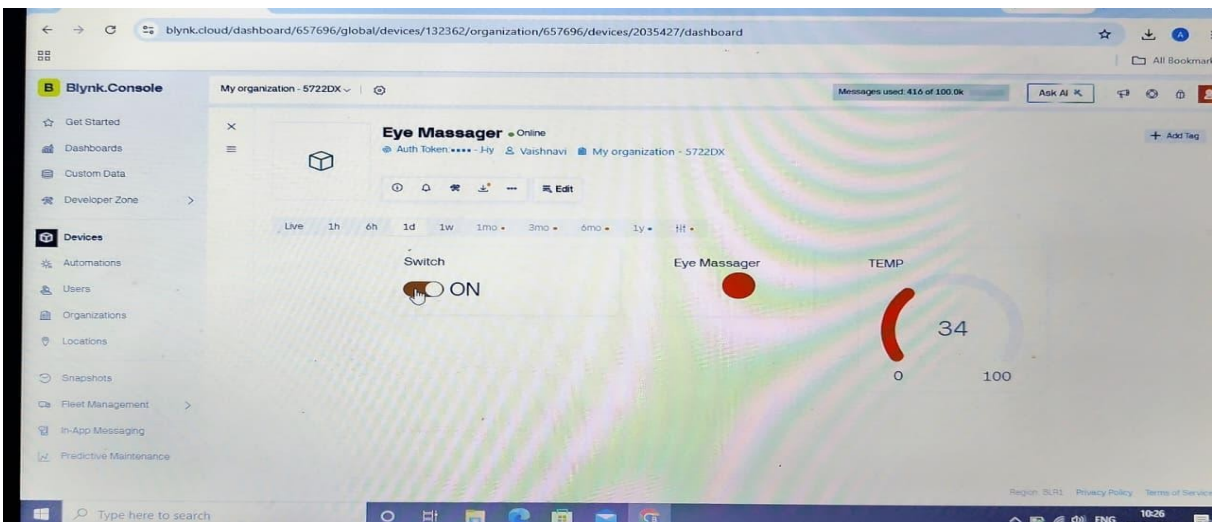
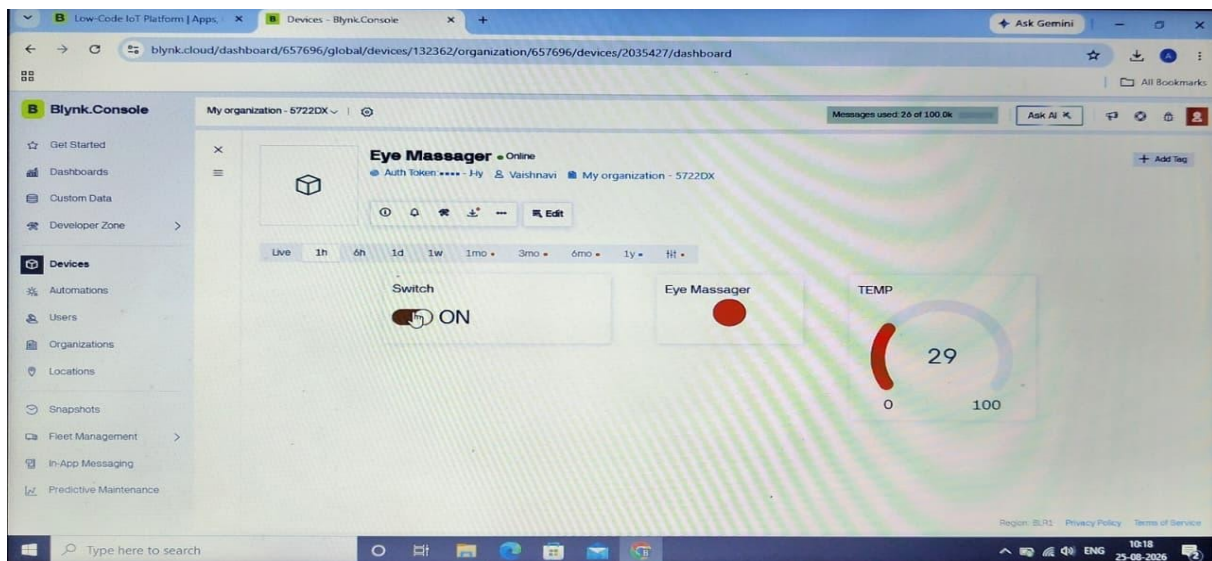
The proposed System is a wearable eye mask that uses controlled heat and vibration to help ease eye fatigue and discomfort from using digital devices for long periods. Digital eye strain often causes problems like tired eyes, dryness, irritation, blurry vision, and discomfort, as discussed in earlier research [6], [12], [13]. The system includes a light eye mask, a heating part near the eyelid, vibration parts for mechanical stimulation, a small computer to control the device, and a battery that can be recharged. The heating is used because past studies showed that warming the eyelid can improve eye surface conditions and tear film [2], [7], [9]. Vibration is included based on research on eye massage and vibration for relaxation and comfort [1], [3]. Vigo et al. tested an eye mask with 42°C heat and up to 20 Hz vibration and found improvements in tear break-up time and the thickness of the lipid layer [3]. Similarly, the Aurai eye massager, which also uses heat and vibration, helped reduce dry eye symptoms after repeated use [8]. Based on these results, the new prototype combines both heat and vibration into one compact wearable device. The system will be tested for how well the heat and vibration work, temperature control, vibration effectiveness,



power use, how easy it is to carry, and how comfortable it is to use. This approach aims to turn previous studies into a small, practical, and affordable device to support eye relaxation and reduce discomfort from screen time.

1. RESULT:

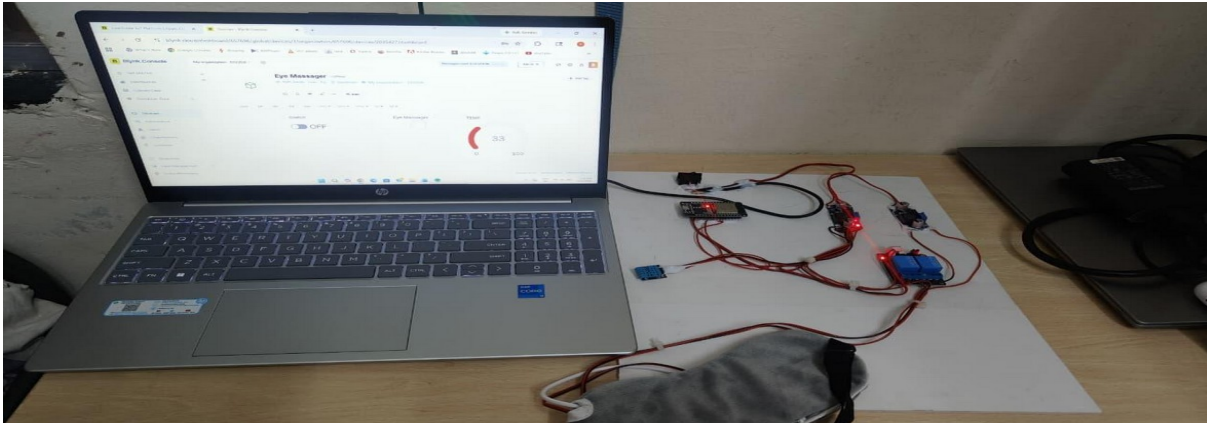
The Vision Relief Embedded Eye Relaxation System is a wearable eye mask that combines heat and vibration to help relax tired eyes. It uses gentle warmth and massage to ease eye strain, which are two common methods studied for improving eye comfort [1]– [3], [7]– [10]. The system is small, easy to carry, and can be charged, making it convenient for people who use digital screens a lot and feel eye fatigue. Based on past research on heat, massage, and vibration, this system is likely to help people feel more comfortable and relaxed, but its real effectiveness needs to be tested through experiments. The final version of the system serves as a good starting point for further testing with users, checking symptoms, and measuring eye health objectively.



IV. Conclusion:

The Vision Relief Embedded Eye Relaxation System is a new, non-invasive way to help reduce eye fatigue and discomfort from using digital devices for long periods. Studies have found that warming the eyelids can improve the condition of the eye surface, help keep tears stable, and ease dry-eye symptoms [2],[7], [9], [10]. Also, massaging the eyes or using vibration can help relax them and make them feel more comfortable [1], [3], [5]. In fact, using both heat and vibration together have shown good results, with improvements in tear stability, eye surface health, and dry-eye symptoms. Research on digital eye strain also shows that spending too much time looking at screens, blinking less, and unstable eye surfaces are major causes of eye fatigue and discomfort [6], [11]-[16]. Based on these findings, combining controlled heat and vibration into one wearable eye mask is a practical way to offer easy eye-relaxation therapy. This system is designed to be small,

portable, and rechargeable, so it's ideal for students, office workers, and anyone who uses digital devices often. More testing will be needed to check how well it works, how comfortable it is to use, and how effective it is at reducing symptoms caused by long screen time.



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