



smart frame technology
that monitors patient data

BLINK FRAMES - WHITE PAPER

VALIDATION STUDY

Monitoring Amblyopic And
Myopic Patients

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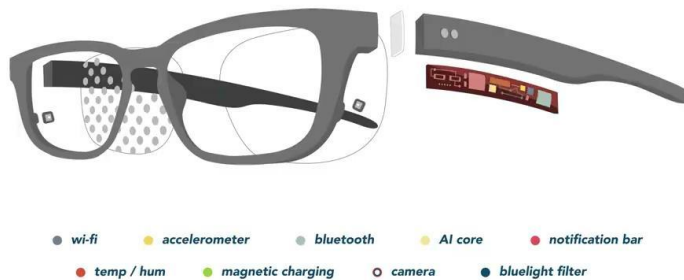
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INTRODUCTION

BLINDNESS PREVENTION SYSTEM

Blink Frames is the latest product created by Globe Biomedical, Inc. an R&D effort aimed at developing eyeglass frames embedded with sensors that photograph the exposed area of the eye. One important use case for the system is the monitoring and reporting of eye-patch wear time for amblyopia in children. Ensuring a timely adherence to the prescribed treatment provides the highest likelihood of improving the child's vision before the problem becomes permanent. By providing doctors with compliance information, they are better able to tailor their care specifically to the patient's needs.

Our innovative device revolutionizes how doctors monitor their patients' patch compliance. The sensors are integrated directly into the frame so the doctor receives images from the device of the patient's eye when they should be patching. The device provides accurate tracking without the need for additional setup or manual input and seamlessly integrates into daily wear.



METHODOLOGY

UNDERSTANDING INITIAL TRAJECTORY

To validate how well the device predicted spectacle and patch wear time, we conducted tests on 15 pediatric subjects over several days at UCI (University of California Irvine). The test consisted of the patient indoors wearing the glasses with and without a patch, and then outdoors wearing the glasses while in direct sunlight. Images of the eyes were collected in two minute intervals and finally were uploaded to be processed by several different machine learning algorithms. These tests provided a great example of real world application of the device in a realistic testing environment.



AS SIMPLE AS 1-2-3

VISION TECHNOLOGY MADE INVISIBLE

With Blink Frames, embracing advanced eye care is as simple as 1-2-3. Just slip on your glasses, and let the smart technology take over—seamlessly tracking everything from patch compliance to screen time, without any extra effort from you. Ideal for monitoring conditions like amblyopia and myopia, Blink Frames offer an effortless way to keep an eye on eye health, providing peace of mind for both patients and caregivers, wherever they are.

1 wear your frames

Once you put on your glasses the frames instantly start capturing data.



2 collect data

Live notifications can be seen on the frames and data tracking can be viewed on your phone.

3 see the benefits

Track different metrics that may improve your vision and overall wellness:

- Patch monitoring
- Spectacle wear-time
- Physical activity
- Daylight tracking
- Screen time monitoring



AMBLYOPIA MONITORING

Blink Frames incorporate continuous, multi-modal tracking technologies that are capable of monitoring not just the wearing time of these corrective devices but also providing comprehensive data on eye health metrics. This continuous monitoring ensures that compliance can be tracked in real-time, allowing for timely interventions by eye care professionals and caregivers to reinforce the adherence to prescribed treatment plans.

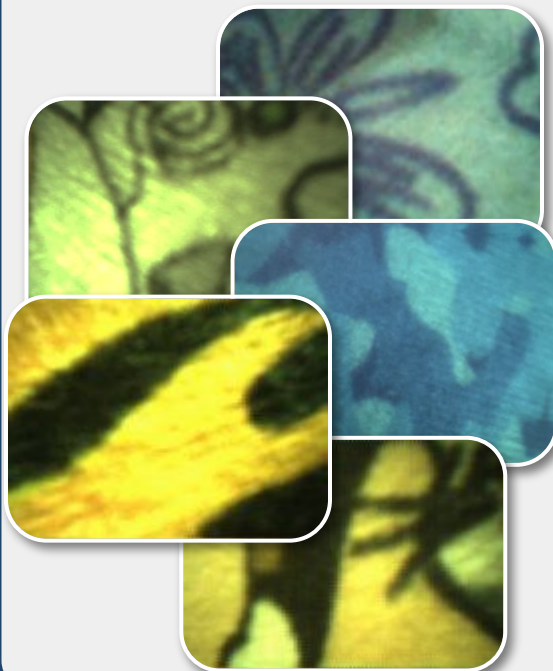
"I look forward to my patients using Blink Frames. Compliance is a major obstacle to getting the best outcomes. With Blink, I'll gain confidence in assessing patch and spectacle compliance, and as a platform for monitoring eye health, other significant health parameters [like screen time, outdoor time, and activity]. Most importantly, it keeps our patients and parents engaged in the treatment and our practice. This is a win-win!"

-- Dr. Donny Suh - Head of Pediatric Ophthalmology UCI

Eye Images



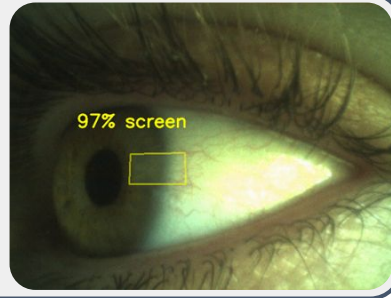
Eye Patch Images



MYOPIA MONITORING

In an era marked by excessive screen time consumption, balancing screen and outdoor time is crucial for mitigating myopia in children. Excessive screen time exacerbates the condition, whereas exposure to sunlight can help manage it. Monitoring these factors is essential for safeguarding young eyes, enabling providers to introduce adjustments integral to effective eye health management. Blink Frames provide this vital data at a glance, aiding in prompt and effective intervention.

Blink Frames use image segmentation to capture corneal reflection of screens, extracting key features for insightful eye health analytics.



4 min of Outdoor Time (96% Accuracy)

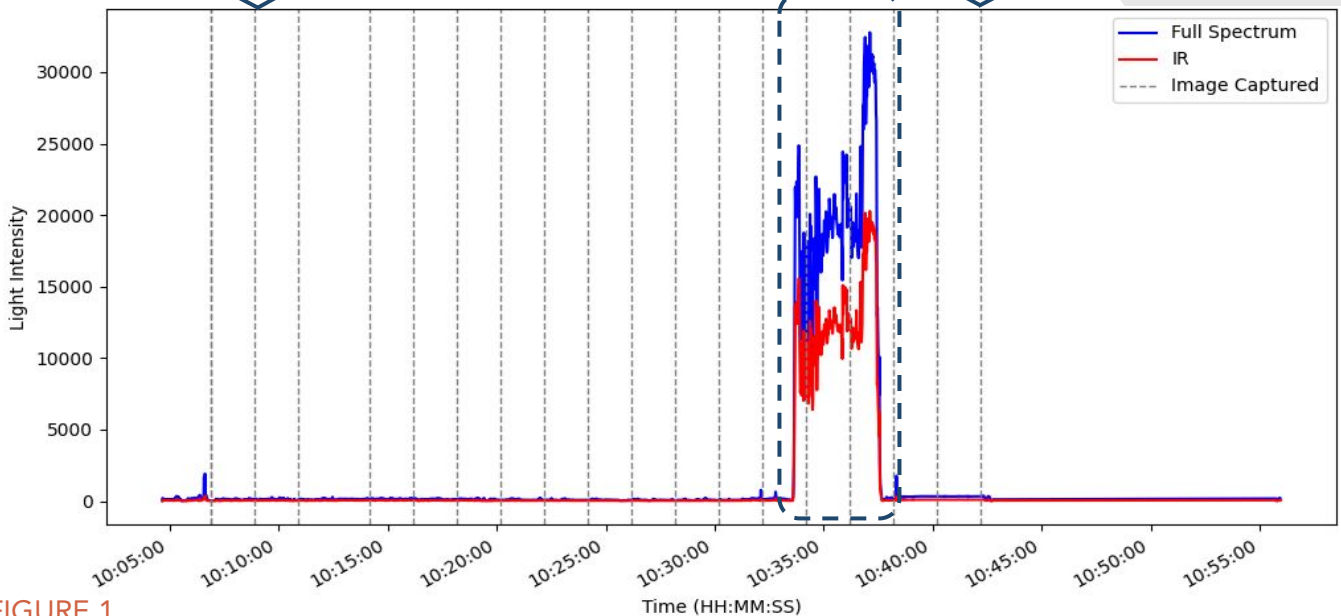
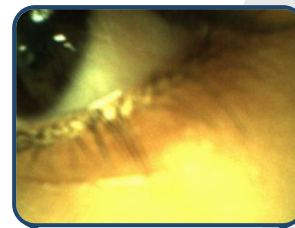


FIGURE 1

Collected Outdoor Time for Subject 207

PROCEDURE

PERFORMANCE PROCESS

During the test, the device recorded images from the subject's eyes at about two minute intervals. Time where the frames were closed during downtime or between tests was not captured. The technician had the subject wear the glasses for approximately five minutes without a patch followed by 18 minutes of patch time and ended with around five minutes of outdoor time. This varied slightly from subject to subject, but the overall actual vs predicted times can be seen in Figure 2.



FIGURE 2

Predicted Vs Actual Frame And Patch Time Across All 15 Subjects

RESULTS

DATA ANALYSIS OVERVIEW

The results of the data collection are summarized in Table 1. For each subject, the times recorded by the technician were compared to the times recorded by the Blink Frames. The comparison was done by taking the deviation of each subject's predicted frame and patch time from the actual to understand the spread of the predictions. The summary shows mean absolute deviation (MAD), standard deviation (STD) and median value for the deviations along with overall accuracy. The raw data can be found in Table 2 below. Figure 3 shows the distribution of the deviations across the subjects.

The overall accuracy for both frame and patch time are high at around 96% and 94% respectively which is well above our threshold of 90%. There is one outlier for subject 212 where we were unable to gather good data for a portion of the test due to not having the correct size frame for the subject's face.

The MAD shows how far off the predictions were on average. This value is around 80 seconds. The frames capture images every two minutes which sets a threshold for how granular the predictions can be. For each subject, the time between when they put on or take off the frames and the next image capture is going to be missed which is reflected here in the STD, MAD, and median. Overall, these metrics show that the Blink Frames were able to accurately capture the data and detect the frame and patch time across a diverse range of subjects and lighting conditions.

TABLE 1: SUMMARY OF TEST RESULTS

Metric	Frame Time	Patch Time	Outdoor Time
Accuracy	96.15%	94.03%	93.23%
MAD	71.53 (s)	66.53 (s)	16.27 (s)
STD (Diff)	49.24 (s)	41.11 (s)	14.74 (s)
Median (Diff)	85 (s)	60 (s)	10 (s)

RESULTS (Cont'd)

TABLE 2: RAW DATA FOR FRAME AND PATCH TIME

Subject	Actual FT (s)	Predicted FT (s)	Deviation	FT Accuracy %	Actual PT (s)	Predicted PT (s)	Deviation (s)	PT Accuracy %
201	1885	1800	85	95.49	1080	1080	0.00	100.00
202	1995	2040	45	97.74	1125	1080	45.00	96.00
203	1890	1920	30	98.41	1125	1200	75.00	93.33
204	1905	1800	105	94.49	1140	1080	60.00	94.74
205	1725	1740	15	99.13	1080	1020	60.00	94.44
206	1715	1560	155	90.96	1125	1080	45.00	96.00
207	1905	1920	15	99.21	1080	1080	0.00	100.00
208	1800	1680	120	93.33	1080	960	120.00	88.89
209	1845	1740	105	94.31	1140	1200	60.00	94.74
210	1845	1860	15	99.19	1140	1200	60.00	94.74
211	1860	1860	0	100	1090	1200	110.00	89.91
212	1845	1740	105	94.31	1079	960	119.00	88.97
213	2100	2160	60	97.14	1121	1200	79.00	92.95
215	1826	1740	86	95.29	1215	1080	135.00	88.89
216	1788	1920	132	92.62	1110	1080	30.00	97.30

RESULTS (Cont'd)

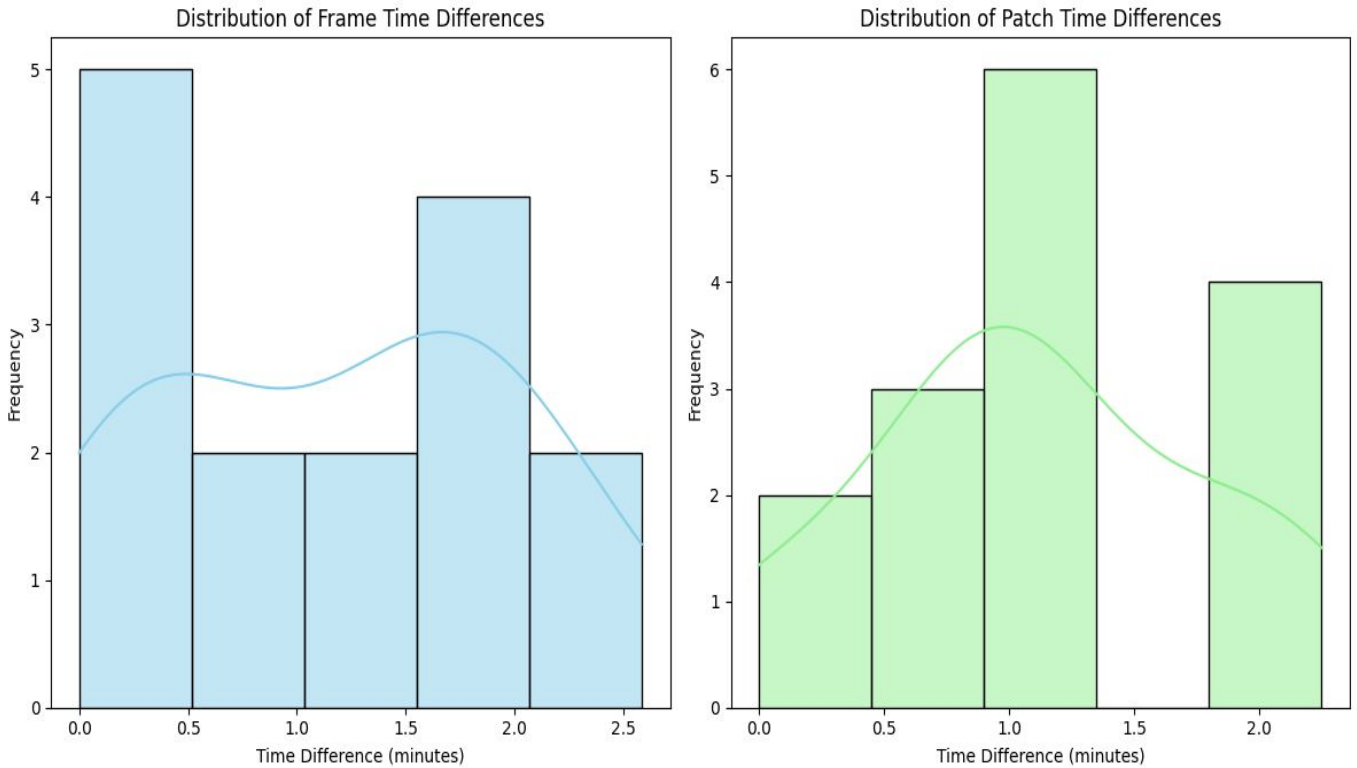


FIGURE 3

Distribution of Frame and Patch Time Deviations

CONCLUSION

The findings of this study affirm the precise performance of Blink Frames in meticulously recording patch wear time essential for effective amblyopia treatment. Furthermore, these frames excel in discriminating between significant and minimal outdoor ultraviolet (UV) exposure, a critical factor in managing pediatric eye health. This dual capability not only underscores the fidelity of the Blink Frames in adhering to their design specifications but also highlights their potential in enhancing myopia and amblyopia management strategies.

In pediatric patients, the precise monitoring facilitated by Blink Frames is pivotal for the successful management of progressive eye conditions. This technology enables doctors to tailor interventions based on reliable data, enhancing treatment adherence and promoting patient eye health. By integrating nuanced data capture and analysis, Blink Frames advanced pediatric ophthalmic care promotes both immediate and long-term ocular health. This transformative technology refines treatment modalities and fosters improved clinical outcomes through enhanced patient monitoring and customized care strategies.



blink

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