

Next-Generation Intelligent Solutions for Commercial and High-End Residential Spaces

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ABSTRACT

The luminXlogic smart lighting system optimizes light's impact on health and behavior through two metrics: sleep quality for health and product perception for behavior. It's tailored for car dealerships and homes, adjusting output based on object color and ambient light. Integrated circadian rhythm functionality utilizes Apple Watch sleep data to enhance sleep quality. Results showed a 17 minute increase in average sleep time when CM Mode used, and a 13% increase in test-driving likelihood for vehicles displayed under Contour Mode.

INTRODUCTION

Light greatly impacts how we perceive the world, but current lighting solutions often fall short in affecting human health and behavior. Introducing the luminXlogic autonomous lighting system, tailored for car dealership and residential clients. It enhances circadian rhythm and product perception to engage customers effectively.

Circadian rhythm is the bodies natural sleep clock that functions in waves throughout the day. Though it's influenced by several factors, the quintessential pathway of this cycle is hormone regulation; specifically of the hormone serotonin. Our lighting system capitalizes on lights effect on serotonin levels, by adjusting the rate of change in brightness and color, before a user wakes up and goes to sleep; timing can be adjusted based on personal preference, or by syncing Apple Watch sleep data to get the perfect settings.

Lighting conditions have been shown to directly influence consumer purchasing behavior, and in the automotive industry it's a product perception altering method severely underutilized. Our lighting system uses the Analogous color scheme to maintain consistent contour of the vehicle being illuminated, based on the vehicles color.

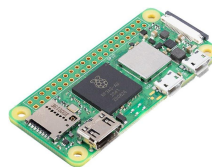
METHODOLOGY

SOFTWARE



1

2



ELECTRICAL

3

2



MECHANICAL

4



1

The luminXlogic iOS app has 2-way communication with the lighting system via the Raspberry Pi Zero 2 W microcontroller.

2

The Raspberry Pi takes ambient light & color sensor data as inputs to determine the correct color output, depending on the use case selected in the app.

3

The Raspberry Pi outputs light information such as color and intensity to the LED, which outputs RGB light, intensified by a lens.

4

All hardware components are stored within the main housing of the lighting system, while the ambient & color light sensors are housed within an attached shell.

TESTING & RESULTS

CIRCADIAN RHYTHM

Circadian rhythm testing was conducted by instructing five participants to wear an Apple Watch to monitor their awake time, REM, core sleep, and deep sleep durations. Participant data was collected over two weeks, with the first week under normal lighting conditions and the second under CM Mode; this mode adjusts lighting conditions 30 minutes before sleep-wake timing. Results showed an average increase in sleep time of 17 minutes when participants were in CM Mode.

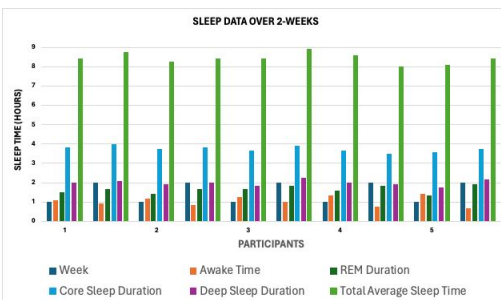


Figure 1. Sleep data of all 5 participants over the 2-Weeks of testing.

PRODUCT PERCEPTION

Product Perception testing was conducted by presenting four groups of 7 participants with photos of 6 cars under different lighting. The first 2 groups were shown photos of the cars under conventional dealership lighting, RGB:[255,255,255]. The 3rd and 4th group were shown the same cars under Contour Mode, which uses an analogous color scheme to output light, based on the cars color. 2 SUVs, 2 Trucks, and 2 Sedans of varying colors were the 6 cars used during testing. Results showed a 13% increase in the likelihood of the participants test driving the car.

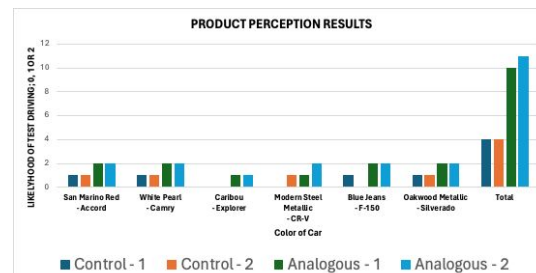


Figure 2. Perception data for 6 cars of varying colors, rated either 0 (No), 1 (Maybe), 2 (Yes), to test driving the car.