**Problem to be solved**

For this project the problem we are trying to solve is relatively simple. To help ease strain and improve productivity and mental health of computer users by keeping them in a well-lit, and productive environment through the use of a dynamic lighting system. Using a lighting system that will automatically adjust to the users’ needs by adjusting the colour temperature and brightness of the light in their office based on the time of day and the amount of natural light filtering into the workspace. By adjusting the brightness, we hope to keep the user’s workspace at a similar level of brightness throughout their day. While also using an internal clock, we hope to keep the colour temperature of this light at the optimal level depending on the time of day. Thereby negating some of the effects of blue light on the user’s eyes, sleep patterns and mental health.

For the past year due to Covid-19 many business, schools and colleges have pivoted to a work from home model. While some people’s workflow is entirely unimpeded, the reality for most is that they are now working in an area that was never intended to be used as a permanent office. This has led to a number of people working in workspaces that could be more damaging to themselves than they potentially realise. The cold blue light given off by computers, smartphones and other devices has been linked to a number of health issues.[[1]](#footnote-1) And being unaware and not taking the correct precautions can worsen the situation for a user. What we aim to provide is a lighting system that can be used in a number of forms to provide the user a safer and more productive workplace.

Another area we hope to cover with this is the improvement of the users overall mental health. The blue light given off by computers has been known to directly affect the circadian rhythm of human beings. Prolonged blue light exposer can through off a natural sleeping pattern.[[2]](#footnote-2) Using this kind of blue light until the end of a working day at around 6 o’clock can lead to the user staying up later, not getting the recommended amount of sleep and feeling more tired throughout the day. This can have a number of negative impacts. Most quickly a decrease in productivity but over time this sleep pattern change has been known to cause problems with mental health.[[3]](#footnote-3) Our aim is to introduce a yellow light to the users work environment there by negating the damage done by blue light, we hope this will promote a better sleeping pattern for our user base and in turn potentially reduce mental health issues and also increase the users productivity throughout the day.

Lastly the simplest solution we aim to solve is light. It can be often overlooked the importance of good lighting in the workplace. While providing the user with a light system that adjusts to the ambient light levels of the workspace, we are hoping to keep them in a consistently lit working environment throughout the day.

***Summary of Project Solution***

Our end goal with this project is to create an automatically adjusting lighting system that will keep the user a recommended level of light throughout the day. Keeping the user in a well-lit environment is the simplest problem. Using a light sensor, we will be able to read in the value of light within the room. Using this value against a tested recommended level we will be able to raise or lower the brightness of the light as needed as the day goes on.   
The next part of the solution is the colour temperature. We are hoping to negate negative effects of blue light exposure on the use throughout the day. This will be achieved by adjusting the colour temperature of the as the day goes on progressively going from blue at the start of the workday to a more-soft yellow, orange tone. By reading from the user’s pcs internal clock we can thereby find the current time and adjust the colour temperature as needed.

Icon

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**Rough illustration of proposed solution.**

Beginning with the light. As a realised project we would using colour changing and dimmable LEDs. This is preferred over a traditional light bulb as it offers the final products cheap build cost as well as cheaper running cost. These LEDs are also smaller and can made to fit into simple USB desk lights if the user does not have space for another light in their workspace. The solution for this is relatively simple, through out the day using a light sensor we can take in a value, this representing the ambient level of light in the users workspace. Depending on this value we can compare it to a known and tested recommended level for the user, depending on the input value the lights will then either raise the brightness, lower the brightness or turn the light off entirely. This means that on a sunny summers day with the blinds open, the users workspace will be flooded with natural light, so the smart light will turn off, and on a cold winters morning where the sun can sometimes not be noticed until midday the users light will turn on and increase the brightness of the room to the optimal level.

The change in seasons is one of the reasons for using the light sensor. If we were to take values as an average for the year this would result in either the incorrect lighting depending on the time of year. For example, if hard coded values were assigned in summer then these would be too bright and in winter there would be insufficient light for the user’s workspace. And if we were to assign values for times throughout the year the code structure would quickly get to be and complicated as well as requiring a lot more testing. The simplicity of the code if afforded thanks to the light sensor.

The next step in the solution is the colour temperature. To avoid affects of blue light we will be adjusting the colour temp of the light throughout the day. We will be using the users Pc’s internal clock to do this. Like using the light sensor, the simplicity of reading in the value offers a lot more flexibility in use while also limiting the amount of coding work to achieve it. Comparing the current time read-in to an assigned value for when to use blue light or when to use yellow light. For example, a user turns on their Pc at 9 am. For them we would set the colour temperature to blue, assuming a 9-5/ 9-6 working day. We would start with a blue light and after the time reaches midday then start to transition the colour temperature gradually so by the end of the day the user is working under an orange toned light.

Once these two systems are working, they can play off each other very well. Our preposed solution would start by reading in both above values and then begins processing. So, assuming a 9 to 5 day for the average person. The light would turn on at a determined brightness based on the reading from a light sensor, as midday is usually the brightest point in the day the lights would dim gradually as it approaches midday, even turning off entirely if the light levels in the room are sufficient. Then after midday the colour temperature would gradually change to a more orange tone, and the brightness will increase as light levels lessen. So, by the end of the day the user will be then using a much softer toned light. The input readings also work in such a way that someone on unusual working hours would always have the correct light for their need. Eg. Someone working throughout the night would never lose much needed light and they would constantly be working under yellow toned light to make up for the lack of natural sun light. We then have made a very effective lighting system for users in any geographical area, for any time of year and for any working hours.

Graphical user interface, diagram

Description automatically generated Example of Hardware design.

1. (Hatori, M., Gronfier, C., Van Gelder, R.N. et al. Global rise of potential health hazards caused by blue light-induced circadian disruption in modern aging societies. npj Aging Mech Dis 3, 9 (2017). https://doi.org/10.1038/s41514-017-0010-2) [↑](#footnote-ref-1)
2. Tosini, Gianluca et al. “Effects of blue light on the circadian system and eye physiology.” Molecular vision vol. 22 61-72. 24 Jan. 2016 [↑](#footnote-ref-2)
3. Yoshitaka Kaneita, Eise Yokoyama, Satoru Harano, Tetsuo Tamaki, Hiroyuki Suzuki, Takeshi Munezawa, Hiromi Nakajima, Takami Asai, Takashi Ohida,Associations between sleep disturbance and mental health status: A longitudinal study of Japanese junior high school students,Sleep Medicine,Volume 10, Issue 7,2009,Pages 780-786,ISSN 1389-9457,https://doi.org/10.1016/j.sleep.2008.06.014. [↑](#footnote-ref-3)