

# Requirements Document

N. Appleton

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## Key Features

Cycles	
ID	CY
1	Should expose users to as natural light-patterns as possible throughout the day and night

Context for Use	
ID	CX
1	Users must be able to use this light as their main light source throughout the day
2	Should be able to light spaces of any size (scalable solution)

## High-Level Requirements

Sleep	
ID	SL1
1	Should not affect users sleep in any meaningful way by only exposing them to appropriate spectra after dark

Morning and Daytime	
ID	DY1
1	Must provide a wide range of wavelengths during the day
2	Output spectra should vary throughout the daytime to match the sun's rhythms

Usability	
ID	US1
1	Users should be able to work for extended periods under lighting provided solely by this light
2	the produced light should be bright and accurate in its reproduction of colour

Modularity	
ID	MD1
1	Device will have a modular design consisting of multiple different module
2	One module will be used to control the device, the others will be varying types of LED collections

Power	
ID	PW1
1	Device should consume as little power as necessary for it to fulfil its function
2	Device should be compatible with a wide range of possible sources to allow for broad use-cases

## Functional Requirements

Circadian Effects	
ID	SL2
1	Device must be able to cause no circadian phase shift by having an option to produce light of less than 5 Equivalent Daylight Lux (EDL)

Spectral outputs	
ID	DY2
1	Spectral Outputs should be calculated based on a set of given spectra, each with an associated time
2	The Spectrum will be calculated based on the previous and next pre-defined spectrum, scaled by the temporal distance from each

Brightness	
ID	DY3
1	Each LED module must be able to produce a brightness of at least 250 lumens
2	Brightness should be configurable on-the-fly by the user

Colourimetry	
ID	US2
1	All LED modules should have a Colour Rendering Index of at least 80%

LED Modules	
ID	MD2
1	There will be at least 3 types of LED module:
2	Daytime Module will contain only white lights, for use in the morning and daytime
3	Evening/night Module will contain amber and red colours for use after dark
4	All-day Module will have all a configurable spectrum in which all the colours' intensities can be edited

Compatibility	
ID	MD3
1	Any combination of LEDs should be able to be used with one controller
2	LED modules output spectra should be accurate within their remit of wavelengths
3	Multiple controllers should be able to be connected and work in tandem to control 1 light system

Control Modules	
ID	MD4
1	Control must have minimal user input and output to allow for ease of use in all conditions
2	All user inputs should be expandable by adding more of those features (eg. an extra on/off switch for the other side of the room)

Time Setting	
ID	SL3
1	The user can set the time manually
2	The Device should be able to automatically ascertain the time via a WIFI connection to the internet
3	The time for all events such as sunrise and sunset can be set by the user
4	The event times of the users location should be collected from the internet if the user so chooses
5	The device will keep track of time even if mains power is lost

Brightness Calculation	
ID	DY4
1	The calculated spectral output should include an intensity that varies throughout the day
2	If the user overwrites the brightness, this should not affect the morphology of the spectral output.
3	When the user overrides the brightness, all spectra up to and including the next predefined point will be edited proportionally to the users input
4	The highest and lowest brightness levels that are output should be configurable by the user

Data storage	
ID	DT1
1	There could be an SD interface to allow the user to upload custom data onto the device without requiring technical knowledge

WIFI Credentials	
ID	DT2
1	WIFI credentials such as SSID and passwords could be stored on the SD card and read by the device when it needs to connect to the internet

Spectral Data	
ID	DT2
1	An SD card could be used to upload custom spectra to the device so that users can edit their own exposure throughout the course of the day
2	Default spectra should be hard-coded onto the device so that no external features are required for the device to function

Brightness Calculation	
ID	DY4
1	A single push knob for navigating the interface could be used to minimise the number of inputs
2	Using a single knob, all 4 directions of navigation can be achieved: up and down by turning, select by pressing the knob and back by double-tapping or long pressing it.
3	A capacitive touch pad can be used as an on off switch that can be of any size - improving ease of use in the dark for example
4	The highest and lowest brightness levels that are output should be configurable by the user

Maximum Power Consumption	
ID	PW2
1	Device should use a 12V supply as this is very common and would make the device usable from mains supplies to car batteries
2	A controller module should consume no more than 500mA of continuous current draw during operation
3	The average consumption of a controller unit over the course of one hour should be no more than 50mA
4	An LED module should consume no more than 1500mA to produce continuous lighting of 1500 lumens

Low-Power / Mobile considerations	
ID	PW3
1	A small internal battery can be used to prevent the device from losing its time data in the event of a power-failure with the use of a RTC
2	There should be a low-power mode that the device can always return to for minimising power consumption where required

## Implementation Options