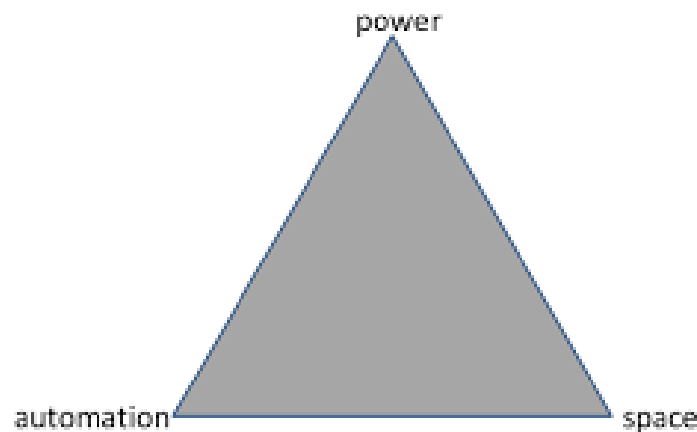


At week 10 of this project we believe that we are far along and well on our way to having a complete, functional, aesthetically appealing final prototype on design day; at this moment we have a functional, but incomplete prototype. Since we got such a jumpstart on developing our tunable light source we hoped to have a nearly complete prototype by now. After consultation with our sponsor Dr. Prem Chahal about our progress thus far we were given positive news; however this resulted in a major change to our initial design.

Initial requirements given to us for our tunable light source was that it had to hit 25 optimal wavelength points along the spectrum of 400 nm - 1100 nm with a minimum power output of 0.1 W and illuminate an area of 1mm². When we began this project we planned to have a single array of LEDs to provide the light source that we would tune by using transistors and pulse width modulation to determine which LEDs are on and how bright they are. To reach the minimum power output for a certain wavelength it required about 40 LEDs to be turned on at once. To reach the minimum power output for all 25 optimal points would require about 1,000 LEDs which we did not have the space for on our array or money in our budget, since some of the higher wavelength LEDs cost \$20 each. From our constraints we determined we had a trade-off triangle where we can only meet two of the three corners:



By the end of week 2 we had a functional prototype that demonstrated the circuit design and programming of our tunable light source concept. This being the heart of our project we spent the next few weeks developing how we wanted

to design our overall device; how we would house it, which lenses we would use to focus light, what type of user interfaces we would have, etc. At the start of week 8 we had most all of our required parts in hand and a clear idea of what we wanted to build. For our mark 1 we planned a rectangular box that had all of the LED's mounted together at one end. This end with the LED's would also contain all of the circuitry and the microcontroller required to control the LED array. Moving away from this end the light emitted would be filtered down to a more exact beam through two lenses. From here the final light would be emitted from the opposite end of the LED array. On the 'top' of the box we plan an LCD display to tell the user which wavelength is being emitted and at what intensity. The box would also contain a USB port that would allow the user to connect to a laptop computer and load a user interface that will allow them to control which wavelength is outputted and at what intensity without having to flip through all the options by using the physical control. This design allowed us to meet the space and automation requirements on the tradeoff triangle but we had to sacrifice power.

We discussed what we planned to do with Dr. Chahal during week 8 and he was very impressed with our progress and wanted to inquire about the cost to meet the required power output for all 25 peak wavelength points. With Dr. Chahal offering additional funding as a possibility we were able to eliminate the cost issue of meeting the minimum power output for all 25 optimal wavelengths. This allowed us to be able to design mark two that met the power and space requirements on the tradeoff triangle but we had to sacrifice automation.

For the design of mark two we created multiple arrays of LED's each of a certain wavelength (labeling the wavelength) then incorporate each individual array into our device by using a CAT5 connection. This connection has 8 pins which would allow us one for PWM of the LEDs, one for ground, one for power source, and five we can use to connect the array digitally to the user interface described above. Now with this new design the user will not be able to change the wavelength with the controls directly but all they will have to do is change the array that is inserted and the user interface will tell them the wavelength and allow them to control the intensity. We plan to incorporate a carrying case that will house both the device itself and all of the needed arrays.

With this mark two design comes the possibility of expanding beyond the required 25 optimal points. Since we are making a separate LED array for each optimal wavelength we can easily create additional arrays of other wavelengths that could be added at any time. At this point we do not have guaranteed full funding to have enough LED's to meet the minimum power, however even without the full number of LEDs we would still be able to demonstrate our mark two tunable light device will work with everything as it should be except for the minimum power. As mentioned above this new design will allow for more expansion potential, so if we do not meet the power requirement on design day the device can easily be altered with additional funding to do so.

We brought the mark two concept to Dr. Chahal and while he was impressed he expressed that he want to do no work and did not want to have to interchange. We plan to proceed with producing our mark one design that meets the automation and space requirements of the trade-off triangle in addition to meeting the power requirement for a few wavelengths to show that it is possible; however we will not be able to meet the power for all wavelengths without sacraficing space.