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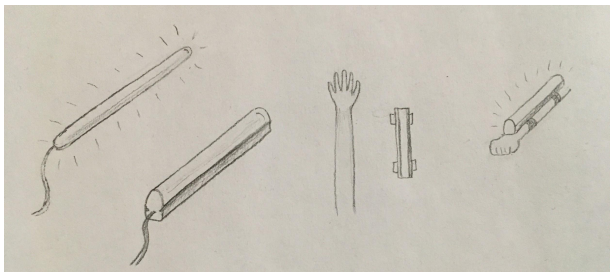
Tinker Design Competition Spring 2021

Coveliminator

What are the nuisances of a worldwide pandemic? Well, for starters, I'd say the disease itself is pretty high on that list. As a student myself traversing the spaces of a bustling city, the open air is not only refreshing but cleansing as well. COVID-19 spreads slower and much less potently in the great outdoors. Continuous air flow and limitless volumes of open space mitigate COVID-19 transmission, and as a result reduces the stress of anyone going about their day. But what about inside? Even with proper ventilation systems, no indoor space can compete with the effects of outdoor living, and the fact of the matter is that many rooms and buildings act as little circulation chambers for the airborne virus. While masks help to reduce the spread of any disease from one person to another, they do much less to stop viral particles from getting to someone's respiratory system from the open air. We all might feel fairly safe around our friends, but how do we really get that security to not breathe in a handful of COVID-19?

When answering this question, we have to think of where the problem exists and what the practicality is of approaching it. I went towards this thinking about the air around me and how I could protect myself from airborne particles of COVID-19. Since the problem is about "protection," there are two main courses of action: either defense or offense. Improving face masks and other face protections has been done time and time again, and frankly I didn't see any inspiration coming from that direction. But what about an offensive measure? That is to say, going after the disease instead of hiding from it. I began my research as to what harms and kills the virus, which of course was piles and piles of different valuable resources. Living with limited materials, though, I was able to cross many of these different studies off the list as they just weren't attainable or useful for my own project. Then I stumbled upon something that was

out-of-the-water: back in December of 2020, multiple news outlets had run some stories on the revelation that UVC lights have the strength to effectively destroy the outer protein layer of the SARS-Coronavirus, which deactivates it. Although this has been more widely studied with the SARS virus from years ago, the same principle can be applied and is being applied across the world, and it's being proven that a UV radiation and the combination of UVC and LED lighting "kills" the SARS-CoV-2 virus upon exposure. With this new information came inspiration.

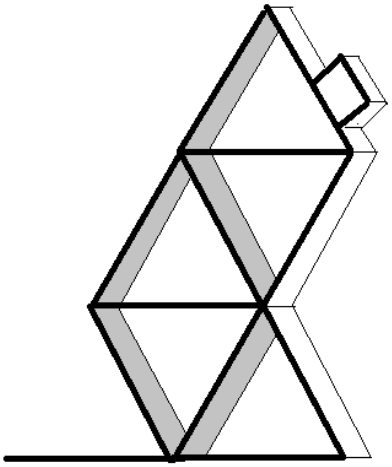


I have always had a lot of random lights lying around for different projects and general home-utility. One of those lights that I had forgotten about until this competition was a small black-light. This was going to be the backbone for the rest of my designs. I began sketching different methods of attaching the small UV lamp to my body as a new form of PPE. I finally settled on creating a belt-like system to strap the lamp to my forearm that would point the radiation out away from me and keep it secure while moving normally. Limited on materials, I used duct tape to create the straps, and bent paper clips to make them adjustable as they were secured. The duct tape held well to the lamp and allowed easy use for one hand to quickly secure the system to the opposite forearm.

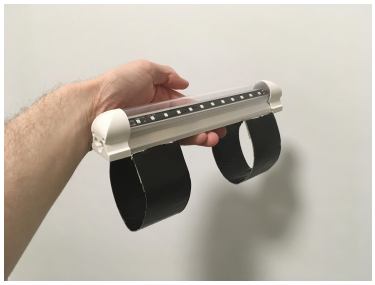
In addition to this equipment setup, I also had a portable LED light that I could use for something else. After all, LED is harmless to humans but helps strengthen the effects of UV radiation against the virus. The LED light would also help to illuminate an area, since using ultraviolet light as a

way of illuminating an area to see better is not recommended and can be dangerous. The supplemental LED was necessary. So, this round push-button LED would need to be easily used and attachable at some point with the rest of the system. I decided that fashioning it to some sort of glove would be the best option. I used one of my touch-pad gloves for the contraption. After a lot of trial and error, and a few mix-ups with batteries, I was able to successfully attach the LED to the palm of the glove. With that in place, my hand and fingers were free to move with the glove with barely any restriction of movement. Simply by curling any of my fingers down towards my palm, I was able to press the LED to turn it on. A second press and the LED would turn off. This was completely wireless, and therefore allowed me to use it in tandem with the rest of the UV-LED system seamlessly.

I then realized that while not in use on someone's arm, this device could still serve a purpose in their own home while not on their person. That's when I had the idea for a sanitation stand. Built out of lexan plastic pieces that I had leftover from a class last semester, the sanitation stand would be able to hold up the UV lamp at an angle that would point the radiation at a specific area. Safety is the number one concern with this system, so pointing it out into open air constantly is not a good idea. Making the stand out of triangles allowed me to position the lamp's radiation downwards at a specific angle. This positioning was intentional: with the stand being low-to-the-ground and the angle pointed down, this was now a sanitizing station for any objects placed in the area beneath the stand. The UV lamp could be run continuously while charging, and anyone in the household could put something underneath the lamp to sanitize it for a minute or so. This would be especially useful at the entrance of a home where you could place something there as soon as you walked inside; and since it's the same device as the one meant to be worn, you could grab the lamp part on your way out the door and strap it on.



From there, I had my full system of the Coveliminator. The glove-LED system allows full use of that hand while also protecting against contact-based contamination, as well as the simultaneous illumination/sanitation functionality. The black-light-forearm system creates a radial steam of UV radiation that sanitizes the air around the user, killing all forms of COVID-19 before it comes close to getting to the user's respiratory system. In the future, this project could turn into a fully developed system as a regularly-used method of PPE in enclosed indoor areas. One of the main struggles of this project was the powering of both devices. It would be nice if they could both be powered wirelessly together, in the same system. I had considered doing that with a battery back and small solar panel that I had, but due to time constraints I had to leave that out. Regardless of that, this tool is fairly easy to manufacture. I would definitely redefine some of the attachments and make it more comfortable/accessible for others to use.



Appendix

BOM			
Item	**Material/Sourcing**	**Size**	**Price***
UV Black-Light	Online Retailers	8.5 x 1.5 x 1.5 in	~ $10
Duct Tape	Black Rubber Tape	3 ft strip	~ $5 per roll
Glove	Retailer	N/A	~ $4 per pair
Press-Button LED	LED bulb + Plastic	1 x 3 in diameter	~ $2
String	String	1 ft	~ $1
Lexan Plastic Strips	Lexan Plastic	0.5 in x 6 ft stock	~ $10

**Prices are estimations, nothing was purchased for this project*

Sources:

FDA UV Lights and Lamps: Ultraviolet-C Radiation, Disinfection, and Coronavirus:
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