Introduction

As society transitions from alert levels to the traffic light system. More people have an incentive to commute into densely populated areas. This increase in commute to densely populated areas in the post COVID era has sparked some concerns of transmission via high touch public surfaces. An example of a high touch surface is crosswalk buttons. These buttons are an integral part regarding the safety of the residents of any major city. Every pedestrian will at some point throughout the day, press one of these buttons. Thus, there has been a demand for a high sanitary procedure in every sector of the economy. This demand for higher sanitary procedures can be fulfilled by exploring the concept of santising high touch surfaces such as pedestrian crossing buttons with the T.L-aura.

Product justification

COVID-19 can survive on surfaces for up to days depending on the material. Our material of interest is stainless steel. This means that COVID-19 can last from 3 days to 7 days [1]. Furthermore, this presents a form of transmission for high touch public surfaces such as buttons. An example of high touch surfaces being a concern to COVID-19 transmission would be when a patient contracted COVID-19 by a patient who previously used the elevator. This was in one of the least developed parts of China where access to sanitary supplies was limited [2].

Current studies conclude that high touch surfaces contribute to a low amount of cases of COVID-19 transmission. Resulting in 1/2000 cases of transmission associated with high touch surfaces. This study was conducted in Massachusetts USA, with a population density of 20,000 per square mile. In that region 10% of the sampled crosswalk tested positive for traces of COVID-19 [3]. However, the studies were conducted in places with good access to sanitary supplies and stable infrastructure. As a result, transmission via high touch surfaces in less developed areas may contribute to higher numbers of transmission than more developed places. Additionally, these forms of transmission still present a risk to the immunocompromised. This may be prevalent in crosswalks near retirement residency and hospitals.

Similar products such as Inhibit Coatings and SteriPro would be inefficient in sterilising crosswalk buttons. Inhibit Coatings are effective on porous surfaces such as textile and wood and wear off in non-porous surfaces such as the crosswalk button. Additionally, SteriPro is tailored specifically to hospital use. This lack of sanitary procedure for metal surfaces where COVID-19 and other pathogens may remain for an extended period of time creates a gap in the market where we hope to fill. We hope to fill this gap with the use of ultraviolet light (UVC) as it retains the same user experience as a normal crosswalk button without the opportunity cost of inefficient sanitisation. A market survey conducted by us shows that only 2.2% says that an automated cleaning would not feel more comfortable when pressing the crosswalk button. Furthermore, UVC is not limited to reducing the risk of COVID-19 transmission but also the transmission of norovirus and other pathogens [4].

Technology

To effectively reduce the transmission of pathogens via high touch surfaces. It is recommended to employ UVC as the form of sanitation. This UVC energy would be radiated onto the metal surface of the crosswalk button to sterilize the pathogens. UVC energy is absorbed by nucleic acids inside the RNA and DNA, resulting in improper covalent bonds which at the right dose can render a pathogen unable to reproduce and infect. The most effective germicidal wavelength occurs with a peak between 260 nm to 270 nm, the point at which DNA absorbs UV energy the most [5].

$$D = \frac{Optical\ Power\ (W) * Exposure\ Time\ (s)}{Surface\ of\ Illumination\ (m^2)}$$

Equation 1: radiation dosage derived from optical power of the UVC, exposure time and size of surface.

Using equation 1, at the wavelength of 268 nanometer, the T.L-aura will produce 3mW of power, with 42 seconds of exposure time and a sterilizing area of 25cm^2. This product would achieve a 5mJ/cm^2 dosage of radiation which would lead to a 99.7% reduction in the detection of live COVID-19 on the surface [6]. This dosage of radiation will be effective in reducing the spread of COVID-19 along with other pathogens such as noroviruses. This is effective in reducing the spread of pathogens that may lead to major unknown clusters by sterilising a high touch surface.

10 seconds after pressing the crossing button, the 42 seconds of sterilising duration will be activated. This aims to reduce human radiation interaction. However, in the event a user would be exposed to the UVC during the sterilising period. The exposed duration is estimated to be under 4 seconds resulting in a low dose of 0.48mJ/cm^2. This is significantly lower than the daily safe intake of UVC of 6mJ/cm^2. Thus, we conclude that the T.L-aura is both effective in sterilising pathogens and safe for human interaction [7]. After sanitisation of this high touch surface, the medically vulnerable and the immunocompromised would be less at risk of becoming a vector of a cluster of COVID-19 and or noroviruses as shown in Figure 1.

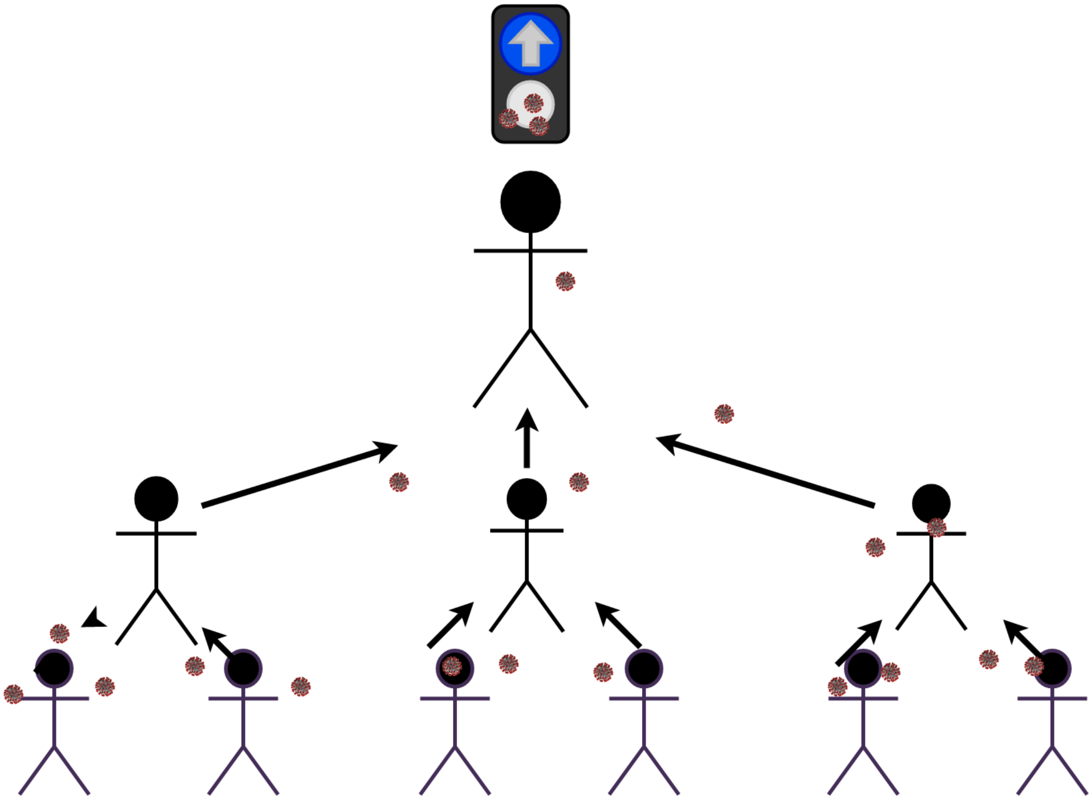
Figure 1: example of a cluster from the transmission of high touch surfaces

Areas of application

Other areas which the T.L-aura can be utilised in the future would not be limited to just crosswalks. This technology can also be used in high touch surfaces in hospitals where pathogens would be more prevalent. T.L-aura has an advantage to other similar products such as hand held UVC bulbs in a sanisating setting. This is because of the varying radiation exposure these hand held UVC provides compared to the T.L-aura fixed UVC output. Additionally, the UVC bulbs have not proven to be effective against pathogens and do not directly target surfaces. Furthermore, these hand held UVC bulbs require additional labor cost which may result in a loss of profit.

Compared to the current products on the market and the effectiveness of the T.L-aura. It is recommended that every T.L-aura be installed on every crossing in New Zealand. This will improve public safety and prevent potential clusters that may put unnecessary stress on the healthcare system.

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