ViralProbe

14.06.2020

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Overview

One of the major tasks of a typical household includes grocery shopping and during the current COVID-19 pandemic it has turned into a stressful task for families and individuals. We chose to tackle the problem of **reducing germ transmission in grocery stores** and we decided to go down this route because grocery stores have been considered essential essential workplaces throughout the pandemic by the Ontario government[1] and it is important that such places do not become transmission hotbeds.

Goals

1. Create a sanitising device that eliminates the need for manual grocery cleansing.
2. Ensure that the device is retrofittable on current grocery store counters.

Background

A concern shoppers are facing during the current COVID-19 pandemic is the threat of catching the viral disease from touching contaminated surfaces such as cardboard boxes, plastic crates, jugs, and grocery store cart handles. According to a survey conducted by Dalhousie University and the angus Reid Institute 71% of Canadians are generally concerned about the coronavirus/COVID-19 outbreak with Quebecers showing the most concern at 79%[2]. Although the transmission of the virus through fomites has not been detected [3], contamination of surfaces touched by employees and customers is a means of spreading COVID-19 [4]. This is problematic because there is a possibility that a shopper may contract the virus upon touching a contaminated item and then bring their hand closer to their mouth, eyes, nose.

Our design consists of a UVC light based sanitising solution that is an improvement upon pre-existing UV based sanitisation machines and intends to reduce the amount of time shoppers spend upon bringing items into their homes and in general reduce the psychological stress and anxiety of bringing foreign contaminants into your residence.

We believe this is necessary during this pandemic when the mental health and wellbeing of societies has been severely affected by the pandemic and there is higher anxiety among those who are financially affected by COVID-19[]. Our design aims to reduce the

occupational stress of grocery shopping and provide a piece of mind to customers and their families.

Specifications

Our sanitisation device, Viralprobe, consists of a conveyor system that moves materials through a UV chamber, exposes the items to a dosage of UV radiation and then brings them outside for packing into bags or carts. Viralprobe is intended to be easily transferable to different kiosks and checkout counters as per the store's needs. The device is designed to be retrofittable and can be placed on standard grocery checkout counters with a width of at least 650mm and a table length of 2500mm.

Fig 1. A typical supermarket grocery store counter. The intended design will be placed on top of the conveyor system to allow the cashier to easily add items into Viralprobe and the customers can find it dispensed at the end.

UV Radiation

UV light has been found to be effective against coronaviruses although SARS-CoV-2 virus has not yet been specifically tested for its ultraviolet susceptibility, other tests on related coronaviruses, including the SARS coronavirus, have concluded that they are highly susceptible to ultraviolet inactivation [6]. An exposure of 30 seconds has been shown to inactivate upto 99% of COVID-19.

UV light has been shown to reduce Salmonella contamination on food contact surfaces such as stainless steel, HDPE, waxed-cardboard, and PVC [8]. The effects of UV light on different materials

Reduced Size

The form factor of our design is an improvement on existing solutions which has been described as “too big and too powerful” for a grocery store’s purposes [7]. Part of the reason lies in the fact that it is a repurposed medical device for sterilizing medical masks. We have purposely designed the device to easily fit in a conventional store and make the process of transporting it between different counters easier.

We believe that our design is a better take on UVC light sanitisation technologies mainly due to its **small form factor**, **reduced noise** and a **cheaper** cost.

Design Description

Our solution, **ViralProbe**, is the fully automated solution for sanitizing groceries at the check-out counter. **ViralProbe** features 4 UV-C light tubes at each side of the case to ensure that every part of an item is fully exposed and sanitized. A major convenience factor associated with our design is the presence of rotating rollers at the base, allowing an item placed at the entrance to exit without human contact. A Nema 23 stepper motor is utilized to power the rollers to ensure enough torque to carry up to 50 kg of groceries at a time. With a width of 550mm, our solution can be retrofitted to any current grocery store counter. Guards made of rubber are placed at the front and the back of our design to prevent human contact with harmful UV-C light while placing grocery items, thus ensuring the safety of the operator. An aluminium 1060 alloy is utilized to ensure that our design can withstand higher operating temperatures while remaining cost effective and light weight. The inside of the shell is covered with a UV absorbing coating to prevent overheating and corrosion due to high energy photons[9].

Design Drawings

Fig 2. ViralProbe proposed design.

Fig 3. ViralProbe proposed design.

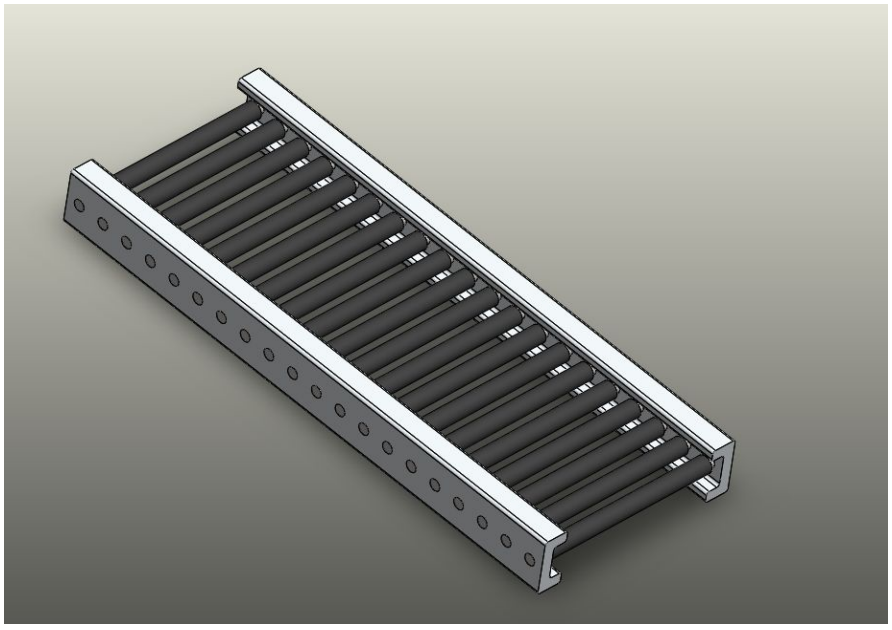

Fig 4. ViralProbe conveyor system with gaps in between rollers for bottom exposure.

Fig 5. ViralProbe top view.

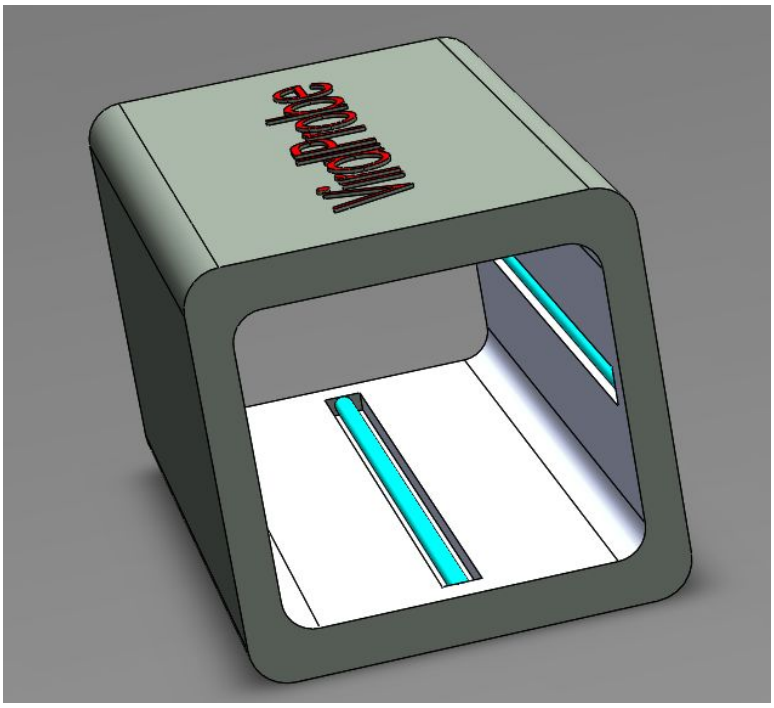

Fig 6. ViralProbe lamps displayed. (Conveyor hidden from view)

Bill of Materials

Item Name	Quantity/Volume	Cost
1060 Aluminium Outer Case [11]	102500 cm^3	$500
UV-C Light Bulb [10]	3	$19.99
Nema-23 Stepper Motor [11]	1	$33.51
Rollers	20 (245 cm^3 per roller)*	$350
Rubber Guards [12]	2	$108
UV-C Absorbing Coating [13]	1	$7.15
Total		$1018.65

*Volume based of SolidWorks CAD Design Specification and price per volume of Aluminium

Conclusion

With a low-cost, effective design capable of killing germs placed on grocery items, ViralProbe is the ultimate solution for grocery stores. With a fully automated and no-contact sanitization solution that can be retrofitted on any grocery store conveyor, our design helps to eliminate the psychological and health concerns associated with grocery shopping.

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