Ultraviolet Sanitization of Wallet using UVC LED'S

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2021 7th International Conference on Electrical Energy Systems (ICEES) | 978-1-7281-7612-3/20/$31.00 ©2021 IEEE | DOI: 10.1109/ICEES51510.2021.9383681

***Abstract*— COVID-19 has spread rapidly across the globe. World Health Organization has declared COVID-19 virus a pandemic. While COVID-19 is identified to be spreading through various mediums, currency is identified to be one significant medium. The apparent usage of currency across the world has only been increasing irrespective of the situation. An infected individual can easily spread this virus through currency and credit/debit cards while using them. This triggered our idea to come up with a wallet that can sanitize its belongings. The belongings in the wallet can be sanitized using the ultra -violet ray technology. Since 555 timer is also used, the circuit will automatically cut off after 5 minutes of switch-in on to have seamless user experience. In this paper it is explained on how this circuit works and how the circuit was embedded in the wallet.**

Keywords— Coronavirus, smart wallet, uvc leds, 555 timer, currency sanitizer, UVC.

I. INTRODUCTION

The novel coronavirus has spread quickly worldwide [1-4]. The first corona case was found in early November in Wuhan China. And at present this virus made each and every thing as its medium to multiply itself and now the total Worldwide Cases has been crossed 3 crores [5]. There are so many mediums for the rapid spread of this corona virus and in which currency, cards are one of the medium[6]. The normal cases through which this virus is being spread is by saliva droplets [7].so there are a lot of chances in which an infected person can spread their droplets(while counting money, touching money with their infected hands ,while sneezing in front of currency)and making a way to spread the virus. As currency changes from hand to hand, there are a lot of chances for a normal person to get effected by this virus.

When a normal healthy person touches the cash (on which virus is present) and kept on his /her mouth, eyes or nose then he/she will be effected by this virus.

Even though people are aware of this issue [8](spread of virus through currency) they are not able to control the spread because currency is the primary means of transaction and has a great importance in everyday life.

This triggered our idea to come up with a wallet that can sanitize its belongings including but not limited to the currency, credit/debit cards, paper products, coin currency etc., It is proven that Ultraviolet rays can be used as a sanitizer and it is able to kill all types of germs including coronavirus [9-10]. This technology is implemented in the wallet. The usage of 4 UVC LEDs in a wallet can sanitize all the items kept in the wallet. The inclusion a 555 timer that can help auto cut off the circuit after 5 minutes and help user experience as well as to ensure things kept in the wallet are safe from all kinds of viruses and other kind of microbes.

While it is understood that using UVC rays can be harmful for humans as it may cause skin cancer[11], it is considered in the design and the wallet is completely covered with Aluminum film. It is proven that Aluminum has the physical property to prevent UVC rays. This Aluminum film will ensure that UV rays remain in the wallet.

II. DESIGN AND DIMENSIONS

This wallet is designed considering the dimensions that are normally available in the market. The reason for us to be careful about the availability of designs is to ensure that there is no need to manufacture a separate wallet instead modifications can be done in the existing wallets that are readily available in the market. The dimensions of this Wallet are 240x10x100 mm as shown in figure1.In which 20x10x100 mm volume in both the ends of the wallet are used for inserting the circuit components in it. And the remaining 200x10x100mm volume can be used for keeping currency, cards, paper products etc.

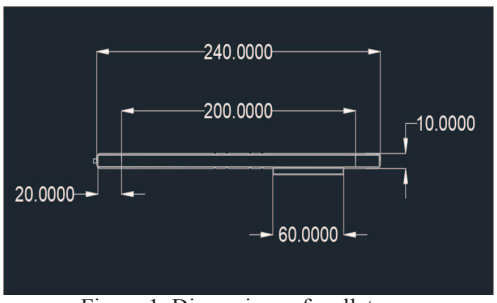

Figure 1. Dimensions of wallet

We have used 4 UVC LEDs for sanitizing the things kept inside the wallet. Each led have a wavelength of 275-285nm which is sufficient to kill the microbes when kept on for 5 minutes.

The complete design of the wallet is shown in the figure 2.1. A zip is placed in the top so that once after the money is kept or taken, it can be closed and can be switched on. Inside the wallet, is the fully covered by the aluminum film to ensure

UVC rays does not escape from the wallet and makes the wallet safe to use.

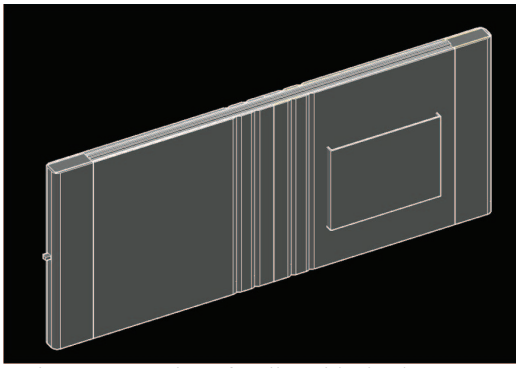

Figure 2.1. Design of wallet with zip shown at top

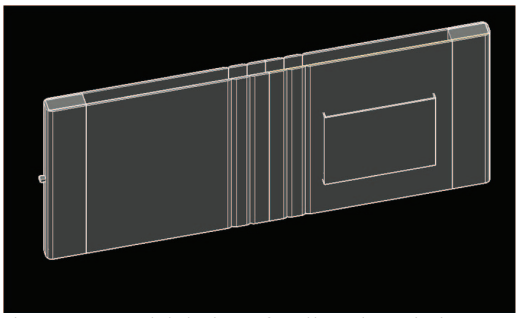

Figure 2.2. model design of wallet when zip is open

As shown in the figure 2.2 the 20x10x100 mm volume both the sides are covered in which the batteries, 555 timer, resistors and capacitors are kept and only those 4 leds will expose to the outside making a way for sanitization. The switch that had been positioned in left side of the wallet (shown in figure 2.1,2.2)is a button switch.

Of those 4 LEDs, 2 LEDs are placed inside the wallet at the ends. And remaining 2 are placed at the bottom of the wallet. As everything is covered by aluminum film the

UV-C rays will get reflected and can be spread across the wallet. This ensure the UV rays cover the wallet across and can sanitize by using these 4 LEDs.

Batteries are kept one side of the wallet (that is right side, in 20x10x100 mm volume) and resistors, capacitors and the 555 timer should be embedded in the left side of the empty volume in the wallet. As switch is near to the 555 timer placing the circuit inside the wallet had been made easy. And the connection that is to be given from the positive terminal to the resistor and to 555 timer can be taken from the bottom of the wallet.

III. Circuit Diagram

The circuit is easy to make. It can be easily embedded into the wallet. For the supply voltage of 9v, 3coin batteries each of 3v had been used. As they are coin batteries they can be easily fit into the wallet (in assumed 20x100x100 mm volume).

So once the switch is given the 4 UVC LEDs will glow and after 5 minutes they will make the wallet completely safe by sanitizing the microbes. However, for the user to manually switch it off is identified as a problem. To ensure the work is simple for the user, we have made the circuit design using 555 timer as shown in the figure 3. This will ensure the wallet becomes automatic and will switch off the circuit after 5 minutes.

Even though it is shown that the voltage is given to leds are 9v in practical circuit it is somewhat less than 9v . As the forward voltage of one uvc led is 5-7 v , there will be no damage to leds.

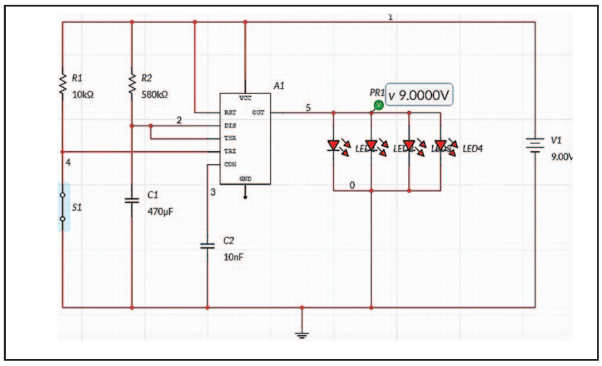

Figure 3 .Circuit diagram

IV. WORKING PRICIPLE OF CIRCUIT

Once after the currency, cards (the things which is needed to be sanitized) is kept inside the wallet, the zip should be closed and ensure the wallet is completely closed. Until the switch is given on the 555 timer will gives the output of 0v so that the LEDs will not glow. once the switch is given for one time then the 555 will produce the output of 9v which is sufficient for UVC LEDs to glow (the forward voltage of each led is 7v,so around 9v supply can be enough and also safe for led).As all the LEDs are kept in the parallel form 9v is enough for the LEDs to glow .

Meanwhile the 470uf capacitor will slowly charge. It will take approximately 5 minutes to charge fully because of the 580k ohm resistor placed in series with it. once after the capacitor is fully charged it will discharge to the threshold pin 9(because of the 555 timer property the output becomes 0v and makes the leds to get off),as the input to the threshold pin is more than the $1/3^{rd}$ of the supply voltage it will turns off the output . Once the circuit is closed until the switch is turned on for the next time the circuit will not be turned on. This is because until the next switch is given the capacitor will not charge and the threshold pin will receive the input of 0v which cannot able to switch-on the circuit as 0v is not more than $1/3^{rd}$ of supply voltage (one third of the supply voltage is 1/3 *9 =2v). using this 555 timer it will make the user work and time easy and also makes the wallet safe.

V. GRAPH AND OUTPUT

As shown in the figure 4 once after the switch is on the graph has raised to 9v (so LEDs will get 9v each as they are in parallel) and the graph is constant for 299.37 seconds that is equal to nearly 5 minutes. In this 5 minutes there are no disturbances and graph is constant with 9v.

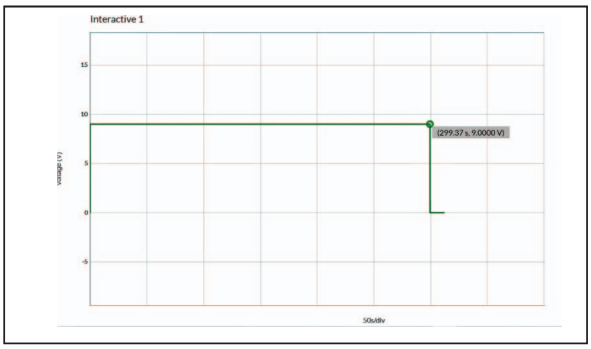

Figure 4. Output Graph(voltage vs time)

In this 5 minutes the UV-C LEDs are capable of sanitizing the complete wallet, once after it reaches 299.37 seconds, the graph suddenly comes down and representing the output voltage is reduced to 0v. until the next switch is given the graph will be in the 0v itself and makes sure that the LEDs will not glow again.

VI. RESULT AND CONCLUSION

This currency sanitizing wallet using UVC LEDs has a major future scope in the domestic sector. Even in the present situation where viruses are getting spread through currency and cards this kind of wallet can be used for making all the things safe from virus. Even the world is going towards digital currency, every person will use wallet and there is always a need of it .As our focus is not only to sanitize the currency but also the cards (credit /debit), paper products, coin currency and other wallet belongings, this UVC safe wallet will play a major role in the public domain .It can be complicated to use currency sanitizing machines every time when currency is going to be exchanged , at that place these kind of wallets can to be used so that there will be no requirement of sanitizing currency separately and saves the user time .As these UVC LEDs have a wavelength of 275nm – 285nm including corona virus it can be able to sanitize any kind of virus which spreads through currency , hence it has a very good future scope.

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