Mechanism to disinfect money to prevent COVID-19

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Abstract. Currency notes and coins play an important role in daily needs for the human being across the world. These currency notes take a major role for spreading the Corona virus infection and circulation of the currency notes enhance some infectious disease like COVID-19. A new prototype is introducing here to prevent the problem that is spreading of corona virus by hand to hand money transfer across the world. This paper is about preventing the spreading of corona-virus through currency by developing automatic, portable alcohol-based money disinfector. The prototype disinfests both currency notes and coins by ethyl alcohol.

Keywords. Currency notes, coins, Sterilizer, COVID 19, Prototype, Disinfection.

1. Introduction
We all know the currency is very needy item for our daily lives. Reserve bank of India (RBI) provides a statistical report which gives the information that 21.1 trillion currency notes are circulated among the people in 2019, 17% higher value than the previous year [1,2]. At this pandemic situation corona-virus is playing the role of agent. It is quite obvious that corona-virus is spreading worldwide rapidly and hand to hand money transfer enhances the spreading speed of corona-virus. According to WHO (World Health Organization), 70-75 percent ethyl alcohol is sufficient to disinfect corona-virus [3,4]. Ethyl alcohol or isopropyl alcohol is able to demolish the outer lipid layer of corona-virus. Considering the statement a specially designed COVID-19 preventing prototype is introducing here that is automatic, portable alcohol-based money disinfector machine. The techno commercial aspect of this prototype entitles “alcohol-based money disinfector” is specifically depicted in this paper. Due to the portability of the prototype, it is able to disinfect currency without touching of notes or coins. Larger size of the device is able to disinfect much number of notes and coins rapidly with excessive efficiency. A mini embedded system of the device with ATM and swipe machine, capable to reduce the chances of spreading of corona-virus through debit or atm card. Apart from corona virus, the exclusive prototype is able to stop the spreading of any others contaminant through money. The rest of the paper is organized as follows: the objective and main motivation of the works is described in section 2, Section 3 is mainly dedicated for the description of the invented prototype followed by mentions the implementation of the prototype in section 4, Section 5 describes the application area of the prototype and finally the entire work is concluded in Section 6.

2. Objective and motivation of the work:
The first Covid-19 cases started in December 2019 and the outbreak began in Wuhan city which is situated in Hubei province of China. Coronavirus is one type of RNA viruses that cause respiratory illnesses of severity from the common cold to pneumonia. COVID-19 appears to be relatively milder compared to Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), which belong to the same coronavirus family of viruses [5,6]. COVID-19 has fewer death rates than other strains of coronavirus, such as SARS and MERS. World Health Organization declared the COVID-19 as a pandemic on 11th March 2020. The pandemic situation is created worldwide due to the COVID-19 in 2020. More than 20.5 million persons affected worldwide. COVID-19 is a much-transmitted disease and it is spreading everywhere too fast. Gram-positive bacteria and Gram-negative bacteria can survive for months on the surface of the currency [7,8]. The COVID-19 effects on the upper respiratory organs (sinuses, nose, and throat) and the lower respiratory organs (windpipe and lungs). The disease can spread through person to person through droplets of saliva, come from mouth or nose of a COVID-19 positive person during coughing or sneezing. Currency disinfection done previously is environmentally stable and viruses can resist the chemical disinfection [9]. Not only the corona virus directly spreading through droplets but also the virus spreading through various surfaces, touched by corona positive persons and their hands get contaminated when they touch their mouth or nose after sneezing or coughing. There is a huge chance of spreading of the virus through money or currency because of the touching of currency notes and coins. Currency notes and coins play the role of vector. Currency notes and coins are passively spreading the contaminated disease [10,11]. Basically, two types of paper currency used worldwide, one is cotton-based paper currency and another is polymer-based paper currency. Both types of paper currency used in various countries, some countries which are used polymer-based banknotes such as Australia, Bermuda, New Zealand, Romania, Vietnam etc., some countries used cotton-based paper currency such as India, China, Bangladesh etc [12]. In the country Mexico, both polymer and cotton-based bank notes are used. Cotton based paper currency made with 75%cotton rag and 25% linen and polymer-based paper currency made with synthetic polymer such as Biaxially Oriented Polypropylene (BOPP). Both types of currency note offer great surface for virus, bacteria and microorganisms to hang out [13]. Many countries use both polymer-based and cotton-based banknotes, it is tested that cotton-based notes are more contaminated than polymer-based notes. Reserve Bank of India reported that 21.1 trillion banknotes are circulated among people in 2019 that is 17% more than year of 2017. W.H.O reported that Corona virus is transmitting through droplets of saliva when a corona positive person sneeze, cough or touches surfaces and most of the common people use saliva to count currency notes. Paper currency counting with the help of Saliva is a crucial contaminated process at this pandemic situation. Center for Disease Control and Prevention and the University of California stated that on copper surface Corona virus can survive for up to four hours and twenty-four hours on stainless steel [13]. Stainless steel and copper are mostly used base metal to manufacture currency coins. So, hand to hand money transfer process enhances possibility of the spreading of contaminated diseases. According to scientist and World Health Organization, corona virus is able to enter our body through eyes, nose and mouth by our hand. There is high chance to get our hand contaminated by corona virus during hand to hand money transaction. Though digital transaction is increasing day by day but still now percentage of digital transaction is less than cash or offline transaction. To stop the spreading of the virus through money and overcome this critical problem the ‘portable money disinfector’ is invented.

3. Proposed method of the prototype

The proposed innovative device is able to stop the spreading of corona virus from corona positive person to others through currency notes or coins. The device is portable and it is specially designed such a way so that anybody can disinfect notes or coins instantly without touching of notes and coins. Instant currency sterilization is too much required at this pandemic situation, as the invented money disinfector
is portable, lightweight and rechargeable so, it can easily and instantly disinfect currency notes or coins anywhere any time with excessive efficiency. The money disinfector disinfects money with two types of sterilization process, one is alcohol sterilization process and another is UV sterilization process. According to World Health Organization (W.H.O), ethyl alcohol or isopropyl alcohol is able to disinfect the corona virus. Ethyl alcohol and isopropyl alcohol both has disinfecting property. The outer membrane of the corona virus made with a layer of lipid and the lipid layer embedded with three types of viral proteins which are spike, membrane and envelope. The viral proteins are too much crucial in the life cycle of the virus. Ethyl alcohol and Isopropyl alcohol demolish the outer lipid protein of the corona virus [14]. In the device a specially designed vaporing module is introduced and the quantity of spraying the mist of alcohol is varied depending upon the size currency notes. One pair of specially designed rotatable brush is introduced in the device. The pair of rollers is used to rub both sides of currency note because rubbing of is very much required to disinfect the novel corona virus properly. UV ray is primarily classified into three categories which are ultraviolet A (UVA), Ultraviolet B (UVB) and Ultraviolet C (UVC). The wavelength of UVA, UVB and UVC are respectively 315-400, 280-315, 100-280nm. So UVC has highest frequency and power than other two UV rays [15]. The harmful UVC ray damages the DNA as well as RNA of a cell or virus. UV-C is capable to disinfect Corona virus is reported by National Academy of Sciences. The smart and portable embedded with an effective microcontroller that is used to operate or control any others internal electronics components such as vaporing module, motors, servo, IR sensor etc. The money disinfector is specially designed for COVID-19 but is has same capability to stop the spreading of any other contaminated disease through currency. Based on the guide lines and research the specially designed money disinfector is invented.

4. Implementation of the Prototype

The process how to disinfect currency note and coin is shown in figure 1 and figure 2.

![Figure 1. Disinfect of currency note](image1)

![Figure 2. Disinfect of coin](image2)
Figure 3. Internal configuration of invented prototype

Figure 3 shows the internal configuration of the invented prototype. One pair of specially designed rotatable brush is introduced in the device. The pair of rollers is used to rub both sides of currency note because rubbing is very much required to disinfect the novel corona virus properly. UV ray is primarily classified into three categories which are ultraviolet A (UVA), Ultraviolet B (UVB) and Ultraviolet C (UVC). The wavelength of UVA, UVB and UVC are respectively 315-400, 280-315, 100-280nm. So UVC has highest frequency and power than other two UV rays. The harmful UVC ray damages the DNA as well as RNA of a cell or virus. The flowchart of the prototype is shown in figure 4.

Figure 4. Flowchart of the prototype
5. Application area of the prototype:

In this pandemic situation disinfection of money is very much necessary; this prototype is planned specially for this situation. As the invented prototype is portable and very much convenient to handle so any body will able to carry it anywhere anytime as and when required and the device will able to disinfect money instantly. This process is too much beneficial for the Cash on Delivery (COD) home delivery services. The device will also be available in larger size so that it can be used in shop, shopping mall and any other places. A mini embedded system of the device with an ATM and swipe machine, capable to reduce the chances of spreading of corona-virus through debit or ATM card. The invented system can be installed in cash locker and any other paper bill collecting drawer or locker.

6. Conclusion

We all know that notes or coins carry various types of harmful germs due to the infinite number of hand-overring. According to the research 26,000 types of bacteria can be there in banknote. But we have not any modern and smart option to sterilize the dirty, unhygienic notes. The invention can solve the problem of spreading infection through currency notes or coins. Although the device is planned only for COVID-19 situation but in near future hopefully it can prevent currency from many antibacterial elements by adding alcohol to spoil the various types of germs. This currency disinfection machine can overcome the cons of previous disinfectant machine that is the virus can’t resist the effect of UV rays. This invention can save people from spreading of infection by different antibacterial elements forever and safe mankind. In future the process can safe mankind from different infectious disease.

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