

DESIGN OF A SUSTAINABLE DISINFECTION TUNNEL OF COVID19

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ABSTRACT

Cleaning and disinfection of public spaces is important and it is necessary to control the transmission of the virus. Disinfection prevents a possible other epidemic wave. In this work, we present a sustainable disinfection tunnel (SDT). Its role is to provide maximum protection to people passing through it in around 10 seconds. The model structure uses renewable energy panel and it is putted at the entrance of hotels, schools and administrations.

I. Introduction

Today, the High Council for Public Health (HCPH) insists on the importance of cleaning of outdoor and indoor public environments. In fact, it is necessary to control the transmission of the virus and thus prevent a possible other epidemic wave [1]. Especially the exceptional situation the world is going through with COVID 19 pandemic. The COVID-19 pandemic is devastating. Its spread can be slowed down by following the infection control practices and by using a sustainable system to disinfect and sterilize outgoing and incoming people in areas that must work in hygienic conditions such as: hospitals, establishments, laboratories, schools [2, 3-8]. To prevent against the propagation of this virus, authorities direct their research to prevention program against the Corona virus. One of these programs is the installation of disinfection tunnels. The first one was installed in China [9]. This was imitated by other countries [10-11]. In Algeria, the first “disinfection tunnel” of this kind was launched in April, 2020, at the entrance of the Association of Renewable Energies and Sustainable Development of Sidi Bel Abbes. Other new walk tunnels have succeeded that of Sidi Bel Abbes [12].

Nowadays, the current interest of renewable energies is due to government awareness. At the same time to fight against the CO₂ emissions and new epidemic of Corona, photovoltaic solar energy [13] is considered as an essential device in this area.

In this work, we combined the solar photovoltaic energy to the disinfection. The sustainable unit works with the principle of eliminating harmful bacteria that they transport people. Indeed, Disinfection is done by misting low pressure of the disinfectant product, flow rate and particle size, nozzle positions, and duration of disinfection. These parameters are sized to ensure even distribution of the disinfectant.

II.Design and work of Disinfection Tunnel

In this work, we combined the solar photovoltaic energy in the disinfection tunnel to use it as a source of energy for the triggering of the pump of the disinfectant liquid spraying circuit and the detector (photocells) of the passage of the persons or of equipment. The sustainable unit works with the principle of eliminating harmful bacteria that they transport people.

The structure of the unit is made of aluminum, stainless steels or other non-corrosive material. These materials allow a better stability. This unit is mobile, with four wheels equipped with a braking system, to facilitate its movement and its positioning in complete safety. These tunnels are equipped with infrared sensor which activates the pump of the disinfectant liquid spraying circuit and the detector when a person accesses [14]. Essentially spray is a mist of sodium hypochlorite solution or Sodium bicarbonate solution (distilled white vinegar; soften clothes without harsh chemicals. Vinegar is inexpensive, and it is safe. It contains no tannins “natural plant dyes” that can stain clothes [15] in order to clean, to disinfect and to neutralize odors. A temperature sensor can also be installed at the entrance to ensure the feverish state of the person passing through the disinfection unit, as shown in figure 1.

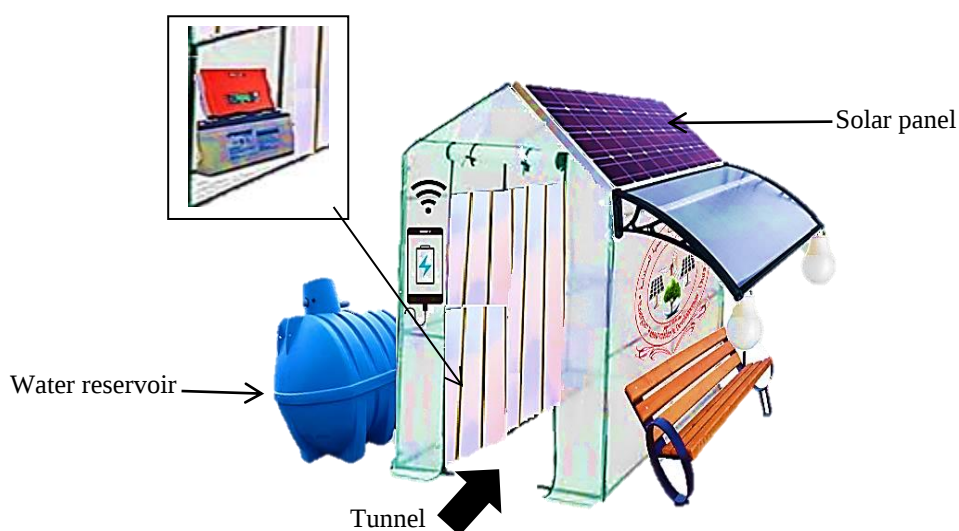


Figure 1 : Schematic representation Sustainable Disinfection Tunnel (SDT)

1. Solar system model

The aim of the autonomous solar system is to provide electrical power everywhere and at any time to secure sensitive devices when the network fails. The size of the system varies greatly depending on consumption and geographic location.

1.1. Contents of the solar kit

- Two polycrystalline solar panels 150W - 12V: A 150W solar panel is easily power most of rechargeable batteries. These draw very little power from the battery and are known to be longer-lasting.
- Specific solar cable between the panel and the regulator: The recommendation is to use standard wire. Since there are several conductors in a single run, stranded wire offers better conductivity.
- Solar regulator 30A - 12/24 V.
- Two sealed slow discharge batteries, 12 V - 110 Ah: Sealed lead acid batteries can have a design life of anywhere from 3 – 5 years.
- Inverter which converts 24 V DC (Direct Current - DC) from the battery to 220 V (Alternating Current - AC) identical to the network.
- Protection box that can accommodate up to 4 circuit breakers, 2 circuit breakers at 16A and another one at 10 A are integrated in the kit to protect the panel, the battery for 24 V_{output}. A circuit breaker can be added for an inverter.

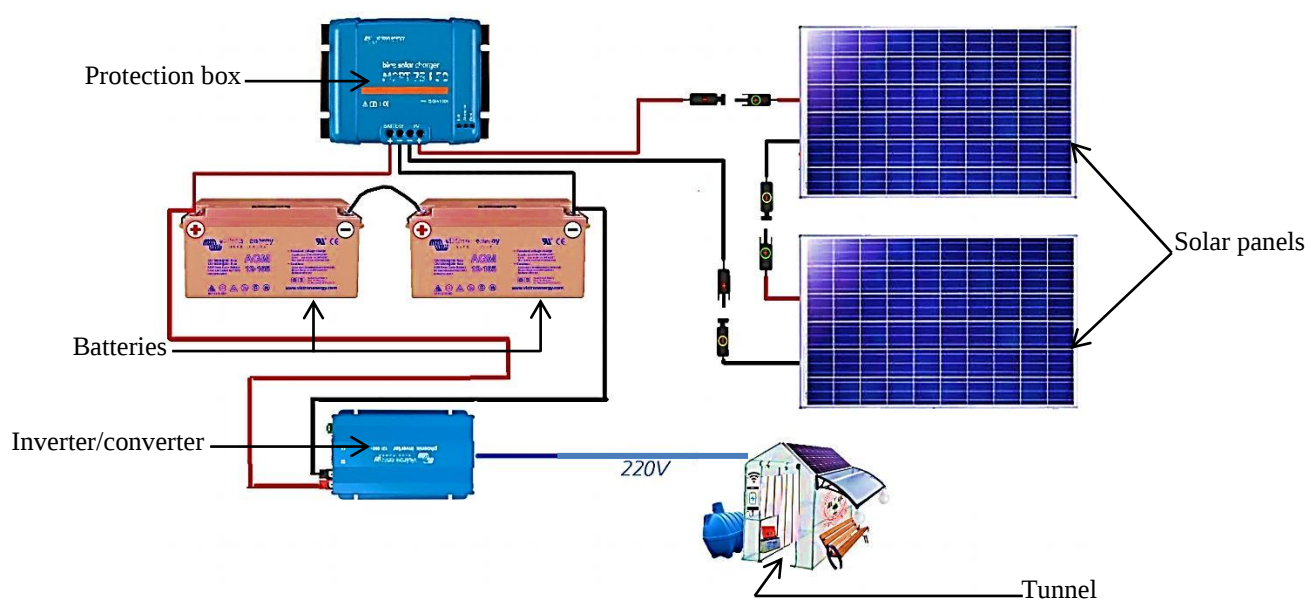


Figure 2 : Cable Schematics of the solar system

Table 1 presents the consumed energies of some components used in disinfection tunnels. This equipment does not consume a lot of energy.

Device	Energies (Wh)
Water Pump (motor)	370 w x 4 hours
2 Spots (LED)	12 w x 4 hours

The prototype is equipped with a sensor that detects the person and to launch a disinfection automatic in order to control the consumption of disinfectant product.

III. Conclusion

The COVID-19 pandemic is devastating, but by following infection control practices and instructions issued from authorities, its spread can be slowed down.

This work presents the sustainable disinfection tunnel (SDT) by using renewable energies (solar energy). It was put at the entrance of the Association of Renewable Energies and Sustainable Development of Sidi Bel Abbas. It can try and prevent the spread of any possible epidemic crisis. The tunnel can disinfect a person fully in a time span less than 15 seconds and the used solution is completely harmless. This structure will allow a total and homogeneous disinfection of people in terms of safety from the external environment. This project needs a moderate budget.

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